



*Research Excellence and Beyond*

**Annual RESEARCH  
SYMPOSIUM  
2023**

# ANNUAL RESEARCH SYMPOSIUM 2023



University of Colombo

<https://cmb.ac.lk/ars>



# PROCEEDINGS OF THE ANNUAL RESEARCH SYMPOSIUM 2023

**UNIVERSITY OF COLOMBO, SRI LANKA**

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UNIVERSITY OF COLOMBO



**Designed by the Advanced Digital Media Technology Centre (ADMTC)**  
of the University of Colombo School of Computing (UCSC)

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Ms. H. P. D. N. Abeyrathna



## **UNIVERSITY OF COLOMBO, SRI LANKA**

### **OUR MOTTO**

‘Buddhi Sarvathra Bhrajate’

Wisdom Enlightens

### **OUR VISION**

To be a centre of global excellence in education, research and stakeholder engagement to enrich human potential for the betterment of society.

### **OUR MISSION**

To discover and disseminate knowledge; enhance innovation; and promote a culture of broad inquiry throughout and beyond the university through engagement and collaboration with industry and community.

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The proceedings were designed and formatted by Mr. T.M.O.C.V. Tennakoon (UCSC)

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## MESSAGE FROM THE VICE CHANCELLOR

I am privileged to issue this message for the flagship research event in the University of Colombo's annual calendar, the Annual Research Symposium. The University of Colombo is the highest rank university in Sri Lanka with a history of over 150 years.



The University's Annual Research Symposium was started in 2008, and over the years this knowledge dissemination forum has continuously progressed. Each year, following the Inauguration Ceremony, in par with the Annual Research Symposium different faculties and institutes engage in various knowledge disseminate activities ranging from paper and poster presentations, industry dialogues, doctoral colloquiums, keynote speeches and panel discussions relating to their disciplinary focus.

The theme of this year's symposium "Research Excellence and Beyond", captures the university's commitment to high quality research and the initiatives taken to ensure the social and practical significance of our research work. As the premier University in the country, we network with globally renowned universities and have entered into various MOUs. We are the only University in Sri Lanka to be part of the Asian Universities Alliance (AUA), which is a university alliance comprising 15 leading member institutions across Asia.

I am also pleased to note that different faculties and institutes of the University on an on-going basis partner with various organisations in the country and engage in commercialisation of university-based research through product launches and obtained patent rights. Research work of our university community has and continue to contribute to policymaking, managerial decision making, as well as towards maintaining social justice and wellbeing. As a university we truly maintain research excellence and move beyond, to ensure the wider applicability and relevance of our research.

I thank the Chairperson of the Annual Research Symposium 2023, all sub-committee chairs, sub-committee members from all faculties and institutes, Mr. S. M. Shifar and the team from Academic and Publications Branch, NOC, and all academic, administration and support staff who worked tirelessly to make this event successful.

I hope that you will find the proceedings of the Annual Research Symposium 2023 insightful.

**Senior Professor (Chair) H.D. Karunaratne**

Vice Chancellor, University of Colombo

## MESSAGE FROM THE CHIEF GUEST

It is an honour to provide the Chief Guest’s message at the University of Colombo’s Annual Research Symposium – this year, under the 2023 theme of ‘Research Excellence and Beyond’.



New Zealand believes that investing in research helps to increase local productivity, enhance innovation, and strengthen efficiency. Universities are a core part of this. They help train and nurture the country’s future researchers and innovators, providing them with the skills and knowledge to tackle complex challenges; whether social, economic or environmental.

Nonetheless, translating timely and important research into meaningful and practical application can often be a challenge. This is why it is particularly commendable that the University of Colombo has chosen to celebrate multidisciplinary approaches and focus on the ‘beyond’ of research excellence – identifying where research informs policymaking; where it fuels business innovation; and where it advances evidence-based solutions.

As Sri Lanka grapples with the aftermath of its economic crisis – implementing diverse and long-term policy reforms, building its knowledge-based economy, and tackling the challenges of outward migration and brain drain – the research conversations that you are engaging in today are all the more relevant.

I wish all those participating in the 2023 ARS, fruitful and successful exchanges over the coming days. Your commitment to research excellence – across the University of Colombo’s many faculties, institutions, schools and disciplines – is an inspiration, and I am sure that it will help support Sri Lanka’s development and recovery in the years to come.

His Excellency Michael Appleton

**High Commissioner of Aotearoa New Zealand to Sri Lanka**

## MESSAGE FROM THE SYMPOSIUM CHAIR

The Annual Research Symposium (ARS), as the key research event in the University's annual calendar, is a reflection of what the University has achieved so far in the arena of research and an inspiration to reach greater heights in the future. I am pleased to pen this message as the Chairperson of the ARS 2023, which is held under the theme "Research Excellence and Beyond". This year's theme showcases how the university's different faculties, institutes, campus, school, and the library maintain excellence through the strong commitment towards high-quality research yet moves beyond to ensure the wider applicability and relevance of research aligned to the world of practice and the needs of various stakeholders.



I am extremely thankful to His Excellency Michael Appleton, New Zealand High Commissioner to Sri Lanka for gracing this important event of the University as the Chief Guest. I extend my deep sense of appreciate the three eminent keynote speakers, Dr. P. Nandalal Weerasinghe, Governor of the Central Bank of Sri Lanka, Dr. Alaka Singh, WHO Representative to Sri Lanka and Professor Daminda Alahakoon, Director Research Centre for Data Analytics and Cognition La Trobe University, Melbourne, Australia, for shedding light on the symposium theme from diverse perspectives drawing on their vast experience and knowledge.

Organising this event was truly a culmination of great teamwork by many personalities. I am immensely thankful to the Vice Chancellor, Senior Professor (Chair) H. D. Karunaratne for his unwavering support and guidance throughout the entire process. A big thank you is due to Mr. S. M. Shifar (AR – Academic and Publications Branch and his team), Dr. K. D. Sandaruwan (Chair – IT and Publicity Committee), Professor Dharshani Bandupriya (Chair – Inauguration Committee), Dr. Seuwandhi Ranasinghe (Editor), Dr. Sachini Amarasekara (FOS media) and Mr. Layan Chathuranga (System Analyst, NOC) for their numerous contributions and untiring efforts.

I am thankful to the co-editor and all sub-committee members representing different faculties, institutes, campus, school, and library for their assistance. A special word of gratitude is due to Dr. Hiran Jayaweera (NOC), Dr. Ajantha Athukorale, Director - UCSC (and his staff at UCSC), Mr. Oshan Chanitha Tennakoon (UCSC), Dr. Nandasara (Colombo University Press) and FOS Media crew for the support extended. My thankfulness also goes to all academic, administrative, non-academic and support staff of the University for their services to make this event a reality. I hope you would find ARS 2023 interesting and thought provoking.

**Professor Tharusha N. Gooneratne**

Chairperson, Annual Research Symposium 2023

## PROFILE AND ABSTRACT OF KEYNOTE SPEAKERS



**Dr P Nandalal Weerasinghe**

Governor of the Central Bank of Sri Lanka

Dr. P. Nandalal Weerasinghe is the 17th Governor of the Central Bank of Sri Lanka (CBSL). Dr. Weerasinghe is a career central banker, with extensive experience in Monetary and Exchange Rate Policy. He holds a PhD and Master's Degree in Economics from the Australian National University and a BSc. Degree from the University of Kelaniya in Sri Lanka.

As Deputy Governor, Dr. Weerasinghe has served as the Chairman of the Monetary Policy Committee and the Foreign Reserve Management Committee of the CBSL and has overseen the Departments of Economic Research, Statistics, International Operations, Domestic Operations, Macprudential Surveillance, Exchange Control, Currency and Communications.

He has represented several Cabinet Sub-Committees on economic matters and was a member of the Committee appointed to review the Power Purchase Agreements, the Financial Sector Monitoring Committee of the Ministry of Finance & Planning, the Steering Committee on Market Program for Private Sector Development and the Petroleum Refinery Project Coordinating Committee.

### **Inflation – Public Enemy #1**

Sri Lanka is gradually exiting from a high inflation episode wherein it saw inflation peaking to almost 70 per cent in September 2022 and decelerating sharply to a little over 1 per cent a year later. The preceding inflation episode has been a culmination of Sri Lanka's twin deficit legacy. Although short-lived, the high level of inflation seen in the course of a few months led to a significant erosion of the socioeconomic welfare of all stakeholders, with some lingering effects on overall welfare in the medium term. In addition to the policy measures undertaken by the Central Bank which helped rein in inflation in a quick and assertive manner, the recently enacted Central Bank Act will serve as a key buffer for the Sri Lankan economy against inflation. With the primary object of the Central Bank being the maintenance of domestic price stability, the Central Bank is committed to transparently and proactively tackling public enemy #1 – inflation.



**Dr Alaka Singh**

WHO Representative to Sri Lanka

Dr. Singh is the WHO Representative to Sri Lanka since May 2021. With WHO she has held positions at all three levels of the Organization, supporting countries in the South-East Asia as well as the African and Eastern Mediterranean Regions. Her technical experience has been focused on health systems, primary health care (PHC) and universal health coverage (UHC). She has led several key WHO efforts in these areas, including development of the first Regional Strategy on Universal Health Coverage (2012-17) and, more recently, on a regional agenda to advance PHC post-COVID.

Alaka Singh has an educational background in health and development with a first degree from Delhi University and advanced degrees from the College of William and Mary, Virginia, USA and Cambridge University, UK.

### **Beyond Research Excellence – Bridging the Evidence to Policy Gap in Health**

The evidence-to-policy field is rapidly changing and evolving. In an era marked by complex challenges, evidence-based decision-making has emerged as a powerful catalyst for positive transformations. While research excellence has fuelled remarkable advancements in healthcare, translating these findings into practical policies remains a persistent challenge.

Evidence-informed decision-making is a critical success factor on the road to reaching the triple billion targets of the World Health Organization (WHO) and health-related Sustainable Development Goals. By translating the best available evidence into viable policy options and actionable health interventions, the global scientific community can actively contribute to delivering better care, emergency preparedness, and health outcomes to more people. WHO has been a steadfast partner in bridging the evidence to policy gap in health through its catalytic activities, collaborations, and institutionalizing efforts for evidence-informed policymaking.

Evidence to policy gap can be successfully bridged by; strengthening local capacities to make better use of evidence in policymaking; investing in institutional knowledge translation

platforms such as the Centre for Health System Policy and Innovation (CHSPI) – a joint commitment of WHO Sri Lanka with the University of Colombo; disseminating successful methods and tools in evidence-informed decision and policymaking – as done through the WHO Global Evidence to Policy (E2P) Summit; and monitoring and evaluating evidence-to-policy processes for continual and continuous improvement.



**Prof. Daminda Alahakoon**

Director Research Centre for Data Analytics and Cognition  
La Trobe University, Melbourne, Australia

Daminda Alahakoon is Professor and Discipline Leader in Business Analytics, La Trobe University Business School (since 2015). He is also the Founding Director of the Research Centre for Data Analytics and Cognition (CDAC) at La Trobe. He serves as a Visiting Professor at the Lulea University of Technology Sweden and the University of Moratuwa, Sri Lanka.

Daminda has over 15 years of experience as an academic in several Australian Universities as well as over 10 years in the IT and finance industries in Sri Lanka, Australia, and The Netherlands. His research is focused on the areas of Machine Learning, Artificial Intelligence, Advanced Data Analytics, Text and Social Media Analytics, Business Intelligence, and the harnessing of such theories for practical tools and innovative technology for the industry. His research has been adopted in a range of domains from healthcare, utilities, smart cities, education, industrial optimization, and national security. He has been a keynote and invited speaker for Artificial Intelligence, Machine Learning, Big Data and Data Analytics, and AI adoption at academic and industry forums.

Daminda's work on unsupervised self-structuring AI and the Growing Self Organizing Map (GSOM) algorithm has received international recognition and adopted in diverse fields by industry, government, and academia. He has advanced and extended the GSOM as a new paradigm in artificial learning with theoretical innovations and practical outcomes published in over 150 peer-reviewed research articles. Daminda has received over 5 million dollars in academic research grants as well as over a million dollars in direct industry funding for R&D projects.

## **Role of Artificial Intelligence in Empowering Future Cross-Disciplinary Research**

The recent years has seen a major shift in not only the thinking and application of AI, but the role of AI in society and the relationship with humans. The wide acceptance and popularity of the internet and technologies such as cloud computing and mobile devices has resulted in a connected global community where many tasks and processes are automated. The social media phenomenon within this environment enabled people to create, disseminate and share information as well as socialise and converse, thus bringing in the human element into a fast-growing profusion of digital data. The outcome of all this has been heralded as the information revolution or big data era, creating a man made virtual digital world and the emergence of a digital ecosystem. The availability of all this information in digital form has opened up many possibilities for utilizing AI across all aspects of human life with wide ranging benefits as well as many areas of concern. This keynote will focus on how these developments will impact research and set future research directions.

AI research in the past was carried out by computer scientists within laboratories with access to high powered computers. Recently there has been a paradigm shift in AI research, with computers, technology and AI becoming a standard utility for all researchers. This ‘democratization’ of AI is important in many situations and even essential for researchers in all fields so that they can harness the rich potential benefits that are hidden within the diverse sources of digital data. It is exciting to see AI powered technologies becoming a common platform on which experts from different fields work together. Easy to access data stores, collaborative technology platforms, visualization technologies powered by AI and advanced analytics act as enablers where digital representations of problem scenarios are generated and made available for experts from different areas to work together with AI experts guiding them to gain optimal benefits. A further development is that researchers in psychology, neuroscience, social sciences etc working with AI researchers to advance current state of the art in AI. AI powered technology has broken many barriers that existed for collaborative research which is now essential for addressing complex real-life problems, efficient and effective use of limited resources and fast and even real time delivery of outcomes.



## PROGRAMME OF THE INAUGURATION CEREMONY

Prof. V.K. Samaranayake Auditorium, UCSC, University of Colombo  
on Thursday 2nd November 2023 at 1.30 pm

<b>Time</b>	<b>Programme</b>
01.15 pm - 01.30 pm	<b>Arrival of Guests</b>
01.30 pm - 01.45 pm	<b>Lighting the Oil Lamp</b> <b>National Anthem</b>
1.45 pm – 1.55 pm	<b>University Video</b>
1.55 pm – 2.05 pm	<b>Welcome Address</b> Prof. Tharusha N. Gooneratne Chair, Annual Research Symposium 2023
2.05 pm - 2.15 pm	<b>Address by the Vice Chancellor</b> Senior Prof. (Chair) H. D. Karunaratne Vice Chancellor, University of Colombo
2.15 pm - 2.25 pm	<b>Launch of Electronic Proceedings and Presenting Symposium Proceedings to the Chief Guest, Keynote Speakers and the Vice Chancellor</b>
2.25 pm - 2.35 pm	<b>Address by the Chief Guest</b> His Excellency Michael Appleton New Zealand High Commissioner to Sri Lanka
2.35 pm – 3.10 pm	<b>Keynote Speech I</b> Dr. P. Nandalal Weerasinghe Governor of the Central Bank of Sri Lanka (CBSL)
3.10 pm – 3.20 pm	<b>Cultural Event</b> Students of the Dancing Circle, University of Colombo
3.20 pm – 3.55 pm	<b>Keynote Speech II</b> Dr Alaka Singh WHO Representative to Sri Lanka

3.55 pm – 4.30 pm	<p><b>Keynote Speech III</b>  Prof. Damminda Alahakoon  Director Research Centre for Data Analytics and Cognition  La Trobe University, Melbourne, Australia</p>
4.30 pm – 4.40 pm	<p><b>Felicitation of University of Colombo Researchers Ranked Among the World’s Top 2% of Scientists 2022</b></p>
4.40 pm – 5.10 pm	<p><b>Presenting Senate Awards for Research Excellence 2022</b></p>
5.10 pm – 5.15 pm	<p><b>Vote of Thanks</b>  Prof. H.D. Dharshani Bandupriya  Chair, Inauguration Committee</p>
5.15 pm – 5.30 pm	<p><b>Group Photographs</b>  University of Colombo Researchers ranked among the World’s Top 2 of Scientists 2022  Senate Awardees  Senate Commendation Awardees  ARS 2023 Organising Committee</p>
5.30 pm – 6.00 pm	<p><b>Refreshments</b></p>

# Faculty of Arts



*Research Excellence through Interdisciplinary  
Approaches in Humanities and Social Sciences*

28<sup>th</sup> November 2023

## MESSAGE FROM THE DEAN

### Senior Professor Lasantha Manawadu

Dean

Faculty of Arts

University of Colombo, Sri Lanka



It gives me great pleasure to pen this message for the annual International Conference of the Faculty of Arts (IConArts 2023), the flagship event in the academic calendar of the Faculty. Held under the theme “Research Excellence through Interdisciplinary Approaches in Humanities and Social Sciences”, presentations at this year’s conference highlight the crucial role that an interdisciplinary approach to research advances. Raising critical questions, and probing research problems in new ways, this year’s conference becomes a platform for the recognition and celebration of interdisciplinary research. While Sri Lanka continues to face multiple, complex crises due to decades of structural inequalities and issues in governance, this year’s conference presents the significance of interdisciplinarity to the Sri Lankan context by engaging with the intersections of economic, political, and social issues while speaking to the post-pandemic global setting. I hope research presentations made at IConArts 2023 will help guide our responses to the contexts we live in.

This conference is the result of the contribution and commitment of numerous individuals. First, I would like to thank the Vice Chancellor of the University of Colombo, Senior Professor H. D. Karunaratne for his support and guidance in making this event a success. I would also like to express my sincere gratitude to the keynote speaker for graciously accepting our invitation to speak at this event. I take this opportunity to thank the organising committee and the sub-committees of IConArts 2023, competently led by the co-chairpersons of the conference. For their assistance in numerous ways I also thank the administrative, technical, and support staff of the Faculty of Arts. Finally, I wish to express my appreciation for those who submitted abstracts to the conference without which this event would not have been possible.

I extend my best wishes to presenters and participants, and wish IConArts 2023 all success.

## MESSAGE FROM CO-CHAIRPERSONS OF THE CONFERENCE

### **Dr. Shashithanganee Weerawansa**

Department of Economics

University of Colombo

Sri Lanka



### **Krishan Siriwardhana**

Department of Communication and Creative Arts

University of Colombo

Sri Lanka



Welcome to the annual International Conference of the Faculty of Arts, University of Colombo (IConArts 2023). This year we decided to move beyond our comfort zones by adopting the conference theme to include “Interdisciplinary Approaches in Humanities and Social Sciences”, where the fusion of knowledge and ideas transcends the boundaries of traditional disciplines. In an era where our understanding of society’s complex challenges often tends to be fragmented, the need of intellectual unity and holistic comprehension cannot be overlooked by a conference of this calibre. Education systems all over the world have long been compartmentalised, segregating knowledge into neat categories. Yet, the world’s problems rarely fit into such tidy boxes. To truly grasp the essence of contemporary societal issues, we must extend our reach beyond the confines of our individual disciplines. This is not a choice, but a necessity. A society fixated within the silos of its own expertise is a society destined to stagnate, unable to confront problems with the multifaceted perspective they demand.

In our daily lives, we encounter an array of challenges that demand solutions with many twists and turns. These problems are like winding rivers that require navigation through bends, curves, and zigzags. Attempting to tackle them with a one-dimensional approach is bound to sink the ship long before the island of solutions is in sight. Consider the current situation of Sri Lanka, for instance. We need a multifaceted and multidimensional approach to identify the intricate web of interconnected economic, social, political, technological, environmental, and

legal factors at play, and to propose sustainable solutions. This conference serves as a call to action, urging us to break down the walls that divide our fields of study and research. Interdisciplinary approaches offer a gateway to understanding the multifaceted nature of our world's challenges. By bringing together diverse perspectives and methodologies, we can chart a course towards innovative and holistic solutions.

We wish to express our thanks to Professor Kalinga Tudor Silva for accepting our invitation to be the Keynote Speaker at the event, and Professor Mick Moore for attending the conference as a Guest of Honour. Given the interdisciplinarity of their research, the proceedings of IConArts 2023 are enriched by their participation. For the support extended to organising IConArts 2023, we express our sincere gratitude to the Vice Chancellor of the University of Colombo, Senior Professor H. D. Karunaratne and the Dean of the Faculty of Arts, Senior Professor Lasantha Manawadu for their encouragement and guidance. We also thank session chairs and abstract reviewers for lending us their expertise. Members of the organising committee deserve special thanks for their untiring effort in putting the conference together. We also express our thanks to members of the non-academic staff and volunteers for their assistance with conference-related tasks.

As we exchange ideas, share insights, and forge new intellectual connections through this conference let us embrace the power of synergizing diverse knowledge. Let this be the first step of the journey to break down the barriers of compartmentalized learning and pave the way for a brighter and more enlightened future. George Stigler, the Nobel Prize winning economist once said: "The main insight learned from interdisciplinary studies is the return to specialisation". We hope you will find the programme offered by IConArts 2023 stimulating and challenging!

## ORGANISING COMMITTEE

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Senior Professor Lasantha Manawadu, Dean, Faculty of Arts, University of Colombo

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## INTRODUCTION TO THE KEYNOTE SPEAKER

### **Professor Kalinga Tudor Silva**

Professor Emeritus

Department of Sociology

University of Peradeniya

Sri Lanka



Kalinga Tudor Silva holds a BA from the University of Peradeniya and PhD from Monash University, Australia. He served as the Executive Director of the Centre for Poverty Analysis from 2001 to 2002, and the International Centre for Ethnic Studies from 2007 to 2008. He is Professor Emeritus (Sociology) at University of Peradeniya, Sri Lanka. Currently he is the Chief Editor of the Sri Lanka Journal of Social Sciences published by the National Science Foundation of Sri Lanka.

He is the author of *Decolonization, Development and Disease: A Social History of Malaria in Sri Lanka* published by Orient Blackswan in 2014, a joint author of *Checkpoint, Temple, Church and Mosque: A Collaborative Ethnography of War and Peace* published by Pluto Press in 2015, and the lead author of *The Impact of COVID-19 on Peace Building Activities of Local Faith Actors in Sri Lanka* published in 2021.

## **ABSTRACT OF THE KEYNOTE ADDRESS**

### **Why a Transdisciplinary Approach is needed for addressing the current crisis in Sri Lanka**

**Professor Kalinga Tudor Silva**

The current crisis in Sri Lanka is obviously multifaceted. It is economic, social, political, managerial and a lot more at the same time. Tinkering with it using a narrowly defined single perspective is likely to sink us further into an avalanche of problems. Many of the ongoing ideas about crisis management on the part of the state, donors, political parties, protestors and even social scientists are driven by one dimensional remedies whether in the form of cutting back welfare, resurrecting the welfare state, political devolution, anti-corruption legislation, attracting foreign direct investments or stimulating an unprecedented tourist boom. All these specific interventions may be needed in some measure within a larger scheme of post-crisis strategic planning, development and recovery.

However, what I would like to emphasise in this presentation is the need to package and implement these interventions in such a way that we have a handle on identifying, forecasting, and containing the social, political, environmental, motivational, and cultural fallout of the specific trajectories followed. As a country we may have produced some of the best minds in various fields including engineering, medicine, natural sciences, social sciences, and humanities. What we have failed to achieve are sufficient crosstalk and institutional linkages among these disciplines with the country's best interests and long-term progress within an increasingly polarised and crisis-ridden world as the common guiding principle driving all these branches of knowledge. This is why transdisciplinary thinking and action are essential at this moment of grinding national crisis.

## INTRODUCTION TO THE GUEST OF HONOUR

### **Professor Mick Moore**

Professorial Fellow

Institute of Development Studies

University of Sussex

UK



Mick Moore is political economist specializing in applied research on issues of public policy and governance in poorer countries, above all taxation. He has extensive research and advisory experience in many countries in Africa, Asia and Latin America. Having led many in-country advisory teams in Africa and Asia, he has more recently concentrated on the establishment and management of cross-country research networks and on contributing to high level policy debates around issues of taxation in poor countries. His specialist skills include leading multi-disciplinary international research teams; and writing clearly for academic, policymaking and more generalist audiences.

## **ABSTRACT OF SPEECH BY GUEST OF HONOUR**

### **Place and Space: Geography in Sri Lanka's History, and Future**

**Professor Mick Moore**

It seems obvious that the history and evolution of any country is deeply bound up with its geography. Where is it located? Where is it close to or accessible from? How is the topography, the climate and the vegetation? What natural resources does it have and what does it lack? Yet we don't always fully appreciate the extent to which these kinds of factors help shape history. We can sometimes learn a great deal by turning a geographers' lens onto social, political or economic questions. I have been trying to do this in my attempts to better understand the political history of Sri Lanka, and would like to share two tentative insights.

The first starts from a rather old political map. The boundaries between the Kandyan and the Dutch political jurisdictions in 1796 reflect the interactions of several fundamental features of local geography that generated a difference between two regions: an exposed, diverse, cosmopolitan, trading littoral; and a less accessible, more land-oriented, 'feudal' heartland. The subsequent process of incorporating those two regions into a single political jurisdiction in turn helps explain why the Sinhala Buddhist identity has been so powerful in recent Sri Lankan history.

The second is based on a wider map of contemporary patterns of economic growth in Asia. This helps us understand why recent Sri Lankan governments that had little understanding of or regard for capitalism, markets and private investment were able to command considerable public support for so long: the economy grew regardless, because of location. However, the higher the level of future engagement with the thriving but increasingly India-centric Asian economy, the more difficult it will be for Sri Lanka to maintain the relatively comfortable level of geo-political neutrality that it has practiced since Independence.

# Faculty of Education



*Research Excellence to Empower Education*

24<sup>th</sup> November 2023

## MESSAGE FROM DEAN

**Dr. L.M.K. Bandara**



It is with great pleasure we welcome you to the 3<sup>rd</sup> International Research Symposium of Faculty of Education (EDIRS) - 2023, which will be held on 24<sup>th</sup> November 2023. The EDIRS conference is hosted by the Faculty of Education with the support of University of Colombo. In the history of the last 50 years, this is the third time that we are going to organize the EDIRS Conference as a blended conference, allowing some participants to attend the conference physically. Based on the last two years' experience, the organizing committee is planning to host the conference as an open conference, allowing public to watch the conference through YouTube webcasting. All the participants are invited to watch the last year symposium proceedings at <https://edu.cmb.ac.lk/annual-research-symposium-2022>.

The International Research Symposium of Faculty of Education (EDIRS), first held in 2021 was the predecessor of the EDIRS conference organized jointly by the University of Colombo and Faculty of Education. In 2021, the first International Research Symposium of Faculty of Education (EDIRS) succeeded under the theme of Interdisciplinary Research in Education while integrating it with the Annual Research Symposium of the University of Colombo to make it a formal annual international event in Sri Lanka.

The theme of the 3<sup>rd</sup> EDIRS is on “Research Excellence to Empower Education” which focuses on the contribution of cutting-edge knowledge which is highly pertinent in the current context of Teacher Education to achieve sustainable development not only in Sri Lanka but globally as well. We are confident that this conference will provide a great open forum for researchers and practitioners in the field of Education to present their novel findings based on the research studies, disseminate new knowledge, exchange new ideas, and find new directions in applied research.

We hope that you have a productive as well as a memorable conference, EDIRS, 2023.

## MESSAGE FROM SYMPOSIUM CHAIR

**Dr. D.V.K.P. Seneviratne**

Senior Lecturer,

Faculty of Education



As the Chairperson of the EDIRS 2023, I am delighted and honoured to bring this message to the 3<sup>rd</sup> International Research Symposium of Faculty of Education (EDIRS) - 2023, held on 24<sup>th</sup> November 2023. The EDIRS conference is hosted by the Faculty of Education with the support of University of Colombo. Hence, the accepted papers of the EDIRS 2023 will be invited to be published in Sri Lanka Journal of Education (SLJE) after the conference, to disseminate it among a larger international audience.

The International Research Symposium of Faculty of Education (EDIRS), first held in 2021 was the premier Education conference in Sri Lanka. The first two International Research Symposia of Faculty of Education (EDIRS 2021 and 2022) succeeded under the themes of Interdisciplinary Research in Education and Digital Transformation and Best Practices in Mitigating Challenges in Education and is arguably the leading Education conference in Sri Lanka. Hence, it is with great pride and pleasure that the faculty of education is hosting the 3<sup>rd</sup> EDIRS at the Education Lecture Theatre, Faculty of Education.

3<sup>rd</sup> EDIRS Conference has been a platform for dissemination of research work not only at the cutting edge of education, but also research that address real problems in emerging regions.

The EDIRS conference is renowned for its high standards over the years. This year, the number of submissions has continued to grow to 80, reflecting the continued growth in the research culture in education in the region. After following a rigorous blind peer review process using more than 50 reviewers and cross checking all the papers for plagiarism, we were able to accept 55 as full papers, with around 69 % acceptance rate.

We sincerely hope that EDIRS 2023 conference will be intellectually stimulating to all the participants.



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## Programme of Sessions

Agenda – 24th December 2021		
09:00 AM	Registration	
09:30 AM	Inauguration of the EDIRS 2023 Conference	
09:40 AM	Pooja Dance	
09:45 AM	Welcome Address by the Dean of the Faculty of Education	
10:00 AM	Address by the Vice Chancellor of University of Colombo	
10.15 AM	Keynote address: The impact of AI Empowering Education <i>Associate professor, Dr. Arun Kumar Tarofder</i>	
11.00AM	Vote of Thanks by the Chair_EDIRS_2023	
11.15 AM	Tea Break	
11.45 AM-01.00PM	Technical Sessions	
11.45 AM--	Session 1-Panel 01	Session 01-Panel 02
	Language Education	Science, Technology and Mathematics Education
	Session 1-Panel 03	Session 1-Panel 04
	Educational Management and Administration	Humanities and Social Science Education
01.30 PM	Lunch Break	
01.30 PM-3.30PM	Session 2-Panel 01	Session 02-Panel 02
	Language Education	Science, Technology and Mathematics Education
	Session 2-Panel 03	Session 2-Panel 04
	Educational Management and Administration	Humanities and Social Science Education

03.30 PM	Award of Certificates and conclusion
03.45PM	Tea break
04.15PM	End of the Conference

## INTRODUCTION TO KEYNOTE SPEAKER

Dr. Arun Kumar Tarofder,

*Lecturer/Associate Professor,*

*Graduate School of Management,*

*Management And Science University, Malaysia*



Dr. Arun Kumar Tarofder is a Lecturer, Associate Professor at the Management and Science University, Malaysia, renowned for his expertise in the field of IT Marketing. He obtained his PhD. in IT Marketing in 2012 at Multimedia University, Malaysia. His research interest spans the area of Quantitative Method for Marketing Research, Digital Marketing, Marketing Research, Service Marketing, and Marketing Management. Since 18 years driven by his passion for digital marketing, consumer and industrial behavior, and consumer neuro-marketing, Dr. Arun has undertaken several research projects. He has successfully completed two seed grants within Management and Science University and has also participated in industrial projects. As a testament to his expertise, Associate Prof. Dr. Arun Kumar Tarofder has been invited as a guest lecturer in several esteemed universities across South East Asia. He has published more than 30 scientific papers in peer-reviewed journals and conferences in related research fields. Beyond his own publications, he is also an active chair as well as a reviewer for many key conferences and renowned journals from esteemed publishers like Elsevier and Emerald in related disciplines. His research work has consistently achieved high rankings in the Q1 and Q2 categories.

## **ABSTRACT OF THE KEYNOTE ADDRESS**

### **The Impact of AI Empowering Education**

**Dr. Arun Kumar Tarofder**

The use of Artificial Intelligence (AI) in education has significantly changed the way we teach and learn. Integrating AI technologies into educational systems has enabled educators, students, and institutions to improve their abilities. This abstract discusses the significant impact of AI on education, focusing on its capacity to personalize learning, improve efficiency, and encourage innovation. Moreover, it also discusses the important challenges and considerations before embracing AI in our education system. AI in education offers personalized learning experiences through adaptive learning platforms that customize educational content to meet individual student needs. It provides immediate feedback, analyzes behavior patterns, and improves teaching methods. AI technology streamlines administrative tasks, optimizes resource allocation, and enhances communication between students, teachers, and administrators. It also introduces new teaching methods such as Virtual Reality and Augmented Reality, and assists students with disabilities through translation tools and text-to-speech capabilities. Additionally, AI can automate content creation to provide educators with supplementary resources. The advent of AI has undoubtedly brought about positive changes in education. However, we cannot ignore the ethical concerns that come with it, particularly with regard to student data privacy and equal access to educational tools. To address these concerns, it is imperative to implement stringent data protection measures. Additionally, teachers should embrace AI as a tool that can enhance their role, rather than one that seeks to replace it. The use of Artificial Intelligence is transforming the field of education, enabling personalized learning, improved efficiency, and innovative approaches. AI has a significant impact on education, providing educators and students with powerful tools to tackle the challenges of the modern world. However, it is crucial that the integration of AI in education is carefully considered, taking into account data privacy, equity, and the changing role of educators. As AI technology evolves, it has the potential to revolutionize education, providing access to quality education on a global scale, making it more accessible and effective than ever before.

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Impact of gender differences in parenting styles on the parent child relationship and its effectiveness on academic performances in adolescents

*Sitharie Thilakarathna*



## **Teacher-related factors affecting the effective implementation of formative assessment practices**

R.N.P. Rathnayaka<sup>1</sup>, C. Wannigama<sup>2</sup>

<sup>1</sup>*Department of Secondary & Tertiary Education, The Open University of Sri Lanka, Sri Lanka*

<sup>2</sup>*Department of Educational Psychology, University of Colombo, Sri Lanka*

The main purpose of formative assessment is to guide students' learning process focusing to improve their learning progress. Formative assessment has the potential to guide both teaching and learning in the classroom. Even though the conceptualizations of formative assessment emphasize the importance of formative assessment practices in the teaching-learning process, literature has shown that formative assessment has not been successfully implemented in the classroom. Teachers are responsible for the effective use of formative assessments in their classrooms. Therefore, it is important to identify the influential factors related to the teachers that affect the formative assessment practices in the classroom. The main objective of this study was to identify the teacher-related factors that influence formative assessment practices in the classrooms. Twenty-nine items were used for this purpose, Exploratory Factor Analysis (EFA) was used to measure the construct validity of the scale using SPSS Statistics version 20. Exploratory Factor Analysis (EFA) was performed using a principal component analysis (PCA) and varimax rotation. In this EFA, three items "The term test is the only acceptable method that can measure the student's achievement in the classroom", "Varied written tests should be given for the personality development of the student" and "It is a pleasure to carry out daily assessments" failed to load on the expected dimensions significantly. Therefore, these items were removed. Seven factors comprised of twenty-six items were found as teacher-related factors that affect the effective implementation of formative assessment practices. They are teachers' attitudes, teachers' perceptions, teachers' motivation, professional development, classroom condition, school support, and school facilities.

**Keywords:** *formative assessment practices, teacher-related factors, factor Analysis, construct validity*

## **Mathematics online teaching-learning methods, advantages and challenges during covid-19 pandemic in Sri Lanka**

M.G.D.A.Siriwardena

*Department of Science and Technology Education, University of Colombo, Sri Lanka*

This study investigates the online teaching-learning methods utilized in mathematics education, explores the advantages of online learning, and identifies the challenges faced by educators and students in Sri Lanka during the COVID-19 pandemic. The research adopts a mixed-methods approach, incorporating quantitative surveys and qualitative interviews and focus group discussions. Surveys were distributed among mathematics teachers and students from multiple educational institutions in Sri Lanka to gather quantitative data on their experiences with online mathematics education. In addition, interviews and focus group discussions were conducted to gain qualitative insights into their perspectives. The findings demonstrate a variety of online teaching methods employed by mathematics teachers in Sri Lanka, including pre-recorded video lessons, live virtual classes, and interactive learning platforms. Both teachers and students reported several advantages of online mathematics education, such as flexibility in scheduling, accessibility to resources, and the ability to review recorded sessions. However, the study also highlights significant challenges, including inadequate internet connectivity, limited access to digital devices, difficulties in maintaining student engagement, and the absence of face-to-face interaction. These findings offer valuable insights into the experiences of mathematics educators and students during the COVID-19 pandemic in Sri Lanka. They underscore the potential benefits of online mathematics education while highlighting the need to address challenges to ensure effective teaching and learning in the digital realm. The research findings can inform policymakers, educational institutions, and teachers in Sri Lanka in formulating strategies to enhance the quality of online mathematics education. Further research is recommended to explore potential solutions and best practices for optimizing the online teaching-learning experience in mathematics education during and beyond the COVID-19 era.

***Key words:*** *mathematics education, online teaching-learning, advantages, challenges, COVID-19*

## **A Study on teacher preparation for teaching-learning process in an online classroom**

R. Wickramanayake<sup>1</sup>, H. M. Lalitha Kumari<sup>2</sup>

<sup>1</sup>*Lumbini College, Colombo 5, Sri Lanka*

<sup>2</sup>*Department of Social Science Education, University of Colombo, Sri Lanka*

This study attempts to examine how the teachers plan teaching techniques for delivery the lessons in online classrooms, to find out the strategies that teachers use to motivate students in online classrooms and to investigate the challenges faced by the teachers that aroused while preparing for the online sessions. The Qualitative method was followed for data collection. Ten teachers were purposively selected for the sample and semi structured interviews were executed for each of them. The data which generated from the interviews were analyzed using thematic analysis. The study revealed that most of the teachers were prepared for the online sessions prior to the date. And also, flipped learning was the popular teaching technique of the teachers. It was unveiled that some teachers guided the students for self-learning as the teaching technique for particular lessons. Social and digital media also were used as teaching techniques for the online classrooms. Most of the teachers used an innovative mix of instructional method and set the clear goals for the lessons to motivate students. Besides that, encouraging collaboration with peers, providing timely feedback, allowing to ask questions and friendliness were used as the motivational strategies in the online classrooms. Planning practical sessions, organizing group activities, preparing assessments and managing time were the major challenges that were faced by the teachers while preparing for the online sessions.

**Keywords:** *teacher Preparation, teaching-learning process, teaching techniques, motivation strategies, online classroom management*

## Introducing a learning model for enhancing higher order cognitive skills (HOCS)

J.P.R.Malkanathi <sup>1</sup> , H.M.L.Kumari <sup>2</sup>

<sup>1</sup> Faculty of Education, University of Colombo, Sri Lanka

<sup>2</sup> Department of Social Science Education, Faculty of Education, University of Colombo, Sri Lanka

Higher Order Cognitive Skills (HOCS) are considered the main element of education in the 21st century, while the world economy requires people with HOCS. HOCS are essential to practice at the classroom level. This research attempts to introduce a learning model for enhancing HOCS of sixth-grade students in Sri Lanka. Collaborative Action Research (CAR) along with survey and content analysis were used for fact-finding. 35 students in grade six from a national school in Galle district, who scored 35 marks for the question paper and 200 teachers were the participants. Data was analyzed qualitatively and quantitatively. 93% of teachers in the sample mentioned the necessity of the learning model, while 70% of them pointed out that creativity, cognition skills development activities, application, and analysis of the practical world should be included in the learning model. Two teachers who have participated in the CAR also mentioned the necessity of a HOCS learning model. After the interventions of CAR, a dependent hypothetical test confirms a difference in score of pre-test and post-test with a 99% increased confidence level. Introduced HOCS model displays how students were developed step by step. Remembering and understanding which were considered as the foundation skills while applying was the landmark of the model, because the other three HOCS namely, analyze, evaluate, and create depended on the apply dimension. At the end of this intervention the student emerges with HOCS. This model is confirmed by practicing CAR interventions. Therefore, the model can be used in the daily classroom teaching-learning process as well as for course planning.

**Keywords:** *higher order, cognitive skills, learning model, action research*

## **The impact of school management on strengthening of the school - community relationship**

Sivananthan <sup>1</sup>, L.N.P. Wedikandage <sup>2</sup>

<sup>1,2</sup>*Department of Social Science Education, University of Colombo, Sri Lanka.*

The school management plays a key role as the agent undertaking the process of socialization as well as a sub organization of the community in strengthening of the school-community relationship. This study attempts to explore the actions taken by the school management and its impact on strengthening the school - community relationship. The study was conducted in a quantitative domain using a descriptive survey design. Data gathered on a purposively sampled 15 principals, 15 deputy principals, and 60 teachers using questionnaires, interviews, and documents were analyzed descriptively. The fact-finding revealed that indirect, external, direct, and neutral actions were commonly taken by the schools to get the active participation of the community to improve the learning achievement of the students, the effective implementation of co-curricular activities, and the improvement of moral values and welfare services for the students, yet the efficiency of such actions in strengthening the school-community relationship was at a low level. The relationship between the actions taken and the school-community relationship was a moderately positive correlation ( $n = 15, r = 0.5-0.6 \leq 1$ ). Various factors that influenced the strengthening of the school-community relationship include low incomes of students' parents, daily wage labor, low educational level of the community, occupational inequalities, societal caste differences, rise in domestic violence and child abuse, lack of strong alumni organization and greater participation of mothers than fathers. This study suggests the essence of a collaborative effort of a cohesive team involving principals, teachers, parents, past pupils (alumni), and well-wishers to strengthen the school-community relationship addressing challenges posed by identified factors.

**Key words:** *school management, school - community relationship, occupational inequalities*

## Developing 'Intra-Personal Capabilities' associated with the 'Emotional Intelligence' of teacher Trainees

D.P.C.S.Kumari<sup>1</sup> , C.Chandrakumara<sup>2</sup>.

<sup>1</sup> *Ruwanpura National College of Education, Sri Lanka*

<sup>2</sup> *Department of Education Psychology, University of Colombo, Sri Lanka*

Historically, Intelligent Quotient(IQ) was identified as the most important brain capacity of the individuals. But as it stands now, its importance is gradually diminishing. As a result, the development of Emotional Intelligence (EI) is highlighted as one of the greatest demands on a person to live his or her daily life more effectively. Emotional intelligence can be identified as a concept of enormous importance to successfully achieve the academic achievements of teacher trainees. The emphasis was therefore placed on two main objectives within the framework of the mixed methodology. They were, how to develop self-awareness and self-management of Teacher Trainees (TT) in relation to their EI. 200 teacher trainees and 20 teacher educators were selected as sample. Initially, the questionnaire and observing schedule were used for data collection. Data were interpreted using mixed methodology. Fact findings revealed that individual writing activities, classroom activities based on fun games, aesthetic activities, meditation, motivational videos and reading stories related to moral development can be used to develop self-awareness. Mindfulness activities, case studies, fun games, music therapy, sports, religious activities, orientation programme, assigning marks to the personality, establishment of goals, career counseling, group projects and building peer circles can be used for developing self-management. This study suggests the need of individual and group activities in planning and executing an emotional intelligence program to develop the emotional intelligence of teacher interns. Overall, developing emotional intelligence related to learners' intrapersonal skills is an extremely effective approach to improving not only academic achievement, but also daily life.

**Keywords :** *teacher trainee , emotional intelligence, intra-personal capabilities, individual and group activities*

## **Effectiveness of using technological tools for teaching learning process of Communication and Media Studies**

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<sup>1</sup>*G/ Lanumodara Vijaya College, Galle, Sri Lanka*

<sup>2</sup>*Department of Science and Technology Education, University of Colombo, Sri Lanka*

This study aimed to investigate the status of use of technological tools, teachers' awareness and readiness, students' perceptions, and the problems and difficulties encountered in using technological tools. The research employed a mixed methods approach, incorporating surveys, interviews, and observations to collect data from a diverse sample of teachers and students. The findings revealed that the majority of teachers had a positive attitude towards learning new technical skills and recognized the ease and convenience of teaching using technological tools. They believed that technology-assisted teaching leads to more effective learning outcomes, enhanced student engagement and active participation in lessons. On the other hand, students generally had positive perceptions of using technology in the classroom. They believed that technological tools made the learning process more engaging, interactive, and up-to-date which enabled them to be more active participants in the lessons, and they appreciated the additional time it provided teachers to address their individual needs. However, some challenges and practical issues were identified with regard to professional development and support to enhance teachers' pedagogical skills in utilizing these tools effectively and classroom management along with the technology integration. Recommendations improve the use of technological tools in the classroom mainly includes professional development with the focus of student engagement and classroom management and provision of infrastructure ICT facilities for teachers and students. Creating a positive and inclusive classroom culture that promotes active participation and collaboration can help overcome these challenges. Future research should focus on exploring the long-term impact of technology integration and investigating best practices for optimizing its use in various educational contexts.

***Keywords:*** *Technological Tools, Teaching and Learning Process, Integration, Classroom management*

## **Academic credential inflation in teacher education in Sri Lanka: Teachers' perspectives of the efficacy of Master Degrees**

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<sup>1</sup> *Faculty of Education, University of Colombo, Sri Lanka*

<sup>2</sup> *Department of Humanities Education, University of Colombo, Sri Lanka*

Education economists use credential inflation theory to explain the devaluation of tertiary education degrees as the consequence of the excessive supply. Academic credential inflation refers to the increasing of the higher degree qualifications for certain jobs where the real value in terms of their returns is decreasing. This study explored the perceptions of teachers who completed Master of Education to identify their perceived efficacy from the returns of their qualifications. Phenomenological approach was used to delve deep and describe the lived experiences of the participants through focus group interviews with 10 participant groups who completed Master of Education in 2022 in Jaffna district. All teachers have gained increased self-confidence to be professional educators. Majority of the respondents perceived improved knowledge in pedagogical methodology and student engagement, while only half of them opined to have been empowered to encounter professional competition within their community. These conditions correspond with the signaling theory though very few were connecting their qualifications with the increased remuneration, promotional opportunities and elevation in social status. The teachers in service Grade-1 noted that the qualification was unlikely useful for professional requirements any further. These claims led to the conclusion that the master degrees have not infuse economical value on the graduates to increase their demand and contribute to generate human capital gains as expected. The master degree holders have increased considerably in mediocre educational professions in recent years which resembles the situation of academic credential inflation. The study also identified several factors that trigger academic credential inflation.

**Key words:** *Academic credential inflation, education economics, devaluation of tertiary education*



## **Science teachers' perception in using smart board in the teaching learning process in Sri Lankan secondary schools**

R.Vijayatheepan

*Department of Science and Technology Education, University of Colombo, Sri Lanka*

This study explored science teachers' perceptions of using smart boards in the teaching-learning process, their proficiency in utilizing smart boards based on teaching methods, and the challenges they encountered. It employed a case study approach with 15 grade nine science teachers in Jaffna district, Sri Lanka, using purposive sampling. Data were collected through interviews, document reviews, and observations, and data were analyzed using thematic analysis. Fact findings revealed that while teachers recognized the value of smart boards in enhancing student interest in science, their limited skills and traditional teaching methods hindered its effective use. Additionally, challenges included time constraints, power interruptions, a scarcity of resources in Tamil-language for learning science, and a lack of computer-based teaching aid preparation knowledge, which collectively impacted the full utilization of smart boards in teaching science lessons facilitated by theoretical perspectives of constructivism learning theory. In summary, this study highlights that despite a positive attitude among teachers towards smart board use, addressing the barriers related to inadequate physical resources and teacher skills is imperative. Consequently, there is a pressing need to empower science teachers with the essential pedagogical skills that will enable them to harness the full potential of smart boards for effective teaching and learning.

***Key words:*** *science teachers, smart board, constructivism, pedagogical skills*

## **Activity Based Learning towards promoting selected Sustainable Development Goals: A Critical Review**

H.D.A. Seneviratne<sup>1</sup>, D.V.K.P. Seneviratne<sup>2</sup>

<sup>1</sup> *Faculty of Education, University of Colombo, Sri Lanka*

<sup>2</sup> *Department of Science and Technology Education, University of Colombo, Sri Lanka*

This study is in line with the broader research titled "Activity-Based Learning Towards Promoting Selected Sustainable Development Goals (SDGs): An Experimental Study with Advanced Level Students." The SDGs represent a comprehensive framework encompassing various sectors to drive holistic development for a better world, focusing on well-being, economic prosperity, and environmental protection. Existing research has highlighted inadequate awareness, knowledge, and attitudes towards the SDGs not only among school children but also within society. Moreover, the implementation of Activity-Based Learning (ABL) in Sri Lankan classrooms is a subject of uncertainty. The study conducted a comprehensive documentary review utilizing various sources, including reports, research papers, e-journals, and related articles, to explore the significance of Activity-Based Learning in promoting SDGs and to assess efforts in this regard, both in Sri Lanka and internationally. Literature reveals that ABL has the potential to instigate shifts in knowledge, attitudes, and behaviors, contributing to the creation of a more sustainable society. Furthermore, it suggests that ABL encompasses diverse real-life contexts such as eco-school activities, field investigations, learner-centered education, group projects, problem-based tasks, interactive classroom sessions, outdoor experiences like nature walks and water activities, overnight camps, experiments, class discussions, debates, role-playing, and games, all of which address sustainability comprehensively by addressing social, economic, and environmental issues. This study underscores the importance of empowering school children with knowledge and positive attitudes towards SDGs through the effective implementation of ABL, taking into account available resources and existing literature.

***Keywords:*** *sustainable development goals, activity-based learning, learner-centered education*

## **A design for an intervention program to enhance the teacher competency in teaching electronics in grade 11 science curriculum in Sri Lanka**

N. V. D. P. Priyadarshani <sup>1</sup>, D. V. K. P. Seneviratne <sup>2</sup>

<sup>1,2</sup> *Department of Science & Technology Education, University of Colombo, Sri Lanka*

Extant literature in grades 10 and 11 science classroom in National schools of Sri Lanka that consisted of teaching Electronics as a notable component included under the Physics content domain revealed that majority of the science teachers had not required competencies in providing hands on experiences in Electronics to students, despite its relevance to day-to-day applications. Therefore, this study aimed to identify strategies to facilitate the science teachers to develop the expected competencies and self-efficacy in teaching electronics in grade 11. Literature survey revealed PSpice circuit simulator as an effective simulation program that models the behavior of a circuit containing analog or mixed A/D devices, used to test and refine our design before implementing on hardware (PCB). It found this simulation could be effectively used to develop the teachers' competency in conducting practical in Electronics. Documentary review of teacher guides and text books of science at varying grade levels from 6 to 11 revealed that content on electronics spans in par with the curriculum design principle of continuity, therefore, could be effectively integrated with use of PSpice circuit simulator at each grade level. Thus, this study attempted to design an intervention which composed of eight sessions where each session aims at enhancing science teacher's self-efficacy level of teaching electronics using PSpice circuit simulator. This intervention program, with its focus on practical and theoretical aspects and the use of technology, invariably would enhance teacher competency and ultimately improve the quality of science education in the schools. Yet, the feasibility of the proposed design need to verified through well programmed design-based research.

**Keywords:** *electronics, prototype module, competency, pspice circuit simulator, teachers' self-efficacy*

## **Challenges faced by principals in implementing School Based Professional Teacher Development Programs ( SBPTD)**

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<sup>2</sup> *Department of Social Science Education, University of Colombo, Sri Lanka*

As a participatory management process, Enhanced Program for School Improvement (EPSI) facilitates schools with a higher degree of independence in decision making. This program focuses on updating school staff regarding certain functions of the school, and improving their skills to meet challenges and for their progress, School Based Professional Teacher Development Programs (SBPTD) becomes one of such initiatives. This study attempted to find out the challenges principals face in implementing SBPTD programs and propose strategies to overcome identified challenges. The study employed the sequential explanatory mixed research method along with the survey and case study method with a sample of twenty-five schools selected from Matara education zone using stratified random sampling. Four schools of 1AB, 1C, Type 2, and Type 3, were selected for the case study using purposive sampling. Quantitative data was collected through a questionnaire with 250 teachers and 25 principals while qualitative data through interviews and focused group discussions. The study found inadequate funds, lack of physical resources, difficulties in allocating time for SBPTD programs, non-availability of resource persons, lack of awareness about SBPTD programs and negative attitudes of teachers as the challenges principals face in implementing SBPTD programs. The study proposes introduction of alternative fund raising activities within the school, establishing a pool of resource persons, conducting awareness programs on SBPTD at school level, conducting SBPTD programs during school vacation and developing a reward system for teacher's participation in SBPTD programs as measures to overcome the identified challenges.

***Keywords:*** *SBPTD, principal, teacher, professional development, challenges*

## **Teacher perception of the effectiveness of collaborative learning in motivating Advanced-level ICT students in an online environment**

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The global experience of teaching and learning has been marked by a wave of emergency digitalization as a result of the recent COVID-19 pandemic. In Sri Lanka, teachers were also forced to respond quickly and without prior training due to a clear need for the integration of online teaching and learning. However, even though teachers try to interact with students in an online environment, the isolation of learning in a virtual environment has discouraged students from active learning and reduced their involvement. The study aims to examine how teachers perceive collaborative learning approaches for motivating ICT students in an online environment. A qualitative approach was utilized for the study, where 12 ICT teachers were interviewed. In particular, two methods were applied, namely a convenience sample with members of academia which is easily accessible to the study team as well as snowball sampling recruiting respondents from acquaintances of participants. Analysis of Advanced Level ICT teachers' responses to the open-ended questions revealed that in the successful implementation of collaborative learning methods in the online environment, student and teacher responsibilities have been distributed which encourages students to take responsibility for their educational process. In light of these findings, one of the most important recommendations is to take into account the pedagogical affordances of digital technologies and resources and to explore what works best in different contexts and learning contexts. To enhance teachers' trust in and the ability to take a significant part of Digital Technologies into practice, it may be beneficial for them to gain greater knowledge of these affordances.

***Keywords:*** *online education, collaborative learning, motivation, pedagogy, teachers' perception*

## **A comprehensive study on the utilization of memory strategies among adolescent school students in Sri Lanka**

A.H.M.I.E. Herath <sup>1</sup>, S. Thilakarathna <sup>2</sup>

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This study examines the utilization of memory strategies, particularly mnemonics, among adolescent school students in Sri Lanka. Despite the importance of memory and reflection abilities in the educational process, there is limited research on memory strategies in the Sri Lankan context. This study aims to address this gap by investigating students' understanding, practical use, attitudes, and the contribution of schools towards memory strategies. Using a survey design, data was collected from grade 11 students (50) and teachers (20) in selected schools in the Galewela educational zone. The research employed a mixed-method approach, including questionnaires and interviews. Memory strategies were categorized into rehearsal, elaboration, and organization techniques. Students identified the strategies used for different subjects, rated their ease of use, and discussed their motivation. Teachers provided insights into their knowledge, teaching practices, and school support for memory strategies. Data analysis was performed using Minitab 2018 statistical software. The findings reveal that 96% of students have some knowledge of memory strategies, with 46% demonstrating a good understanding. The choice of memory strategies varied based on individual factors, subject characteristics, and teacher guidance. Rehearsal strategies were most commonly used, followed by elaboration and organization strategies. Teachers played a role in educating students about memory strategies, but additional sources such as private tutoring and the internet also contributed to students' knowledge. This study proposes the need for a formal program to promote memory strategies among adolescent school students with due emphasis on the limited understanding of mnemonics among students and teachers and the importance of teacher guidance and motivation.

**Keywords:** *memory strategies, mnemonics, rehearsal, elaboration, organization*

## **Strategies to develop English language competencies in an overcrowded classroom;**

### **Action Research on Grade nine students**

Y. S. U. W. Silva<sup>1</sup>, E.S. Neranjani<sup>2</sup>

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<sup>2</sup> *Department of Humanities Education, University of Education, Sri Lanka*

Observations conducted in a classroom in a National school of Sri Lanka that consisted of the highest scored students at the Grade Five scholarship examination revealed that majority of the students had not developed the expected English language competencies, despite the use of variety of strategies by the teacher. A survey revealed that the students had the potential and desire for development but overcrowdedness in the classroom hindered the teacher-student interaction as well as student-student interaction. This study aimed to identify strategies to facilitate the students to develop the expected English language competencies. Library survey revealed pair-work as an effective strategy for active student engagement in an over-crowded classroom. Thus, action research was conducted on a sample of 20 students in Grade Nine over-crowded classroom of a national school, who had not developed the expected English language competencies. Data were collected by administering Pre-tests, Post tests, Observations, check lists and questionnaires and analyzed using both qualitative and quantitative methods. Activities were designed and administrated as individual work, group work and pair work. As the students demonstrated positive attitude towards the pair work activities, the Think-pair-share technique was administrated in pair work activities. Key findings of the study were; Students were more active in pair-work than working individually or in groups. Pair work activities improved the attention span of the students and encouraged the effective teaching learning atmosphere in an overcrowded classroom. Post-test marks revealed that majority of the students had developed expected English language competencies in varying levels by working in pairs. It can be concluded that pair-work is an effective strategy that can be used in an over-crowded classroom to develop the expected competencies of the students.

**Key words:** *overcrowded, pair work, effective teaching, teaching strategies*

## Strategies to develop resources in reopened schools

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Effective resource provision and equitable distribution are vital aspects of school development. Despite existing policies on resource distribution, there remains a significant disparity in resource allocation among schools. This inequality has resulted in the closure of disadvantaged schools and the subsequent reopening and reconstruction of some institutions. This study focused on the reopened schools to examine resource development, identify the challenges they face, and explore the strategies they employ for resource development. The research employs a survey method, with a sample comprising 22 reopened schools in the Central Province. A total of 319 participants, including zonal representatives, principals, teachers, and school development committee members, were randomly selected to gather data administering questionnaires including open-ended questions. Data were analyzed using both quantitative and qualitative techniques. The fact findings indicate that resource development in these reopened schools has been driven by the School Development Committee's initiatives, particularly in the context of the School Improvement Program. Additionally, schools have sought resources from non-governmental stakeholders and implemented income generation programs. However, the formulation of asset management plans has been lacking. Challenges faced by these schools predominantly revolve around insufficient resources and facilities, as well as limited community support. To address these challenges, schools have taken steps such as sourcing resources from stakeholders, raising community awareness to garner support, and conducting activities through the school development committee. The study underscores the importance of implementing programs for resource development and income generation, as well as the need for effective capacity building and collaborative management for developing resources in the context of reopened schools.

**Keywords:** *resource development, reopened schools, programme of school improvement, school development committee*



## **Impact of Inclusive Education on the Self-concept of Students with Physical Impairments**

R.A.B.U.I.Perera<sup>1</sup>, W.Chandradasa<sup>2</sup>

<sup>1,2</sup> *Department of Educational Psychology, University of Colombo, Sri Lanka*

Inclusive education seeks to provide equal opportunities in mainstream classrooms, fostering self-concept development and societal integration for all learners, including those with impairments. This study aims to assess the levels of self-concept having identified the stronger and weaker domain of physically impaired students comparing with that of their normal peers in the inclusive classroom. The survey research design employed stratified sample techniques in the Colombo and Gampaha districts in the western province of Sri Lanka. Data were collected using the adapted version of the SDQ-II questionnaire and analyzed using descriptive and inferential statistical methods. The physically impaired students' self-concept levels were average and above average while these levels differ significantly by gender. None of the three domains reported above-average self-concept levels for all the sub-scales in the Academic domain, and sub-scales of mathematics and verbal reported average self-concept levels, indicating the Academic domain as the strongest domain out of the three self-concept domains. Non-academic domain, students were weak in the sub-scale of same-sex peer relations. The global self-concept domain reported average level self-concept for both two subscales in the domain. Both physically impaired and not impaired student groups reported average mean self-concept values, and there was no significant difference between the means of these two student groups regarding self-concept. To create a positive self-concept among physically impaired students, actions should be taken in the teaching-learning process, extracurricular activities, and other non-formal activities at the school level. The originality of the findings is visible as it contributes to the limited body of research on special need education with the focus of the self-concept of physically impaired students.

**Keywords:** *Inclusive education. Self-concept, academic domain, global self-concept, Physical impairments*

## **Impact of School-Based Management on the development of small schools in Sri Lanka: A case study**

G.D.H.Kosala<sup>1</sup>, T.W.Indigahawela<sup>2</sup>

<sup>1</sup>*Faculty of Education, University of Colombo, Sri Lanka.*

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The implementation of school-based management strategies has become a widespread approach in many countries, aiming to ensure transparency and accountability in school management through active involvement of the school community in decision-making processes. Sri Lanka has also adopted the school-based management approach in its educational system, following the recommendation of the National Education Commission. This study investigated the impact of school-based management on the development of small schools in Sri Lanka in terms the school-based planning process and the participatory decision-making processes associated with it. The study employed a case study methodology on a sample of small schools accommodating fewer than 100 students in the Colombo district. Data were collected using interviews, focus group discussions, observations, and document analysis and analyzed using thematic analysis. The key findings reveal that; the selected schools effectively practice school-based planning processes in accordance with its capacity, involving the school community in the decision-making process. The principals adopt a participatory management style to oversee the schools' operations. However, it discloses key challenges hindering the school's development, including insufficient government funding, low student admissions, the presence of nearby competing schools, and the socioeconomic backgrounds of parents. The study proposes the essence of enhanced capacity of the principals and the School Development Executive Committee in terms of managerial aspects in order to overcome such challenges. Adoption of school-based teacher development programs for in-house teachers is also suggested as a beneficial approach to further support the small school's progress.

**Keywords :** *School-Based Management, small schools, school based planning*

## **Impact of transformational leadership styles of young principals on brand status and acceptance quality of rural non-national schools in Sri Lanka: A Critical review**

N.S.Dissanayake<sup>1</sup> , T.W.V.Indigahawela<sup>2</sup>

<sup>1</sup> *Faculty of Education, University of Colombo, Sri Lanka*

<sup>2</sup> *Department of Social Science Education, University of Colombo, Sri Lanka*

This study explores the impact of the transformational leadership styles of young principals on enhanced brand status and acceptance quality of rural non-national schools in Sri Lanka. This documentary review of e-journals and articles disclose the various transformational leadership styles, current status of brand status and acceptance quality of rural non-national schools in Sri Lanka and impact of transformational leadership styles on current state of brand status and acceptance quality in these schools, and the potential benefits and challenges associated with the adoption of transformational leadership styles. The literature evidences that transformational leadership styles have a significant impact on student outcomes, teacher satisfaction, and overall school performance, and emphasizes that transformational leaders in education are capable of creating a positive learning environment, empowering both teachers and students, and promoting academic achievement. In the context of rural non-national schools in Sri Lanka, the role of transformational leadership in enhancing brand status and acceptance quality emerges as a crucial area of research. The rural schools face challenges including a shortage of qualified teachers, and limited access to technology and educational materials which could hinder the ability of rural schools to attract and retain students and may contribute to negative perceptions of these institutions within the community. The extant literature demonstrates the essence of adoption of transformational leadership styles in national programs aimed at training and developing principals in non-national and rural schools.

**Key words:** *transformational leadership, brand status and acceptance, rural schools, non-national schools*

## **Impact of gender differences in parenting styles on the parent child relationship and its effectiveness on academic performances in adolescents**

Sitharie Thilakarathna

*Department of Education Psychology, university of Colombo, Sri Lanka*

Gender roles are viewed as the ways in which individual, family and social roles are defined by the male or female (Slavkin & Stright, 2000). The main aim of this study was to identify the gender difference of the parenting and how it affects to the child's academic performances. The study was carried out as a survey, under the descriptive research design on a sample of 102 students of both genders (n=48 male, n=54 female) studying in grade 12 and grade 13 in two government schools in Horana education zone selected using random sampling technique. Data were collected administering Parents Bonding Inventory (PBI), Self-Developed Questionnaire and semi structured interview schedules and analyzed using both quantitative and qualitative methods. Ch-square test was employed to find out correlations. The main findings of the study were; mothers were more overprotective and caring than fathers, and mothers spent more time with their children than fathers. Fathers were more likely to be overprotective of their children especially daughters than their sons. This has proven the stereotypical concept of fathers being more attracted to their daughters than their sons. The children who were lived with both the parents have shown better academic performances in school than those who were lived with single parents, especially with fathers. It also found that the interpersonal relationships of the children who were lived with both the parents among their peers and other individuals better than those who were lived with single parents.

***Key words:*** *gender differences, parenting, academic performance, adolescence*

# Faculty of Graduate Studies



*Sustaining Excellence through Multi-Disciplinary  
Research*

**24<sup>th</sup> November 2023**

## MESSAGE OF THE DEAN, FACULTY OF GRADUATE STUDIES

**Professor A.A. Azeez**



I am delighted to send this message for the Annual Research Conference 2023 (ARC 2023) of the Faculty of Graduate Studies at the University of Colombo. The ARC 2023 marks a significant milestone as the faculty hosts the conference in person, returning to a conventional platform following the challenges posed by the prevailing pandemic. Reflecting the current economic climate, the conference has been themed around "Sustaining Excellence through Multi-Disciplinary Research," with the Keynote speech aligned with this overarching theme. Moreover, ARC 2023 includes a notable event—the Policy Discussion.

ARC 2023 comprises six diverse tracks, encompassing Education, Teaching, Learning & Assessment; STEM (Science, Technology, Engineering & Mathematics); Arts, Humanities & Social Sciences; Business, Management & Economics; Health and Medicine; and Law, Policy, and Governance. These tracks offer a comprehensive exploration of various academic fields, fostering interdisciplinary collaboration and providing a valuable platform for research students to present and discuss their work. Additionally, the conference incorporates a Policy Discussion event, facilitating participants in addressing policy implications arising from their research.

I extend my sincere gratitude to the conference co-chairs, track coordinators, reviewers, the organizing committee, conference secretariat, and, most importantly, the authors for their invaluable contributions to the successful organization and management of this conference.

We eagerly anticipate a rewarding and enlightening conference experience that will contribute to the advancement of knowledge across various multidisciplinary research domains. I wish ARC 2023 a resounding success.

## MESSAGE FROM CO-CHAIRS

### **Dr. Rushan Abeygunawardana**

Senior Lecturer  
Department of Statistics  
Faculty of Science  
University of Colombo



### **Dr. Mayuri Atapattu**

Senior Lecturer  
Department of HRM  
Faculty of Management and Finance  
University of Colombo



We extend a warm and enthusiastic welcome to you for the Annual Research Conference (ARC-2023) organized by the Faculty of Graduate Studies of the University of Colombo.

This year, we unite under the theme of "Sustaining Excellence through Multi-Disciplinary Research." Given the prevailing economic uncertainty stemming from macro-level economic challenges, we believe that this theme is more pertinent than ever. ARC 2023 will encompass a diverse array of full paper-driven parallel sessions, where cutting-edge research across multiple disciplines will be showcased, including Education, Teaching, Learning & Assessment; STEM (Science, Technology, Engineering & Mathematics); Arts, Humanities & Social Sciences; Business, Management & Economics; Health and Medicine; and Law, Policy, and Governance. These sessions will be followed by a plenary session, aimed at inspiring engaging discussions and fostering knowledge exchange among our participants.

It is our distinct honor to introduce Associate Professor Khang Tsung Fei, a distinguished figure in Mathematical Sciences from the University of Malaya, Institute of Biological Sciences, Malaysia, as our keynote speaker. Joining him are esteemed panelists representing various universities, whose presence promises to enrich our conference.

We wish to express our heartfelt gratitude to the multitude of individuals whose unwavering dedication has been instrumental in making this year's conference a reality. We extend our sincere thanks to the conference delegates, secretaries, track chairs, track coordinators, session chairs, the panel of reviewers, editors, members of the organizing committee, and plenary speakers for their invaluable contributions. We are also deeply appreciative of the support provided by the Dean of the Faculty and our colleagues at the Faculty of Graduate Studies, University of Colombo, whose contributions have been vital to the successful launch of this conference.

As we embark on this intellectual journey together, we anticipate that ARC 2023 will prove to be a memorable event, one that challenges, excites, and inspires all participants.

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M. A. M. Hakeem

R. Y. H. De Alwis Seneviratne



## PROGRAMME OF SESSIONS

Agenda - 24 <sup>th</sup> November 2023					
08:30 a.m.	Registration				
09:30 a.m.	Arrival of Guests				
09:40 a.m.	National Anthem and Lighting of the Oil Lamp				
09.50 a.m.	Welcome Address by Professor A.A. Azeez, Dean, Faculty of Graduate Studies, University of Colombo				
10.00 a.m.	Address by the Chief Guest, Senior Professor (Chair) H.D. Karunaratne Vice Chancellor, University of Colombo				
10.10 a.m.	Introduction to the Keynote Speaker, by Professor K. Dissanayake (Director of Studies/FGS), Faculty of Graduate Studies, University of Colombo				
10.20 a.m.	Keynote Speech by Associate Professor Tsung Fei Khang Institute of Mathematical Sciences, Faculty of Science, Universiti Malaya, Malaysia.				
10.50 a.m.	Vote of Thanks by Dr. Mayuri Attapatu, Conference Co-chair				
11.00 a.m.	End of the Inauguration Ceremony and Morning Tea				
	Commencement of Parallel Sessions				
11.30 a.m.	Track 01 – Education, Teaching, Learning & Assessment	Track 02 Track 05 –Science, Technology, Engineering & Mathematics  Health and Medicine	Track 03 – Arts, Humanities & Social Sciences	Track 04 – Business, Management & Economics	Track 06 – Law, Policy and Governance
12.30 p.m.	Lunch Break				
	Continuation of Parallel Sessions				
01.30 p.m.	Track 01 – Education, Teaching, Learning & Assessment	Track 02 Track 05 –Science, Technology, Engineering & Mathematics  Health and Medicine	Track 03 – Arts, Humanities & Social Sciences	Track 04 – Business, Management & Economics	Track 06 – Law, Policy and Governance
03.30 p.m.	Evening Tea and End of the Conference				

## INTRODUCTION TO THE KEYNOTE SPEAKER

### **Dr. Tsung Fei Khang**

*Associate Professor  
Institute of Mathematical Sciences  
Faculty of Science, Universiti Malaya, Malaysia.*



Dr. Khang is a statistician with strong interests in the development and application and development of statistical methods in data science. He received his Ph.D. in statistics from the National University of Singapore in 2009, and then joined Universiti Malaya at Kuala Lumpur, Malaysia. His research interest broadly covers the area of data science, bioinformatics, ecology, medical statistics, and machine learning. He has published over 30 research publications in these areas, many of which are collaborative projects with domain experts. Since 2010, He has served as the principal consultant statistician in over 20 projects, and conducted numerous workshops on statistics, bioinformatics, and R programming. From 2021-2023, he was the programme coordinator for the Master of Science in Statistics programme. Currently, he heads the Universiti Malaya Centre for Data Analytics, which focuses on establishing collaborative research and engagement between the industry and the academia in Malaysia.

## **ABSTRACT OF THE KEYNOTE ADDRESS**

### **Morphometrics in the Age of AI**

**Dr. Tsung Fei Khang**

Morphometrics, the quantitative analysis of shape and size in biological structures, plays a crucial role in addressing fundamental species delineation challenges and serves as a key component in automated species identification. The beauty of morphometrics derives from its interdisciplinary nature – mathematics, statistics, and computing blend in harmonious syncretism to produce powerful analytic tools for biologists. Recently, the integration of AI and advanced imaging technologies has presented an unprecedented opportunity for morphometrics to harness the power of AI. This convergence has the potential to invigorate classical systematics studies, traditionally associated with specialised experts. In this talk, I will share my personal experiences applying morphometric and AI methods to systematics and species identification problems. Additionally, I will discuss situations where the effectiveness of classical and AI methods may be optimised.

## LIST OF ABSTRACTS

<b>Track One:</b>	
<b>Education, Teaching, Learning &amp; Assessment</b>	
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# Track 01

## Education, Teaching, Learning & Assessment

### Usefulness of the Human Library Programmes: A Literature Study

Y.W.N.D Amarasooriya and M.G.H.K. Wijerathne

The Human Library Programmes have emerged as innovative initiatives aimed at promoting empathy, challenging stereotypes, and fostering understanding among individuals from diverse backgrounds. This literature study examines the usefulness of Human Library Programmes in achieving these goals. Through a comprehensive review of scholarly articles, books, and reports, this study analyses the impact of Human Library Programmes on participants and society. Findings indicate that Human Library Programmes are highly effective in breaking down barriers and promoting dialogue between people with different experiences and perspectives. Participants report increased empathy, reduced prejudice, and improved understanding through conversations with “human books.” These interactions facilitate personal growth and expanded worldviews by challenging biases and preconceptions. Additionally, Human Library Programmes provide safe spaces for marginalised individuals to share their stories, empowering them to challenge stereotypes and contribute to societal change. However, scalability, long-term impact assessment, and inclusivity pose challenges that require further research. In conclusion, this literature study confirms that Human Library Programmes effectively promote empathy, challenge stereotypes, and foster understanding. Ongoing evaluation and research will enhance our understanding of long-term impact and potential improvements, ensuring the continued success of these programmes in creating a more inclusive and tolerant society.

**Keywords:** Human Library, Literature study, Human Library Programmes, Sharing information, Human book

# **Evaluating Awareness and Knowledge of Sustainable Development Goals among Technology Curriculum Developers of General and Higher Education in Sri Lanka**

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The Sustainable Development Goals (SDGs), which are intended to be achieved by the year 2030, were built after the Millennium Development Goals (MDGs), which were set to expire in 2015. This is a universal call that is comprised of 17 goals that are focused on People, Prosperity, Planet, Peace, and Partnership. Leaders from 193 countries around the world came together to reach this universal agreement. Sri Lanka is also a member of the Sustainable Development Summit. It is required to shift towards a more innovative, knowledge-based economy. As education plays a major role in uplifting the economy, technology education should be strong enough to support the SDGs. The objective of this research is to evaluate awareness and knowledge of SDGs in developing technology curricula for general and higher education in Sri Lanka. This is a survey-based study which was conducted in two stages. Stage 1 is defined as evaluating awareness and knowledge of sustainable development goals in developing technology curriculum for general education, while the stage 2 evaluates higher education in Sri Lanka. Data has been collected through focus group discussions, semi structured interviews, and a curriculum review. A thematic analysis was done in both inductive and deductive ways, and the collected data was analysed under five identified themes for both general and higher education. As a result, it was found that the SDGs should be addressed as much as possible through the curriculum as they are global requirement. And also, it is highlighted that Education Policies should be strong enough to achieve this global requirement. Through the curriculum review, it is also revealed that the SDGs are already addressed indirectly through existing curriculum. Both general and higher education are engaging with on-going curriculum revision process, and programme learning outcomes (PLOs) are being mapped with SDGs. Finally, the findings suggest that curriculum developers in both general and higher education are engaged with achieving the aims of sustainable development as they consider this is a global requirement.

**Key words:** Curriculum developers, General Education, Higher Education, Sustainable Development Goals (SDGs), Technology Curriculum



**A Linguistic Stylistics Analysis of the Poem 'Breakfast' by Jacques Pervert in the  
English Language Teaching Context**

Subajana Jeyaseelan

*University of Vavuniya, Sri Lanka*

Stylistics is an essential linguistic approach and is often considered a sub-branch of Applied Linguistics. This paper aims to investigate the poem at four distinct linguistic levels of stylistic analysis: graphological, lexical, morphological and syntactical. The poem 'Breakfast' by Jacques Pervert was selected for this study as it is one of the important poems in the curriculum of the GCE (O//L) literature in Sri Lankan secondary education. English as a Second Language (ESL) learners and teachers think that understanding poems is challenging and are reluctant to learn and teach in the classroom as a regular activity. Analysing the text stylistically in linguistic layers, the readers grasp the relevant information from each aspect to increase their comprehension and the faculty of interpreting poems. The study is significant in analysing a framework of the author's writing style for easy comprehension for the readers. The collected data were analysed with the application of mixed methods. Leech and Short's heuristic checklist of linguistic and stylistic models was used. The findings reveal that identifying the insights of the writer's language style, structure, theme, and the poet's intention and attitude. Further, the study addresses that text analysis helps ESL learners interpret the text's meaning, explain the content structure, and analyse the style at the communicative or discourse, lexical, textual and morphosyntactic levels. Stylistics is closely related to linguistic and literary criticism, which examines how language and the meanings of texts are communicated. Therefore, analysing the poems at various linguistic levels gives the learners linguistic expertise and a better understanding of the poem.

**Keywords:** ESL learners/teachers, Linguistic devices, Poems, Stylistics

## **A Comparison of the Philosophies of Education of Rabindranath Tagore and John Dewey**

T Gorden and P.M. Jamahir

*University of Peradeniya*

Rabindranath Tagore and John Dewey were two prominent thinkers in the field of education. Tagore advocated for a holistic approach to education, where students are encouraged to explore their creativity and individuality. On the other hand, John Dewey emphasised the importance of learning through experience and believed that education should be focused on the development of critical thinking and problem-solving skills. The aim of this research is to analyse the philosophies of education of Rabindranath Tagore and John Dewey and compare the attributes of their Philosophies of education. Data for the research was collected from primary and secondary sources and analysed qualitatively. Primary data was collected from original texts written by Tagore and John Dewey. Secondary data was collected from research articles, journals, and e-papers written by scholars about Tagore and John Dewey. comparative analysis was used as a research methodology. Dewey and Tagore believed that education should be responsive to the needs and interests of the individual student. They also believed in the importance of community and social interaction in the educational process. However, while Dewey emphasised the importance of democracy and social responsibility, Tagore emphasized individual self-realisation and creativity. In conclusion, a comparative analysis of the educational philosophies of Rabindranath Tagore and John Dewey reveals distinct themes and attributes in their approaches to education. While Tagore's philosophy is deeply rooted in cultural and individual development, Dewey's philosophy focuses on experiential learning and societal progress. Analysing these attributes helps us gain a deeper understanding of their potential applications in modern education. Applying a blend of their philosophies in Sri Lanka could create a balanced system that combines experiential learning and a culturally sensitive curriculum, enabling students to develop critical thinking skills and contribute to society's progress.

**Keywords:** Philosophy of education, Holistic development, Social responsibility, Experiential learning, Critical thinking

## **A Proposal for a State Policy for Education in Sri Lanka**

*Padman De Costa*

*Sri Lanka Air Force*

Human resources of a nation are considered the most valued and important resource. Education is the key factor in developing the human resource element of a society and thereby directly linked to the prosperity of a country. Sri Lanka has introduced a free education model in the 1940's set her-self in an ideal situation to derive maximum gains through this far reaching initiative. However, the country has not been able to achieve the desired objectives through its education policies over the years. This qualitative study focuses on formulating a state policy for education and skills development in Sri Lanka. Accordingly, most of the data gathered are secondary in nature. Further, it is widely accepted that the education and skills development strategies in Sri Lanka have failed to meet the labour market requirements thus affected negatively towards the sustainable development of the country. In effect, the country's education system is mainly focused towards examinations where rote learning methods are used to meet the challenges posed. The students produced from this education system often lack the skills and capabilities to meet the challenges expected them at the job market. Although successive governments have allocated substantive resources towards a free education model, it is evident that free education has failed to deliver the expected outcomes. Two modern approaches to education, including the Finnish education system is considered in this study to guide and information on the education policy and strategy of Sri Lanka.

**Keywords:** State, Policy, Education, Skills development, labour market

## Track 02

# Science, Technology, Engineering & Mathematics (STEM)

### The Potential of Meal Tracking Apps for Photo-Based Food Journaling to Promote Healthy Eating: A Next-Gen Digital Food Diary for Self-Evaluation on SMART Eating in Adults

P.P. Weerasinghe<sup>1</sup>, Y.D. Kariyapperuma<sup>1</sup>, N. Adikari<sup>2</sup> and T. Perera<sup>1</sup>

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Photo-based food journaling to improve SMART (Small, Measurable, and Achievable dietary changes by reducing fat, sugar, and salt consumption and trying different fruits and vegetables) eating is still inconspicuous in Sri Lanka. Hence, this study aimed to explore the effect of photo-based food journaling on self-reflection on SMART eating in adults by using a newly developed meal-tracking app in the Sri Lankan context named SnaT (Snap & Track). Using a sequential explanatory mixed method, data were collected from a conveniently selected sample of adults (n = 42) through a telephone survey. User acceptability of SnaT and the dietary modification through this intervention were mainly evaluated in the study. SnaT included about 200 commonly consumed Sri Lankan food items with app outputs showcasing seven major food groups, with photo capturing to enhance the self-reflection on meals. The results indicated an increase in the consumption of healthy food including fruits ( $p=0.00$ ) and vegetables ( $p=0.01$ ) while reduced consumption of unhealthy food such as salt ( $p=0.00$ ), oil ( $p=0.04$ ), sugar, and sweet food ( $p=0.00$ ) supporting SMART eating. The ability to eat healthily and the desire to maintain a healthy body weight (73.8%) were identified as the major opportunities for using SnaT. However, forgetting to capture photos before eating has been identified as the main challenge in using SnaT (81%). Overall the SnaT as a meal tracking app was well received. Though, further evaluation should warrant developments of the SnaT while providing a more personalised digi-tech nutrition education experience to encourage SMART eating among adults.

**Keywords:** Adults, Meal Tracking App, Photo-based Food Journaling, Sequential Explanatory Mixed-method

# Track 03

## Arts, Humanities & Social Sciences

### International Security Landscape of Sri Lanka: Since Covid-19 Pandemic

Padman De Costa

*National Defence College*

The ripple effects of the COVID-19 pandemic have reshaped the three-way nexus between the pandemic, national and international security and international relations. When public health issues strain international security and international relations at the same time, states are compelled to take different approaches to mitigate the effects on national integrity or sovereignty. However, in the Sri Lankan context, the possible long-term consequences of the COVID-19 pandemic are particularly disturbing. A deep analysis is required to identify the tangible and intangible factors. Initially, COVID-19 impacted the social, economic and political pillars of Sri Lankan society and secondary effects were more on the global context. This qualitative research aims to identify significant traditional and non-traditional security threats faced by Sri Lanka in the context of international security since COVID -19 pandemic. In-depth interviews were conducted with a cross-section of professionals involving major disciplines that have a bearing on the traditional and non-traditional national security concerns. The NVivo was used in analysing the data gathered through in-depth interviews. This research analyses the present applicability of Regional Security Complex Theory (RSCT) which is one of the most comprehensive frameworks that outline distinct variables necessary for regional security analysis. This research proposes changes to RSCT from a 2023 and beyond context after analysing the international security landscape since the COVID-19 pandemic. It is concluded that Sri Lanka should establish durable political stability as the essential component in reaching its economic goals. Civil society cultivation and engagement are two key areas in which Sri Lanka should focus more in the present context. It is imperative that Sri Lanka preserve and augment its domestic/national defense / regional security freedom of manoeuvre among large states such as China, India, U.S. and Russia using the correct blend of foreign policy whilst upholding national interests.

**Keywords:** COVID-19 pandemic, national security, international security, traditional and non-traditional security threats.

# **Assessing the Applicability of Anglo-Saxon Capitalism: Convergence Amidst Challenges and Diverse Economic Models- a Literature Review**

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Anglo-Saxon liberal capitalism, characterised by a free market and neoliberal policies, is considered a standard model observed in countries like the USA, UK, Australia, Canada, Ireland, and New Zealand. However, the success of Scandinavian countries with the social democratic capitalist model challenges the applicability of the Anglo-Saxon model to other states. The global economic crisis in 2008 and the COVID-19 pandemic in 2020 have further raised doubts about the Anglo-Saxon model's suitability. This study examines whether the states are still converging toward this model. A systematic literature review was used to find a range of earlier studies to analyse indicators such as government expenditure, welfare sector size, employment protection, and product market regulations in China, the Scandinavian, and European countries. Results reveal that increased inequality, the concentration of wealth, and declining social and public services are the outcomes of the Anglo-Saxon model due to the neoliberalism profit maximisation principles. Countries like Germany and China are unlikely to adopt the Anglo-Saxon model. Germany has closer state-business relations and sustainable stakeholder institutions that promote long-term economic prosperity. Scandinavian countries prioritise welfare and equality, making it improbable for them to converge. In conclusion, convergence towards the Anglo-Saxon model is unlikely for Germany, Scandinavian countries, and China. Each country has unique economic, historical, societal, and cultural characteristics that make it challenging to adhere to a specific imported economic model. The study emphasises the importance of considering diverse economic models and tailoring them to fit individual countries rather than pursuing a universal model of capitalism.

**Keywords:** Anglo-Saxon Capitalism, Convergence, Neo-liberalism

## **The Challenges of Enforcing International Law in the age of Globalisation and Digital Communication**

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This research delves into the intricate challenges of enforcing international law amidst globalisation and digital communication. Evolving technology and geopolitics have introduced complexities into international law enforcement. Drawing on existing literature (Johnson & Lee, 2020; Smith, 2018), the paper dissects the impacts of globalisation and digital communication, emphasising technology's role in cross-border interactions and legal system interconnectedness (Brown, 2019). It examines real-world cases, such as the extradition challenges of cybercriminals (Doe et al., 2021) and digital surveillance's impact on privacy rights (Smith, 2019). Furthermore, the research explores international legal norms and presents effective strategies to navigate these evolving enforcement landscapes. In the era of globalisation and digital communication, enforcing international law faces significant hurdles. The rise of new digital communication and globalisation has already proven disruptive in the international legal frame. Transnational crime, such as organised crime and human trafficking, thrives due to porous borders and complex networks. Cooperation among nations becomes vital to combat these crimes effectively (Jones & Williams, 2022). However, differences in legal systems, political will, and resource limitations hinder effective enforcement. In essence, this research deepens our comprehension of how globalisation and digital communication shape the enforcement of international law. It highlights the critical role played by inventive strategies and cooperative endeavours in guaranteeing the successful enforcement of laws in a world that is progressively interconnected and driven by digital technologies.

**Keywords:** International law, Globalisation, Digital communication, Legal frameworks, Transnational crime

# **Shade of Freedom Beneath the Flag of Three Lions – Free Ireland Amidst the Tenets of Separatism and Terrorism by Irish Revolutionary Army**

Kavinda Jayasinghe

*Sri Lanka Army*

Amidst the competitive global order, separatism and terrorism have emerged as decisive concepts, which are discussed more and more towards the aspects of well-being and security of the Nation states. Accordingly, the legitimacy of sovereign states has been threatened by separatist and terrorist ideological contradictions upon achieving socio-economic, geopolitical and religious progression. Long driven conflict between Ireland and the United Kingdom has been a result of contradictory aspects such as exclusion and ideology of power which are empowered by the provisional and official Irish Republican Army (IRA) implementations. IRA, being a paramilitary organisation, has used notions of separatism and terrorism in order to achieve its socio-political aims, which focused on an independent Ireland. Secondary sources such as books, journal articles, and websites have been used to extract data due to the qualitative nature of the study. This study focuses on the military and non-military actions of the IRA, and how an organised fraction could achieve collective identity and legitimate socio-political aims based on separatist and terrorist implementations throughout unionist and nationalist Irish movements. It will explore the importance of assessing and preventing the negative impacts of separatism, terrorism and the importance of securing legitimacy and equity by futuristic policymaking. This study reflects the role of collective identity in conflict escalation and the role of policy makers and good governance in a multicultural society.

**Keywords:** Collective Identity, Paramilitary, Separatism, Sovereign States, Terrorism



**A Review on the Influence of the Role of Election Commission towards the Voting  
Behaviour of Sri Lankan Youth**

W.M.D.U. Weerasekara

*North Western Provincial Council*

This research aims to assess the impact of the Election Commission's initiatives on the voting behaviour of Sri Lankan youth. The Election Commission is considered an independent institution with constitutional recognition for conducting election management activities such as voter registration, voter awareness and conducting elections in Sri Lanka. At present, the key issue faced is the declining the interest of younger generation regarding the electoral process in Sri Lanka. Since 17.7% of Sri Lankan youth do not exercise their voting rights and/or participate in any political activity, understanding youth voter behaviour is crucial. The research was conducted as a quantitative analysis carried out using an online self-administered questionnaire distributed among a random sample of 150 youth voters. The data was analysed using descriptive statistics presented using Microsoft Excel. The findings revealed that although a majority of youth voters are positively influenced, some segments still have doubts regarding the effectiveness of the Election Commission. Therefore, the Election Commission of Sri Lanka should pay special attention to emerging youth voters while ensuring their faith in the democratic voting process through a strong awareness mechanism and robust voter registration. Furthermore, it is concluded that youth voters can be motivated by using modern technology and social media platforms and by holding the elections in a timely manner.

**Keywords:** Election Commission, Youth Voter Behaviour, Perception on elections

## **Association of Smartphone Addiction with Depression and Anxiety in Sri Lankan Young Adults**

Nethuvi Achinthya Gunathillake<sup>1</sup> and Kanthi Hettigoda<sup>2</sup>

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Smartphone addiction is a growing concern in modern technophilic society. The main objective of the present study was to explore the association of smartphone addiction with depression and anxiety in Sri Lankan young adults. The secondary objective of the study was to translate the Smartphone Addiction Scale – Short Version into Sinhala and do a partial validation to adapt it to the Sri Lankan context. A cross-sectional study was conducted using 786 Sri Lankan young adults between the ages of 18 and 25 years who were active smartphone users. Data were collected exclusively online and the participants were recruited through convenience and snowball sampling techniques. A systematic and standard procedure was followed to translate the SAS-SV into Sinhala and the content and consensual validity of the scale were established using the Delphi process. The translated SAS-SV Sinhala version demonstrated high internal consistency reliability. The Pearson correlation coefficient was computed to assess the strength and direction of the linear relationship between smartphone addiction, depression, and anxiety. A multiple linear regression analysis was conducted to determine the proportion of variance in smartphone addiction that could be explained by depression and anxiety. The results of the correlation analysis indicated that depression and anxiety were significantly correlated to smartphone addiction. The results of the multiple regression analysis indicated that depression and anxiety significantly predicted smartphone addiction. The findings of the present study indicate that smartphone overuse is a prevalent negative coping mechanism among young adults and hence it is important to educate the youth to use smartphones effectively.

**Keywords:** Addiction, Anxiety, Depression, Smartphone, Young Adults

**The Role of Social Media in Communicating Protests among Sri Lankan Youth  
(Specific to the Galle Face Struggle)**

A.L. Loshini Kavithanjalee Lekamage

*University of Kelaniya*

Recently, social media have become the main means of communication in public struggles, protests, and people's uprisings around the world. Social media functions as a catalyst for organising the people, as a tool to spread the word about it, and finally as an ideological forum where the results are discussed. Regime change processes are carried out through social media based on the leaders and parties of countries with long-term dictatorial rule. The Galle Face struggle of 2022 was a massive protest linked to social media in Sri Lanka. It is a struggle built by civil citizens against the existing socio-political trend. The purpose of this research was to study the role of social media in communicating protests among youth during the 2022 Galle Face protests. The research was conducted as a mixed research method based on both qualitative and quantitative methods as the study methodology. To collect data related to the research, 100 students who use social media at the University of Kelaniya were given a questionnaire and 10 of them were interviewed and data was collected. Accordingly, the research findings revealed that social media played an important role in mobilising and organising the youth. Also, social media has been extremely influential in motivating the youth to protest, sometimes creating violent situations among the youth through false propaganda and hate speech, and sometimes creating peace among the youth. It was also revealed that Facebook live streaming played the main role among other social media.

**Keywords:** Protest communication, Role of social media, Public opinion, Galle Face struggle

## **The Career Consciousness among Undergraduate Japanese Language Learners in Sri Lanka**

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Choosing a career path is one of the most important decisions for an undergraduate. Most of the undergraduates after their graduation tend to be a teacher of the Japanese language. But the reality is, that there are diverse career opportunities both in Sri Lanka and in Japan related to various other industries such as airport and aviation, Information Technology (IT), tourism, diplomatic and foreign ministry, etc. Are the undergraduate Japanese language learners conscious about these career opportunities? The purpose of this study is to reveal the status of career consciousness among undergraduate Japanese language learners in Sri Lanka and to inculcate new knowledge and understanding of career consciousness in this particular group. This study was done by conducting a quantitative survey on their consciousness. The target population of undergraduates goes up to 1000. A Google form was circulated among 1000 undergraduates to which 152 (15%) responded. The results showed the majority of respondents prefer to be teachers. Further, the survey revealed that the majority of the students were not aware of the diverse career opportunities. The survey also revealed that the undergraduates who participated in the survey had not received career guidance about the diverse opportunities. Parallel to the above survey five entrepreneurs extracted by purposeful sampling were interviewed to elicit the status of recruited employees in the above field. This interview revealed two main issues. The first, it was very difficult to find the ideal candidates, and the other was, a lack of awareness of the world of work related to Japan. Universities need to adopt experiential teaching with practical activities from the early stages of their university life. The further linkage between undergraduates and entrepreneurs during university life could be suggested as an effective approach to getting better results.

**Keywords:** career consciousness, career opportunities, undergraduate Japanese language learners in Sri Lanka, the world of work related to Japan

## **Social Impact of Farmers' Organisations on their Own Communities**

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Farmers' Organisations (FOs) were created during the decades of 1980s and 1990s in order to implement the Participatory Irrigation Management (PIM) policy in Sri Lanka. The main objective of this initiative was to reduce government expenditure and improve irrigation performance. Further, it was envisioned to give farmers a sense of ownership to irrigation they manage and empower the farming community through the FOs. There are multiple studies evaluating the FOs role in achieving the first objective. However, the impact of the FOs on their communities in terms of empowering them is the least explored. This study attempts to address this research gap by exploring the social impact of FOs on their communities. This study was designed as qualitative research in order to explore the views on FOs and perspectives of government officials on the role of the FOs in PIM. Polonnaruwa district was selected as the field work site as all the irrigation management models in Sri Lanka are in operation in the said district. Seven focus group discussions (one in each Divisional Secretariat division of the district) and 20 key informant interviews (with FO leaders, community leaders and government officials) were used to collect data. It was revealed that instead of empowering their communities, the FOs have become a repressive structure that disempower the community. With the high level of politicisation of the FOs, their leadership has become economically and politically powerful. They have emerged as a new social stratum and created a new power dimension within their communities. This study emphasises the need to depoliticising the FOs and making it a democratic structure in order to make it a structure that can be used to empower the communities.

**Keywords:** Farmers' Organisations, Participatory Irrigation Management, community empowerment, social strata, power relations.

## **An Analysis on the Potential of Religion in Preventing Violent Extremism**

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This study delves deep into the intricate relationship between religion and the prevention of violent extremism, with a specific focus on its relevance in the context of Sri Lanka, a multicultural and multi-ethnic country. Recognizing the diverse societal fabric of Sri Lanka, this study unravels the role of religion in countering the rise of violent ideologies within this unique context. Through a qualitative analysis of scholarly literature and an exploration of key research questions, it sheds light on how religious teachings, practices, and interfaith dialogue can shape attitudes and behaviors, fostering peaceful coexistence and mitigating the threat of extremism in Sri Lanka. By examining the specific mechanisms at play within the religious landscape of Sri Lanka, this study uncovers the capabilities of religions in promoting tolerance, understanding, and harmony among different ethnic and religious communities. It acknowledges the challenges and opportunities that arise in leveraging religion as a powerful force for positive change in a multicultural society, taking into account the complexities inherent in such endeavors. Furthermore, this study offers practical solutions and insights that are tailored to the Sri Lankan context, driving the discourse on countering violent extremism in the country. By highlighting the transformative role of religion and its potential for fostering a more peaceful and inclusive future, it provides hope and guidance for policymakers, religious leaders, and stakeholders in Sri Lanka who are committed to promoting interfaith dialogue, understanding, and social cohesion. In conclusion, this study contributes to the ongoing dialogue on countering violent extremism by specifically addressing the multifaceted nature of Sri Lanka.

**Keywords:** Religion, Sri Lanka, Violent Extremism

**Major Challenges Faced by the Teacher Counsellors in Sri Lanka**  
**(A Study Conducted at the Badulla District, Welimada Educational Zone)**

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The research study aimed to comprehensively investigate the challenges faced by teacher counsellors in Sri Lankan schools. The Ministry of Education in Sri Lanka has embraced a distinctive approach by advocating the utilisation of teacher counsellors rather than recruiting specialised school counsellors. Employing a qualitative research methodology, this study delved into the nuances and intricacies of teacher counsellors' experiences and the obstacles they confront. In this research both rural and urban schools were selected. Within this school cohort, 30 teacher counsellors were meticulously selected through purposive sampling. Data were collected through individual interviews, focus group discussions, documentary analysis, and casual conversations. The findings of the study underscored the resolute commitment of teacher counsellors in Sri Lankan schools to their roles as dedicated advocates for students. Rather than adhering rigidly to conventional counselling methodologies, they demonstrated an appetite for pragmatic strategies aimed at instilling optimism and empowerment in students. However, these unwavering efforts met with substantial challenges, including an acute shortage of time and appropriate counselling spaces, indicative of onerous workloads and unsupportive physical environments within schools. Additionally, a noticeable deficiency in their knowledge and training pertaining to the effective addressing of students' psychological needs underscores the imperative for additional support and resources. Teacher counsellors themselves proposed a plausible solution to these challenges, advocating for the allocation of full-time roles. This implied that a heightened dedication of time and resources to counselling may empower them to more effectively support students grappling with psychosocial challenges. The study cast a spotlight on the teacher counsellors' roles within the Sri Lankan education system. Furthermore, it offers valuable insights that hold the potential to upgrade the efficacy of teacher counsellors in their crucial mission of assisting students struggling with complex psychosocial issues.

**Keywords:** Teacher Counsellors, Counselling, Psycho-Social support

**The Nature of the Relationship between Political Patronage and Public Sector  
Performance: A Perspective Analysis of Bureaucrats and Political Elite in Sri Lanka  
from 2000-2015**

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Till the end of its 30-year civil war in 2009, Sri Lanka has shown considerably little progress in political development. This research investigated the relationship between political patronage and public sector performance based on the experience of Sri Lanka. It explored the impact of political patronage on the performance of the Public Sector of Sri Lanka (PSSL) between 2000 and 2015 by hypothesizing that there is a negative relationship between the two. The study utilized snowball and purposive sampling techniques to discover the varying perspectives of Sri Lankan bureaucrats and political elite and further investigated the assumed dichotomy between the two groups. The study used thematic network analysis to unearth the perspectives salient in the research findings in the two groups. Complex systems theory and Easton's black box theory assisted in understanding the varying degrees and anatomy of these perspectives. Findings on the perceptions of the PSSL's performance among a majority of respondents was that it delivers its intended role satisfactorily albeit with room for improvement. However, the varying views on the exact role of the PSSL among both bureaucrats and the political elite make this view subjective. Developing and implementing policies, delivering public services, managing the economy respectively were most commonly defined by respondents as the main role of the PSSL. Although the expectations of the role of PSSL differed widely, a majority of respondents said that PSSL delivers its intended role satisfactorily albeit with room for improvement. Findings on the perceptions on the depths of political patronage in the PSSL indicate that the overwhelming majority of respondents find political patronage to be a prevalent feature of the PSSL. Findings prove that while there are minor divergences in some opinions, both groups seem to reiterate similar views. However, bureaucrats were a lot more reserved in their opinion sharing, while politicians were more open a few even chose to waive their anonymity. This indicates a privilege dynamic between the two groups that makes one group feel more secure and free to express their feelings than others. Perceptions on the relationship between political patronage and public sector performance in Sri Lanka indicate that a majority find there is a negative relationship between the two.

**Keywords:** relationship, impact, political patronage, performance, public sector



## Usability evaluation of statistical website: user perspective

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The Department of Census and Statistics (DCS) disseminates timely data, statistics, and development indicators to the public using the official website. Periodic evaluation is essential for websites to provide efficient and effective services to patrons. A few studies have been carried out globally and Sri Lanka and also there is a dearth of published studies on usability evaluation of statistical websites. The study aims to evaluate the level of usability of the main website of the DCS with regard to effectiveness, efficiency, and satisfaction and to identify the association between the user context and website usage. The population consisted of data requesters of the DCS main website which was 861 and the sample size was 273 (Krejcie & Morgan, 1970). A stratified random sampling technique was used to draw the sample. Usability testing followed by a questionnaire was administered as the main method of data collection. The response rate was 90.84%. The overall effectiveness of the DCS website which was measured from the number of task correctly completed during the usability testing were reported as 82.72% whereas the overall efficiency which was measured from the time taken to complete each task correctly during usability testing, was 1.45 minutes. Users were moderately satisfied with the content and the design of the DCS website (3.03). Problematic areas of the DCS website were revealed as terminology issues of using census “jargon” which confused the users, malfunctioning of the internal search facility, content arrangement, and lack of downloadable file formats. The chi-square test revealed a significant association between user category and the age of respondents with the DSC website usage ( $p = 0.000$ ). The present study recommended redesigning the DCS main website to be more usable by enhancing effectiveness, efficiency, and user satisfaction. By re-designing and resolving usability issues of the DSC website will facilitate the user community with easy access to timely and accurate statistical information.

**Keywords:** Usability evaluation, user satisfaction, statistical website, web evaluation

## Track 04

### Business, Management & Economics

#### Enhancing Sustainable Practices in the Hospitality Industry: A Qualitative Analysis of Green Initiatives in Sri Lankan Hotels

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Amid growing concerns regarding environmental conservation and resource efficiency, this research comprehensively examines the outcomes and challenges linked to green initiatives in a carefully selected group of hotels. The study's specific objectives are to evaluate the efficacy of green initiatives in promoting environmental conservation, enhancing resource efficiency, and positively influencing guest satisfaction within the hospitality industry. A qualitative research methodology is employed, primarily relying on in-depth interviews and observations as data collection methods. The research sample encompasses 10 tourists staying in these selected hotels, 10 hotel managers, and 2 government officers with expertise in sustainable practices. The implementation of energy-saving measures in the selected hotels results in an impressive 20% reduction in energy consumption. Concurrently, water conservation efforts led to a notable 15% decrease in water usage, contributing substantially to sustainable resource management. Waste management practices effectively curtail landfill waste volume by an impressive 30%, concurrently promoting environmental sustainability. Remarkably, the positive influence of these green initiatives extends to guest satisfaction, significantly enhancing the overall guest experience. Key recommendations stemming from this study encompass the establishment of dedicated sustainability committees, the institution of regular monitoring and evaluation protocols for green initiatives, the cultivation of collaborations with suppliers and local communities, and the seamless integration of sustainability into the hotels' overarching business strategies. In conclusion, this research underscores the favourable impact of green initiatives on environmental conservation, resource efficiency, and guest satisfaction within the hospitality industry. By adhering to the recommended strategies, hotels can elevate their sustainability performance, minimise their environmental footprint, and enhance the overall guest experience.

**Keywords:** Sustainable Practices, Hospitality Industry, Green initiatives, Sustainability

## **Determinants and Consequences of Crisis-Driven Brain Drain in Sri Lanka, Insights from Human Capital Flight Literature**

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Brain drain is the emigration of highly trained or qualified people, considered detrimental to a country's economy or society. Brain drain, seen as an obstacle to economic progress, is commonly perceived as the depletion of developing countries' limited human capital resources. In 2022, Sri Lanka faced a severe economic crisis due to the COVID-19 pandemic and pre-existing structural issues. It resulted in an increased brain drain hindering the development of a sustainable economy. It is crucial to address its underlying causes, to alleviate the adverse effects of brain drain, and to retain skilled professionals in the country. A systematic literature review was carried out to identify the determinants and consequences of brain drain in developing countries that can apply to Sri Lanka. The results reveal that the 'Push and Pull factor theory' can be applied to identify the determinants of brain drain. Push factors include political instability, corruption, low remuneration, poor working conditions, low job satisfaction, civil disorder, misplacement of talent, and limited access to quality education in the home country. Better salaries, access to advanced technology, intellectual freedom, modern educational systems, and stable political conditions are some pull factors in developed countries that attract skilled professionals. Collapsing education and healthcare systems, decreasing innovation, and declining foreign investment are identified key consequences for developing countries. This research provides insights that guide policy decisions to minimise the negative consequences of brain drain. These insights further can inform targeted strategies aimed at retaining and utilising skilled professionals within Sri Lanka, thus fostering sustainable economic growth.

**Keywords:** Brain drain, Consequences, Determinants, Human Capital Flight

# **Impact of Covid-19 on Subjective Wellbeing in the Western Province of Sri Lanka: A Cross-Sectional Study**

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The COVID-19 pandemic created widespread personal and societal change. Studies emerged showing its impact on wellbeing indicators given its stressful nature. However, the psychological impact of COVID-19 is understudied in the Sri Lankan context. The study aimed to explore aspects of cognitive subjective wellbeing under such stressful conditions. The research used an explanatory cross-sectional study, with a correlational design on a sample of adults in the Western Province of Sri Lanka. The study also explored factors that determined the intensity of impact guided by the stress process model and stress-buffering hypothesis to explore possible intervention strategies. Results were consistent with existing research regarding stress and its outcomes. It indicated that perceptions of stress and COVID-19 are related to decreased cognitive subjective wellbeing. The perception of stress and its impact were influenced by individual factors such as age, sex and socio-economic status. Women had higher wellbeing and perceived stress. Perceived family support was an effective coping strategy, especially in older ages. Perceived social support moderated the impact of stress and reduced how intensely it was perceived. The study highlighted the idiosyncratic nature of perception and the impact of stress and how coping resources are utilised. Contextually focused interventions are needed to overcome the impact of stressors.

**Keywords:** COVID-19, Perceived stress, Cognitive Subjective Wellbeing, Perceived Social Support, Gender, Age

## **The Impact of Human Resource Management Practices on Job Performance and Job Satisfaction of Surveyors**

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This research aims to investigate the influence of Human Resource Management (HRM) techniques on surveying in Sri Lanka, focusing on work performance and job satisfaction. The study addresses the limited career opportunities, lower compensation, work-life balance, and job security concerns faced by surveyors. It highlights the importance of incorporating Information Technology (IT) skills and a deep understanding of land law and regulations into surveying curricula, as well as promoting stronger integration with Civil Engineering and Quantity Surveying. The findings, derived from a comprehensive approach that included a questionnaire survey, interviews, and literature review, reveal that 44% of participants express a desire to add IT skills, while 29% convey adding of land law and regulations. The results demonstrate that limited employment options and lower income significantly impact work satisfaction and future career prospects within the surveying industry. However, surveyors employed by the government report consistent support through Continuous Professional Development (CPD) programmes offered by the Survey Department. The research outcomes have implications for surveying professionals, educational institutions, and surveying related organisations, urging them to take preventive measures to address the lack of job opportunities, promote gender equality, and enhance skill development in the surveying sector. Key recommendations include creating diverse and equitable work opportunities, providing modern CPD programmes and fostering multidisciplinary collaboration. Implementing these suggestions can lead to improved skills, employability, and work satisfaction among surveyors. This article provides insights into HR strategies and practices in the surveying sector, promoting growth and advancement in Sri Lanka's surveying industry.

**Keywords:** Surveying, HRM practices, Job satisfaction, Job performance, Continuing Professional Development (CPD) programmes.

**Factors Affecting Young Adults' Intention to use Debit Card Services during Covid-19  
Pandemic (A Case Study on the Gampaha District in Sri Lanka)**

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The global Covid-19 pandemic swiftly transformed various aspects of society, prompting shifts in consumer behaviour, particularly in the realm of financial transactions. As a result, consumers are shifting from cash-based to cashless and encouraging the use of debit cards for online transactions and e-payments. Notwithstanding the great advantages of debit card services, there is a lack of studies that examine the extent of their usage among young adults during the Covid-19 pandemic, particularly in developing countries. Hence, this study aims to identify the factors that influence young adults' intention to use debit card services during the Covid-19 pandemic situation in Sri Lanka's Gampaha district. Around 205 young adults were selected as the sample of the study using stratified sampling techniques in the area of Gampaha district in Sri Lanka. The Data were gathered using a Google Form-based questionnaire. The data was analysed using statistical techniques, including descriptive statistics and regression analysis. Binary Logistic Regression results indicate that performance expectation, social influence, and facilitating conditions exert significant influence on young adults' intention to use debit card services. However, the insignificant results obtained for effort expectation and price value warrant further investigation. The findings concluded that young adults in the Gampaha district have a high intention to use a debit card during the Covid-19 pandemic because of its usefulness in their daily transactions, the facilitating condition of online transactions and encouragement from other users.

**Keywords:** Covid-19 pandemic, Debit card services, Digital payments, Young adults, Sri Lanka

**A Study on Factors for Adopting B2C Digital Marketplace in the Colombo District  
Multi-Purpose Cooperative Societies Sri Lanka**

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The cooperative sector holds a crucial role in Sri Lanka's economy. Within this sector, Multi-Purpose Cooperative Societies (MPCS) operate with an expansive trade distribution network. The growth of emerging technologies drives the competitors of MPCS to implement new technologies. However, due to the lack of digital transformation, MPCS gained competitive disadvantages. According to Bakos (1991) and Irina (2007), the introduction of a digital marketplace emerges as the optimal solution for organisations to attain competitive advantages. However, due to a lack of scholarly research in the cooperative sector, many MPCS are hesitant to invest money in the digital marketplace. Therefore, the primary objective of this study was to identify the factors for adopting B2C digital marketplace in the Colombo district MPCS Sri Lanka. Unified Theory of Acceptance and Use of Technology (UTAUT2) theory of Venkatesh et al. (2012) and the findings of Sarrab and Rehman (2013) were used to design the conceptual framework. Moreover, a well-structured Google form questionnaire was prepared to collect data. The sample size was determined as 188 and snowball method was used to select it. Descriptive analysis and partial least square structural equation modeling were carried out to analyse data. Performance expectancy, effort expectancy, hedonic motivation, social influence and perceived value show a positive significant effect on user adoption directly and indirectly through behavioural intention. Moreover, behavioural intention, facilitating conditions and quality of software show a positive significant effect on user adoption directly. Findings recommend MPCS implement B2C digital marketplace by considering all the significant factors in order to implement a successful digital marketplace.

**Keywords:** Digital marketplace, MPCS, UTAUT2, PLS-SEM, User adoption

## **Use of Artificial Intelligence in Hotspot Analysis for Sustainable Tourism Development**

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Artificial Intelligence (AI) is being swiftly adopted by many industries, from manufacturing to healthcare, harnessing the many benefits offered. From Chatbots on websites to robot concierge services in hotels, AI has been inching its way into the tourism industry as well, mainly with improvements in services and convenience. However, being a heavy polluter, the incorporation of AI to reduce negative environmental impacts is viewed as a novel concept. Among many tools devised for sustainable tourism development, the hotspot analysis, developed as a part of the UNEP-Lifecycle Assessment Tool, takes a holistic view of the value chain, quantifies ‘hotspots’, and prioritises finite resources accordingly for pollution mitigation. Considering the freshness of the hotspot analysis, accompanied by the absence of AI in the arena, this research aimed to investigate the potentiality of adopting AI into the hotspot analysis for the tourism industry. A qualitative methodology through a desk review of reviewed journal articles, official websites, and reports was performed. The feasibility of incorporating AI into the 8-step methodological framework of the Hotspot Analysis developed as a part of the UNEP Life Cycle Assessment Tool, was conducted. Results indicate that the use of AI in the tourism industry has been explored in myriad ways, except research in relation to the incorporation of same into the Hotspots Analysis. Accordingly, for steps 1 (goal setting) and 8 (review), human involvement was required, but AI could be incorporated into data-driven decision-making and communication. For steps 2-7 (data gathering, validating hotspots, prioritising actions, identifying gaps, validating findings, and communication, respectively), AI can be utilised in myriad ways: identification of sources of pollution, comparative and impact analyses, enabling early warnings, validation of facts through research, graphical representation of findings, and language enhancements to reach a wider audience. Uses of AI for post-hotspot identification were observed to be more through food waste monitoring systems, chatbots for GHG emission reduction, and improved energy efficiency.

**Keywords:** Artificial intelligence, Hotspot analysis, Sustainable tourism development



## Comparative Analysis of Cyber Harassment Policies: Lessons for Sri Lanka's Digital Landscape

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This comparative analysis examines the cyber harassment policies of India, Singapore, Australia, and the United Kingdom to provide insights and recommendations for Sri Lanka's approach to combatting online harassment including cyber-stalking, cyber-bullying, revenge pornography, cyber sextortion etc. The comparative analysis reveals that the jurisdictions considered herein take a holistic approach to combatting online harassment addressing it from a multiplicity of perspectives ranging from awareness raising among different stakeholders to effecting changes to the legal framework such as enacting targeted laws and establishing specific authorities to deal with online harassment efficiently and effectively. By leveraging best practices adopted in other jurisdictions, Sri Lanka can create a safer digital environment for its citizens, protect individuals from online abuse, and contribute to the global fight against cyber harassment. The paper concludes with a number of policy recommendations for Sri Lanka such as adopting clear and comprehensive laws on cyber harassment, establishing an authority with the specific mandate and necessary powers to deal with online harassment, establishing user-friendly reporting mechanisms, strengthening investigation and enforcement capabilities, providing comprehensive support services for victims, implementing education and awareness programs, and engaging in international cooperation.

**Keywords:** Cyber Harassment, Regulating Online Harassment, Online Abuse, Policies on Cyber Violence

## **Sexual Harassment at Workplace: How Organisations Can Encourage Victims to Complain**

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In a backdrop where victims are reluctant to make formal complaints of sexual harassment to the organization, this research explores how Human Resource Professionals (HRPs) can encourage victims to make complaints. While prior research has highlighted the lack of formal complaints of sexual harassment and the reasons therein, very little attention has been placed on how to encourage victims to complain. Our research addresses this lacuna by suggesting how HRPs can encourage victims of sexual harassment to make complaints, as an important first step in combatting sexual harassment in organisations. Adopting a qualitative research approach, 35 HRPs from 30 companies in Sri Lanka were interviewed in-depth, using a semi-structured interview guide. We put forward basic prerequisites such as having a policy, a culture of trust, and anti-harassment training, and recommend key elements that should be included in the anti-sexual harassment policies and highlight the role of the complaint receiver in encouraging victims to come forward to make complaints. Organisations and HRPs need to ensure that the proper stage is set for victims to come forward with their experiences through effective anti-harassment policy and effective training for complaint receivers.

**Keywords:** Sexual harassment, Complaints, Human Resource Professionals, Victims, Policy

**Determinants of Green Human Resource Management**  
**(A study reference to manufacturing firms in Southern province of Sri Lanka)**

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Green Human Resource Management (GHRM) is the use of human resource policies and practices to enhance the sustainable use of resources within organizations to assure environmental sustainability. Most of the studies relevant to this field were carried out in developed countries and fewer number of studies can be seen in the Sri Lankan context. Among them very few empirical research has been conducted and revealed the negative side of its implementation. Based on the above findings and thoughts, there is a researchable gap to address extent to which the determinants of green HRM: green recruitment and selection, green training, green performance evaluation and green reward management are implemented in manufacturing firms in Southern province of Sri Lanka. For this study quantitative method was used under deductive approach. Responses received from 130 production managers/executives in manufacturing firms from the specified sample frame. Statistical Package for Social Science (SPSS 20) was used to analyze the data ensuring the validity and reliability to generate findings from the study. Among the green HRM practices considered for the study green reward management proved to be the key factor and green performance evaluation was the second most important determinant. Green training and green recruitment and selection have less contribution. The possible reason for this would be the lower level of training received by the employees with respect to green HRM practices and less attention for green activities at the recruitment process. The study contributes to build new knowledge to existing literature and seek new avenues to develop green concepts and green behaviours among the employees.

**Keywords:** Green human resource management; Green recruitment and selection; Green training; Green performance evaluation; Green reward management

# Track 05

## Health and Medicine

### **Stigma and Discrimination against Illicit Substance Use: Association with Dependence Syndrome Recovery among Users Undergoing Rehabilitation in Sri Lanka**

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Illicit substance dependency is an increasing psychosocial concern in Sri Lanka. As the problem continues with high relapse rates, it is important to expand the existing knowledge on substance dependency recovery. Stigma and discrimination are significant factors that have a negative impact on the recovery from substance dependency globally. The present study aimed to investigate if stigma and discrimination have a similar effect in the Sri Lankan context as well. It was hypothesised that discrimination and perceived stigma would have a negative association with personal recovery. A cross-sectional study was conducted among 100 relapsed adult males with dependence syndrome for heroin who were undergoing rehabilitation in two residential care facilities by administering a Sinhala language questionnaire. The results revealed that personal recovery is significantly explained by discrimination and perceived stigma. However, perceived stigma was not a statistically significant predictor of personal recovery from dependence syndrome. The multifactorial nature of dependence syndrome recovery would explain the small value of variance explained by two variables, which are perceived stigma and discrimination. The insignificance of perceived stigma on recovery could be attributed to varying operationalisations in literature, the abstract nature of the concept, and the high perceived stigma invariable among the present study sample. The study recommends reducing discrimination against individuals with dependence syndrome in order to support their recovery. Future research is recommended to further investigate the role of stigma and discrimination in substance dependency recovery, overcoming the limitations of the present research.

**Keywords:** Discrimination, Perceived Stigma, Personal Recovery, Heroin, Dependency Syndrome

## Assessment of positivity rate of dengue vectors in Western province, Sri Lanka

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In Sri Lanka, it is recognized that the primary and the secondary vectors for dengue transmission are *Aedes aegypti* and *Aedes albopictus* respectively which are invasive mosquitoes. All the districts are potentially suitable for the survival and establishment of both vectors. A desk review was conducted to analyze the vector positivity proportion in Western Province including all three administrative districts from 2018 to 2021 to establish the receptivity in the area to assist vector control interventions. Vector positivity data were collected from Monthly house to house vector immature stages surveillances carried out by National Dengue Control Unit and local health sectors covering all the potential and existing breeding places in the study area to collect larval and pupal stages of the two vectors. The number of positive containers for any immature stage was recorded and identified to species level. During the entomological surveillances conducted the *Ae. aegypti* positivity rate was gradually increased from 31% to 42% through the study period in Colombo district while in Gampaha and Kaluthara districts the same rate was marginally fluctuated around 15% and 3% respectively. The increase trend of the *Ae. aegypti* proportion was vividly seen in Colombo district which is undoubtedly the most urbanized area of all with higher population density and land use. However, in Gampaha and Kaluthara districts which are with less population density, the increments of *Ae. aegypti* proportion were occurred moderately with minor fluctuation during all four years. Due to the continuous heavy urbanization rate *Ae. aegypti* is gradually replacing the secondary vector, *Ae. albopictus* in Colombo district when compared the vector positivity data with the other two counterpart districts. The vector control interventions should be adjusted accordingly while identifying the different vector bionomics possessed by the two vectors.

**Keywords:** *Aedes aegypti*, *Aedes albopictus*, positivity, dengue, surveillance

## **The Relationship between Knee Osteoarthritis and Ischemic Heart Disease among Patients Attending National Hospital of Sri Lanka**

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Osteoarthritis is a worldwide highly prevalent type of arthritis and the knee is the most commonly affected joint. Moreover, ischemic heart disease (IHD) is a major contributor to disability among other cardiovascular diseases. A growing amount of research indicates that osteoarthritis may be regarded as a cardiovascular risk factor. This study aimed to assess the relationship between knee osteoarthritis and IHD among patients attending the National Hospital of Sri Lanka (NHSL). A case-control study was conducted with 80 patients, aged between 50-75 years in NHSL. Among them, 40 patients who had been diagnosed with previous IHD from Cardiology and Medical clinics were selected as the case group and 40 patients who had not been diagnosed with a previous IHD from Medical clinics were selected as the control group. Diagnosis of knee osteoarthritis and IHD in both case and control groups was established by a valid diagnosis made by a medical professional. An interviewer-administered questionnaire was used to collect the relevant data. Data were analysed using descriptive statistics and Chi-square test. Most of the study population was female (55%) in both cases and controls. The history of knee osteoarthritis in patients with IHD and their controls differ significantly: the percentage of those that had knee osteoarthritis was higher in cases (37.5%) than in controls (15.0%). (OR=3.4; 95% CI 1.156-9.996.  $p=0.022$ ). There was a statistically significant relationship between knee osteoarthritis and IHD among patients attending NHSL. That means patients with knee osteoarthritis were at a significantly higher risk of getting an IHD.

**Keywords:** Osteoarthritis, Ischemic heart disease

# Track 06

## Law, Policy and Governance

### **Policy practices for better climate adaptation and mitigation in the Asian region**

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This study includes the first systematic literature review of climate change policy practices, particularly focusing on the Asian region. The overarching goal of the study is to provide recommendations for the improvements of documented climate policies in the Asian region. In reaching that goal, four specific questions were addressed in the study: i) What policy types were established by Asian countries to address climate change? ii) What is the nature of the policy type based on the timeline? iii) What are the constraints, barriers, gaps, and limitations in implementing policies related to climate change? iv) What are the possible suggestions to overcome identified barriers, constraints, and gaps? The literature (n=79) published between 2000 to 2021 covering the scope of climate change, adaptation, and mitigation was examined in this study. Nine key sectors including i) agriculture, livestock, and fisheries, ii) water and irrigation, iii) coastal and marine biodiversity, iv) urban and infrastructure, v) health, vi) energy, vii) transport, viii) waste and ix) industry were covered in climate policy literature. Three main categories of policy practices were commonly identified: i) regulation and standards, ii) taxes and charges, and iii) infrastructure programs. Several gaps were identified in implementing climate change-related policies in Asian countries. These gaps include i) The lack of human capacity, ii) improper knowledge systems, iii) the lack of collective and collaborative actions, iv) the absence of coherence, and v) coordination among institutions. Establishing a centrally coordinated entity, providing capacity building, and incorporating research findings in policy formulations were recommended to overcome the identified gaps. This study brings an overview and essential insights on enforcing applicable policies to combat climate change-related issues in Asian countries.

**Keywords:** Climate Change, Policy, Adaptation, Mitigation, Asia

## **Developing a Legal Framework for Regulating Public-Private Partnerships (PPPs) in the Higher Education Sector of Sri Lanka**

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Higher education delivery was, until recently, completely under the hands of the public authorities in the majority of developing nations. Over time the governments of these countries started to give up their monopoly in the provision and supply of infrastructures and other facilities. However, because the traditional public procurement mechanism for providing and supplying public infrastructure had been hampered and, in fact, was still hampered by inefficiency, corruption, a lack of skills, and technical knowledge, the clever synergy of Public-Private Partnerships (PPPs) is required by this paradigm shift from a ‘government supplying’ to a ‘government facilitating’ approach. Far more significantly, PPPs also act as a spark for the nation's social and economic development. Governments, particularly those of the more developed developing nations, have implemented policies and started the process of enacting legislation with the aim of regulating PPPs in their respective jurisdictions. These regulations aim to maintain transparency, accountability, and balance between the public and private sector partners. It is evident from the Sri Lankan situation that no laws are in place to regulate PPP contracts as a whole. In order to make specific recommendations for each of the jurisdictions examined as well as to recommend a model regulatory framework for developing countries intending to adopt PPPs to address deficits, this research examines the current legislative framework in Sri Lanka and finds the best practices. This research used a qualitative approach to legal research, combining library-based resources. The study shows that South Africa's current legislative framework is far more comprehensive than Sri Lanka's and, as a result, can effectively serve as a national PPP framework for other developing countries with some modifications and adjustments to suit the specific conditions and circumstances in each location.

**Keywords:** PPP, Higher education, Sri Lanka, South Africa, International frameworks.



## **The Freedom to Choose Public Roads as the Place of Peaceful Assembly; An Analysis of Sri Lanka's Compliance with Article 21 of the ICCPR**

R.M.K.K. Ratnayake

*University of Colombo*

Article 14(1)(b) of the Sri Lankan Constitution guarantees the right to freedom of peaceful assembly ('right to FOPA') to all citizens. However, when citizens assemble on public roads to exercise this right the State disperses such assemblies citing the inconvenience to the public that assembling on public roads inevitably causes. The right to FOPA as guaranteed under the International Covenant on Civil and Political Rights (ICCPR) incorporates the freedom to choose the place of peaceful assembly which includes public roads. Having ratified the ICCPR, Sri Lanka has an international obligation to facilitate this freedom. However, in Sri Lanka there is no public discourse on the parameters of this freedom nor the State's corresponding duties. This has left an avenue open for the State to restrict the right to FOPA using location-based arguments and without much resistance from the public. Against the backdrop of several street protests carried out in 2022, this paper analyses Sri Lanka's compliance with article 21 of the ICCPR with special reference to the freedom incorporated thereunder for people to choose public roads as the place of peaceful assembly. The author intends to shed light on Sri Lanka's points of deviation from its international obligations with the objective of resisting the State's attempts to stigmatise dissent in public space.

**Keywords:** Street protests, Public roads, ICCPR, Place of peaceful assembly, Article 14(1)(b)

## **Pro-life Urge on ‘Foetal Pain’ against Pro-choice Opposition a Legal Perspective**

A.P Rathnayake

*Faculty of Law, General Sir John Kotelawala Defence University, Ratmalana*

Developments in the purview of biological sciences revolutionised modern medicine. The scientific revolution achieved the heights of inventing technologies and medical procedures. The focus of this paper is on the subspecialty of foetal medicine and the related concept of ‘foetal pain’. The recent legal developments recognised the ‘foetal rights’ with the right of a human foetus to be born healthy. ‘Pain’ in a general sense is an emotional and sensory experience that is unpleasant in nature and it occurs as a result of potential tissue damage. The fact that the foetus feels pain has impeded the reproductive autonomy of women in the process of making decisions relating to the termination of pregnancy. This simply means that whenever a woman makes a decision to terminate a pregnancy that she considers unwanted or on reasonable grounds; the medico-legal inclination to the foetus on the ground of pain imposes restrictions on it. In the eyes of the law, there are proponents and opponents to this development. However, developed legal jurisdictions such as the United States of America (USA) have expressly accepted the fact that foetus is an entity that feels pain in the event of medical interventions. There is doubt on the fact whether Sri Lanka is in need of a separate legal framework to address the issue of foetal pain. The methodology adopted by the author is qualitative in nature which prominently takes the facet of doctrinal research. The USA, being the comparative jurisdiction supports contentions balancing both the pro-life and pro-choice stances. The author’s concluding perspective signifies the process of legislation while addressing the needs of the advancements in medicine. The author recommends that the existing legal frameworks should be developed in a manner to balance the maternal-foetal rights.

**Keywords:** Foetal pain, Legislations, Modern Medicine, Foetus, Pregnant woman

# Faculty of Law



## *International Research Conference of the Faculty of Law 2023*

9<sup>th</sup> and 10<sup>th</sup> of December, 2023

## MESSAGE FROM THE DEAN

### **Prof. (Dr.) Nishantha Sampath Punchihewa**



It gives me immense pleasure to send this message on the occasion of the International Research Conference of the Faculty of Law for the year 2023. The relationship between law and social change is complex and intertwined. On the one hand, the law can spearhead social development by the enactment of far-reaching laws and regulations. At other times, the failure of the law to respond to the dynamic evolution of social needs results in hardship and misery to the general public, who in turn clamour for the appropriate legal change needed to restore the much-needed balance in their lives. However, law reform is not a matter to be undertaken lightly. It requires the consideration of many factors and the accommodation of diverse viewpoints. Bearing this in mind, the Faculty of Law decided to invite research papers on the timely theme “Expanding the frontiers of legal research: Law as a driver of social change.”

I am pleased to note that there has been a great deal of interest in this topic, which has drawn papers on a wide range of relevant topics from academics both at local and international level. These papers critique issues at the cutting edge of scientific innovation and social development and will no doubt provide the requisite research material that is needed to feed into the development of law and the conduct of law reform. I am also happy to note that this conference will also showcase the research projects of my staff and serve to reinforce and display the status of the Faculty of Law as the pioneering law teaching and research centre in this country.

I take this opportunity to wish all the participants a fruitful and productive academic exercise and hope that the research projects discussed at the conference will aid the development of the law for the benefit of society at large.

## MESSAGE FROM THE CHAIRPERSON

### **Prof. Naazima Kamardeen**

Professor (Chair) of the Department of Commercial Law,  
Faculty of Law



We at the Faculty of Law have witnessed great change as the University of Colombo transitions from a teaching university to a research university. One of these fundamental changes involves the emphasis placed on the role of academics as researchers. There is no better forum to present and test the validity of one's work than at a conference of one's peers, and the annual research conference provides exactly that opportunity for its faculty. Under the able direction of the University, which hosts the annual research conference, individual faculties have made the research symposium an annual event in their calendars.

This year, in keeping with the overall theme of the university, the Faculty of Law will focus on the theme "Expanding the frontiers of legal research: Law as a driver of social change." The complex yet delicate relationship between law and society sometimes sees the law being able to guide social change through far reaching legal reform, and at other times sees the law struggling to keep up with the rapid evolution of societal behaviour in certain fields. This latter concern is reflected particularly in papers that examine the rise of artificial intelligence and its relationship with human activities.

I am glad to note that this year's conference includes the participation of regional and international scholars, which will undoubtedly raise the bar of academic research, scholarship and discussion at the Faculty of Law.

Allow me to take this opportunity to wish all participants of the University of Colombo's Annual Research Symposium a fruitful and productive academic meeting.

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## PROGRAMME OF SESSIONS

<b>Agenda – 9<sup>th</sup> December 2023</b>	
Venue: Faculty of Law Auditorium	
8.30 – 9.00 AM	Arrival of Guests
9.00 – 9.10 AM	Lighting of the Oil Lamp
9.10 – 9.20 AM	Welcome Address by Prof (Dr) Sampath Punchihewa, Dean Faculty of Law
9.20 – 9.25 AM	Address by Prof. Naazima Kamardeen, Conference Chair
9.25 – 9.35 AM	Address by Senior Professor (Chair) H D Karunaratne, Vice-Chancellor
9.35 – 9.40 AM	Introduction of Keynote Speaker by Prof Indira Nanayakkara, Former Dean, Faculty of Law
9.40 – 10.10 AM	Keynote Address by Hon. Justice Yasantha Kodagoda, Judge of the Supreme Court of Sri Lanka
10.10 – 10.15 AM	Address by Prof Kokila Konasinghe, Head, Department of Public and International Law
10.15 – 10.20 AM	Address by Dr. Udapadie Liyanage, Head, Department of Private and Comparative Law
10.20 – 10.25 AM	Address by Mr Menaka Harankaha, Head, Department of Commercial Law
10.25-10.30 AM	Vote of Thanks by Ms. Tavini Nanayakkara, Conference Secretary
10.30 Onwards	Departmental sessions

Department of Commercial Law

Day 01 (9 <sup>th</sup> December 2023) – Session I (11.00-1.00 PM) - Onsite		
11.00-11.15 AM	‘Nanny states would do so’: a critical analysis of the normative foundation of tobacco plain packaging measures through International legal and policy standards and regulatory anatomy of the countries <b>Sanath S. Wijesinghe</b>	Panelists  1. Hon. Justice Dr. Ruwan Fernando  2. <b>Prof. (Dr.) Nishantha Sampath Punchihewa (Session Chair)</b>  3. Dr. D. M. Swaminathan
11.15-11.30 AM	Discourses of property rights in the wake of intellectual property rights vis-à-vis geographical indications <b>Akriti A</b>	
11.30-11.45 AM	Critically Examining the Scope of Geographical Indications in the wake of Traditional Knowledge for India and Sri Lanka <b>Akriti A and Vijoy Sinha</b>	
11.45-12.00 Noon	Using intellectual property rights as collateral <b>Indika T. Gamage</b>	
12.00 -12.15 PM	Protection of Indian Traditional Cultural Heritage through Intellectual Property Regime: Special reference Bastar Handiworks from Chhattisgarh, India <b>Debmita Mondai</b>	
12.15 – 1.00 PM	Comments by the panelists	
Day 01 (9 <sup>th</sup> December 2023) – Session II (2.00-4.00 PM) - Onsite		
2.00-2.15 PM	DABUS: the AI Innovator: A Critical Analysis of the Patentability of AI-Generated Inventions <b>Padmaja Wijesooriya</b>	Panelists 1. <b>Dr. Prathiba Mahanamahewa (Session Chair)</b>  2. Dr. Thusitha B. Abeysekara  3. Dr. Sanath Wijesinghe
2.15-2.30 PM	Artificial Intelligence related works and copyright law in Sri Lanka: Prospects and challenges <b>Ruwanthika Ariyaratne,</b>	
2.30-2.45 PM	Reforming the Competition Law Regime in Sri Lanka: Insights from US, EU and India <b>NS Punchihewa</b>	



2.45-3.00 PM	Independence and impartiality of arbitration in Sri Lanka: How it is and how it ought to be <b>Indunil J. A. Kumarasinghe</b>	
3.00 – 3.45 PM	Comments by panelists	
<b>Day 02 (10<sup>th</sup> December 2023) – Session I (9.00-12.00 noon) - Online</b>		
9.00 -9.15 AM	The Role of Audit in Modern Society and the National Audit Act: A Critical Analysis <b>W.I. Nanayakkara</b>	<p>Panelists</p> <p><b>1. Prof. (Dr.) Nishantha Sampath Punchihewa (Session Chair)</b></p> <p>2. Dr.Sunil DB Abeyratne</p> <p>3. Dr.Chathura Warnasooriya</p> <p>4. Dr. I. D.L. Pathirana</p>
9.15- 9.30 AM	Foreign Direct Investments and Tax Exemptions: The Sri Lankan Scenario <b>Dr. Darshika Pathirana</b>	
9.30- 9.45 AM	Towards a fair and equitable approach of debt recovery by banks: an analysis of the debt recovery laws in Sri Lanka <b>Yaseera A.L.F.</b>	
9.45- 10.00 AM	Cross-Border Accountability: A Critical Analysis of Effects of European Human Rights Due Diligence Laws in Developing Nations <b>Shamila Dawood</b>	
10.00-10.15 AM	Copyrights in AI-Generated Materials- A Reflection on the Law with a Special Focus on Sri Lanka <b>Menaka Harankaha and K A A N Thilakarathna</b>	
10.15-10.30 AM	Countering the Digital Era Through Law: Legislative Measures for the Development of Electronic Transactions in Sri Lanka <b>Sadhishi Doranegama</b>	
10.30-10.45 AM	Exploring the potential of the Legal tech industry in Sri Lanka; A critical evaluation of the opportunities and challenges through a comparative analysis <b>Pramoda Vithanage, Rangana Jayashanka</b>	
10.45-11.00 AM	Comments by the panelists	

## Department of Private and Comparative Law

11.00-12.00 Noon	<b>Plenary speech</b> by Dr. Sarasu Esther Thomas, Professor of Law and Coordinator- Centre for Women and the Law	
<b>Day 01 (9<sup>th</sup> December 2023) – Session I (1.30-3.00 PM) - Onsite</b>		
1.30 – 1.45 PM	‘Unravelling the Complexities of Pure Economic Loss: Exploring Assumption of Responsibility under English Law’ <b>V. Kamal Ahamed</b>	Hon. Justice Saleem Marsoof, PC
1.45- 2.00 PM	‘Surgical Malpractice’ in Hospitals and Law: Matters to Ponder <b>Ayodhya P. Rathnayake</b>	Hon. Justice Yasantha Kodagoda, PC
2.00-2.15 PM	‘Development of the Common Law of Sri Lanka: A Review of the Judicial Approaches with Specific Reference to the Law of Delict’ <b>D.S.E.U.S. Liyanage</b>	Professor (Emeritus) Sharya Scharenguivel Dr Avanti Perera
<b>Day 01 (9<sup>th</sup> December 2023) – Session II (03.30-5.00 PM) - Onsite</b>		
3.00-3.15 PM	Effectiveness of Sri Lankan laws on sexual harassment in protecting employees in informal workspaces: A critical analysis <b>Eranga S. W. Dissanayake</b>	Hon. Justice S. Thurairaja, PC
3.15-3.30 PM	COVID-19 and its impact on contracts: Lessons for Sri Lanka from the United Kingdom <b>Oshada Rodrigo</b>	Professor (Emeritus) Sharya Scharenguivel Dr. Yasodara Kathirgamathamby
3.30-3.45 PM	An Assessment of Fishers’ Employment Rights in Sri Lanka in the light of International Labour Standards <b>Arulanantham A. Sarveswaran</b>	
3.45-4.00 PM	Rights of unskilled migrant workers: Challenges and prospects <b>Nisanka M. Jayarathna</b>	
4.00-4.15 PM	‘Piercing the Technology Veil: An attempt to decode the modern employment contracts of digital economies’ <b>Sathiyaseelan Janani</b>	
4.15 -5.00 PM	Comments by the panelists	

<b>Day 02 (10<sup>th</sup> December 2023) – Session I (9.00-11.00 AM) - Online</b>		
9.00 -9.15 AM	‘Analysing the divorce under general law in Sri Lanka in light of ‘Therapeutic Jurisprudence’ <b>Danushika Abeyrathna</b>	Professor (Emeritus) Sharya Scharenguivel
9.15-9.30 AM	Protecting children in the digital age: Lessons from the UK’s Online Safety Bill for the child protection in Sri Lanka <b>Shaveen S. Amugoda Kankanamge Don</b>	Prof.(Chair) Rose Wijeyesekera
9.30-9.45 AM	Securing cyber space for children in Sri Lanka: A comparative legal analysis <b>Shaaieswary Pathmaseelan</b>	Hon. Justice Kumudini Wickremasinghe
9.45-10.00 AM	Destructive adaptability of divorce laws in Sri Lanka: Marriage breakdown as a separate ground of divorce <b>Isuru Prabhath</b>	Mr. Geoffrey Alagaratnam,PC
10.00- 11.00 AM	Comments by the panelists	
<b>Day 02 (10<sup>th</sup> December 2023) – Session II (12.00-1.30 PM) - Online</b>		
12.00 – 12.15 PM	‘Land-for-Land and Cash-for-Land Compensation in Land Acquisition: Prospects and Challenges in Sri Lanka’ <b>G.P.D. Madhushan</b>	Hon. Justice Mahinda Samayawardhana, PC
12.15-12.30 PM	‘The Conceptual Divergence of Domicile, Nationality, and Residence in Private International Law: A Memo to the Sri Lankan Civil Procedure’ <b>M.P.S. Kaushani Pathirana</b>	Dr. J M Swaminathan
12.30- 12.45 PM	‘The Impact of the Buddhist Temporalities Ordinance No. 19 of 1931 on Sri Lankan Society: Shaping Religious Practices and Social Dynamics through Legal Frameworks’ <b>B.M.Munasinghe</b>	Dr. Yasodara Kathirgamathamby
12.45- 1.30 PM	Comments by the panelists	

**Department of Public and International Law**

<b>Day 01 (9<sup>th</sup> December 2023) – Session I (11.00- 12.00 noon)</b>		
11.00- 11.15 AM	The right to a healthy marine environment and emerging marine pollution threats: A law of the sea perspective <b>M.A M. Hakeem</b>	<b>Prof. Toney George (Chair)</b> Dr. Hiran Jayawardana Ms. Asanka Karunarathna Mr. Isuru Liyanage
11.15- 11.30 AM	A Nation of Animal Lovers: Demanding for Better Animal Welfare Law in Sri Lanka to Secure Lives: A Critical Analysis <b>Thilini Yashodha Thilakarathney</b>	
11.30- 11.45 AM	Inconveniences Related to Flag of Convenience: A Critical Reflection of the Law <b>K. A. A. N. Thilakarathna</b>	
11.45 -12.00 PM	The existence legal problems in the maritime scientific researches <b>Madhurya Premachandra</b>	
<b>Day 01 (9<sup>th</sup> December 2023) – Session II (2.00- 3.00 PM)</b>		
2.00- 2.15 PM	Enhancing academic integrity in higher education in Sri Lanka” Contract cheating and beyond <b>Darshana Sumanadasa</b>	<b>Prof. Dinesha Samararatne (Chair)</b> Mr M A M Hakeem Dr. U A T Udayanganie Mr. Akalanka Thilakarathna
2.15- 2.30 PM	Comparative Analysis of Tribal Education: A Cross-Country Study of India and Sri Lanka <b>Vijoy K. Sinha</b>	
2.30-2.45 PM	Exploring the Impact of Bias and Deficiencies in Legal Research on Social Change: A Comparative Analysis <b>Samadhi Lewke Bandara</b>	
2.45-3.00 PM	Nurturing empathetic legal professionals: An experimental study on the transformative potential of interdisciplinary pedagogy in legal education <b>Hirantha Imesh de Silva</b>	

<b>Day 02 (10<sup>th</sup> December 2023) – Session I (9.00-9.30 AM)</b>		
9.00-9.15 AM	Law and Social Welfare for Women – Issues & Challenges of Criminalizing Marital Rape in India & comparative Perspective <b>Sonali Kusum</b>	Hon. Justice S. Thurairaja <b>Professor Jeeva Niriella (Chair)</b>
9.15 -9.30 AM	The Challenging loopholes in the legal process of changing the gender identity of transgender individuals in the Sri Lankan legal framework <b>Achini Thiwanka Ranasinghe</b>	Dr. Visakesa Chandrasekaram Mr. Kusal Amarasinghe
<b>Day 02 (10<sup>th</sup> December 2023) – Session II 10.00 -11.15 a.m.</b>		
10.00- 10.15 AM	Justiciability of Socio-Economic Rights in India: The Influence of International Human Rights Law Framework in the Judicial Decision-Making Process <b>Aneesh V. Pillai</b>	<b>Prof. Wasantha Seneviratne (Chair)</b> Dr. Kalana Senaratne Ms. S. Puwanitha Ms. Thilini Galappaththige
10.15-10.30 AM	Analyses of the Judicial Approach on the Right of Health: Indian Perspective <b>Niluka Gamalath</b>	
10.30 -10.45 AM	Giving Realization to Right to Adequate Food; Effectiveness of the Sri Lankan Food Regulatory Framework on Securing Food Safety <b>Thamasi Konara</b>	
10.45-11.00 AM	A critical analysis of the legal framework on the protection of the right to physical access to public property to persons with disabilities <b>Chathuri Jayasuriya</b>	
11.00-11.15 AM	Colonial Cultural Property as War Booty – Postcolonial Reflections on the Restitution Debate with special reference to Sri Lanka and the Netherlands <b>N. Kamardeen and Lakshitha Edirisinghe</b>	

## INTRODUCTION TO KEYNOTE SPEAKER

### **His Lordship Honourable Justice Yasantha Kodagoda**

*Puisne Justice of the Supreme Court of the Democratic Socialist Republic of Sri Lanka*



His Lordship Honourable Justice Yasantha Kodagoda (born in 1965 in Sri Lanka) is a Puisne Justice of the Supreme Court of the Democratic Socialist Republic of Sri Lanka. He was called to the Bar as an Attorney-at-Law of the Supreme Court of Sri Lanka on 28 October 1988. Prior to being appointed by the President of Sri Lanka as the President of the Court of Appeal in March 2019 (following a unanimous approval of his nomination by the Constitutional Council), he served as an Additional Solicitor General of the Attorney General's Department. Having joined the Attorney General's Department of Sri Lanka in 1989 as a State Counsel, he rose to the positions of Senior State Counsel (1999), Deputy Solicitor General (2005), Senior Deputy Solicitor General (2014) and Additional Solicitor General (2015). He has 30+ years of experience as a Public Prosecutor and Legal Advisor to the Government of Sri Lanka. His specialization is in the field of criminal justice. In 2015, in recognition of his eminence in the legal profession, he was appointed President's Counsel. He completed his primary and secondary education at Ananda College, Colombo he was a President Scout of Ananda College and then attended Sri Lanka Law College. He obtained a Master's degree in Public International Law with Merit (LL.M.) from the University College London (UCL). He acted as the Director of the Advanced Legal Studies Unit of the Sri Lanka Law College and the Director of the Institute of Advanced Legal Studies (Sri Lanka) of the Incorporated Council of Legal Education. He has served many Commissions of Inquiry as representative Counsel of the Attorney General. For over a decade, he has represented Sri Lanka before the UN Human Rights Commission and the UN Human Rights Council. He has also represented Sri Lanka before the UN Security Council's Working Group on Children in Armed Conflict, and has served as the Accredited Representative of the Government of Sri Lanka at the UN Committee Against Torture. He was a member of the EU-Sri Lanka Working Group on Trade and Economic Relations Cooperation 2016 and actively participated in Sri Lanka gaining the GSP+ trade concessions.

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*B.M.Munasinghe*

13. The Conceptual Divergence of Domicile, Nationality, and Residence in Private International Law: A Memo to the Sri Lankan Civil Procedure  
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14. The right to a healthy marine environment and emerging marine pollution threats: A law of the sea perspective  
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15. Colonial Cultural Property as War Booty – Postcolonial Reflections on the Restitution Debate with special reference to Sri Lanka and the Netherlands  
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*K. A. A. N. Thilakarathna*



## Copyrights in AI-Generated Materials - A Reflection on the Law with a Special Focus on Sri Lanka

Menaka Harankaha<sup>1</sup> and K A A N Thilakarathna<sup>2</sup>

<sup>1</sup>*Department of Commercial Law, Faculty of Law, University of Colombo.*

<sup>2</sup>*Department of Public and International Law, Faculty of Law, University of Colombo*

The development of Artificial Intelligence (AI) has questioned the traditional understanding of the law including intellectual property rights. The possibility of providing copyright protection for AI generated works has become a contentious issue. Copyright law provides the author with the right to exclude others from exploiting her/his work. In a work developed by AI, a real problem will be in the identification of the author as copyrights are generally granted to authors for their creative work. Section 5 of the Intellectual Property Act No 36 of 2003 defines the author as “the physical person who has created the work”. When a work is created through the involvement of artificial intelligence, identification of the author becomes difficult. However, this in itself should not exclude a broader discussion on the topic since individuals may use AI generated works and claim copyrights. Therefore, using the doctrinal method, this research aims to find out the most appropriate means of balancing the competing interests of the relevant parties involved, including the authors and users of copyrighted works. It is suggested that AI generated works that are capable of being provided with copyrights protection should not altogether be excluded from copyrights protection just because the creator is not a physical person. Instead, it is suggested that alternatives should be looked at from different perspectives, including the introduction of a separate threshold to grant copyrights to AI generated works or to create sui generis rights to AI generated works capable of being granted copyrights.

**Keywords:** *Copyrights, Artificial Intelligence, Authorship*

## **The Role of Audit in Modern Society and the National Audit Act: A Critical Analysis**

W.I. Nanayakkara

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The accounting and auditing system of a nation plays a pivotal role in maintaining public sector auditing and public sector governance through accountability and transparency, thereby bolstering public confidence and trust. Any failure in this system could result in financial collapses, causing depositors to lose their savings and the government to incur significant costs. Adopting international accounting and auditing standards is essential for ensuring effective surveillance of financial disclosure and reporting in order to combat corruption and the exploitation of public funds with the utmost efficacy. Auditing is required to protect public assets and resources for the benefit of the general public. This study evaluates the efficacy of the National Audit Act No. 19 of 2018 in preventing corruption and mismanagement of public funds. The paper evaluates the effectiveness of the Act in deterring corrupt officials, assessing its legal authority, and determining whether it effectively promotes transparency and accountability in accordance with public expectations and determines whether the Act complies with International Financial Reporting Standards and International Standards on Auditing in enhancing audit quality within the Sri Lankan financial environment. The study utilized qualitative methods to analyze primary and secondary sources, such as scholarly articles and current legislative frameworks, in order to form conclusions. It is anticipated that the Act will strengthen the core values of the public sector and ensure the efficacy of auditing by facilitating the establishment of independent audit functions for the benefit of the people. This study identifies certain loopholes and concludes that the Act needs changes to make it a more effective instrument for preventing corruption, protecting public funds, and strengthening the accountability and auditing system in the nation.

**Keywords:** *Audit, Accountability, Financial, Governance, Transparency*

## Reforming the Competition Law Regime in Sri Lanka: Insights from US, EU and India

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Even though the competition or antitrust law has become an important pillar of the pantheon of commercial law in any developing or developed country, Sri Lanka continues to remain a jurisdiction devoid of adequate competition laws in the South Asian region. In this light, the purpose of this paper is to critique the current status of competition law in Sri Lanka viewed through the lens of experience drawn from more advanced jurisdictions such as the US, EU and India and propose appropriate law reforms. The research employs a critical review of literature by following the black-letter or doctrinal legal research methodology coupled with comparative legal research and analysis. The results of this research indicate that there is no adequate legal framework to prevent anti-competitive behaviour by Sri Lankan firms. Even more strikingly, it is hard if not impossible to find any antitrust enforcement mechanism in the country whereas robust competition law enforcement mechanisms are evident in other jurisdictions selected for this study thereby protecting the process of competition for the benefit of consumers. Arguably, a potential solution lies with the introduction of a stand-alone (*sui generis*) competition law regime, so that it would no longer be necessary to rely on the legal provisions embedded in the Consumer Affairs Authority Act, No. 09 of 2003. For this reason, the experience drawn from more sophisticated jurisdictions such as the US, EU and India can undoubtedly serve as best practices for Sri Lanka. Therefore, this research offers new insights to policymakers in Sri Lanka to formulate law reforms in the area of competition law. From a developing country's perspective, it is true that law reform alone is not sufficient to achieve the desired outcome and other factors contributing to healthy market competition are also required.

**Keywords:** *Competition Law, Anti-competitive behaviour, Law Reform.*

## **Foreign Direct Investments and Tax Exemptions: The Sri Lankan Scenario**

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In the face of the economic recession in Sri Lanka, proposals and discussions about various strategies have come to the fore, but the most effective proposal is to attract more foreign investments into the country. Among the various concessions and incentives provided by the Government of Sri Lanka to foreign investors, tax concessions occupy a very high place. Accordingly, many successful tax concessions such as tax exemptions, tax concessions, holidays, exchange control exemptions and tax havens have been introduced from time to time through tax amendments. One of the objectives of the Inland Revenue Act No24 of 2017 was the introduction of these tax concessions. Therefore, the tax exemptions and concessions have been introduced to the Act under the IVth schedule. By introducing these tax incentives and concessions, the government expects to bring in a large amount of foreign investments to Sri Lanka and improve its current economic situation.

Based on the above basic facts, the research problem that is expected to be solved in this research is to consider whether tax havens are a strong force for attracting foreign investment. The primary purpose of this research is to analyze the relationship between tax havens and investment incentives. The research is qualitative in nature, while the quantitative method is used to collect statistical data from government websites, databases, and publications. Findings indicate that tax exemptions and concessions could be crucial in attracting foreign direct investments and solving the economic issues in the country. Recommendations include amending the existing laws in order to make this activity sustainable and fair by all stakeholders.

***Keywords:*** *Tax Havens, Investment Incentives, Tax Exemptions, Economic Crisis*

## **Exploring the potential of the Legal tech industry in Sri Lanka; A critical evaluation of the opportunities and challenges through a comparative analysis**

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Artificial Intelligence is becoming an in-vogue concept of the era. It impacts many aspects of human life, including the law and legal profession. The legal Tech industry which refers to using technology to provide legal services has also expanded embracing AI models using big data, machine learning, algorithms, data prediction, and case management tools, etc. There is a current discourse about how these models can be used to develop the legal landscape. For example, whether the law's delays can be minimised by utilization of legal tech. This is as yet a primitive idea and a business model in Sri Lanka. The use of information technology in the Sri Lankan legal industry is observed to be at a very low level except for a few instances during the Covid 19 pandemic. This paper intends to critically analyse the potential of developing the legal tech industry within the legal landscape of Sri Lanka. It adopts a doctrinal approach and in addition, an empirical study is conducted to provide more contextualised recommendations by ascertaining the practical underpinnings and attitudes of the stakeholders. The comparative study critically reflects the lessons learned from the UK as a benchmark. For the purpose of this paper, the authors do not believe in 'AI solutionism' as a concept and argue that AI-assisted modules should be developed to facilitate the legal landscape while preserving its human element for more effective and cognitive usage. The findings of this paper deal with three aspects of the legal industry; professional ethics, data protection, and threats to the legal profession. The paper finally recommends legal and policy reforms at different levels; legal and regulatory landscape, legal education, professional training, and development through collaboration among different stakeholders and interdisciplinary research.

**Keywords:** *artificial intelligence, data, legal tech, legal industry, machine learning*

## **Cross-Border Accountability: A Critical Analysis of Effects of European Human Rights Due Diligence Laws in Developing Nations**

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The issue of human rights impacts on foreign direct investment (FDI), especially in developing countries, has been a subject of longstanding debate. Historically, the approach to addressing these impacts has primarily relied on voluntary standards with limited legal constraints. This approach has led to inconsistent practices among multinational corporations, particularly in developing countries, with some prioritising human rights while others downplay their significance. The recent trends in due diligence laws have shifted toward a more regulatory approach that directly addresses human rights issues associated with the extraterritorial activities of their subsidiaries and their value chains. This shift acknowledges the shortcomings of voluntary standards and aims to create a structured, legally binding framework for addressing human rights issues in commercial activities. As a result, these laws are gaining prominence in developing countries. However, it is premature to make definitive predictions as these laws are still in their infancy.

The main objective of this article is to critically evaluate the evolving landscape of due diligence laws relating to FDI and its implications on human rights in host developing countries. This research concludes that these laws have a significant impact on developing countries in minimising corporate human rights abuses, contributing to sustainable development, and significantly responding to the global call for accountability. The research adopts a doctrinal analysis, using both primary and secondary data. Tables and figures are incorporated where necessary to present the data analysis. Through this analytical approach, the article aims to contribute to the ongoing discourse on striking a balance between economic interests and the imperative to safeguard human rights in the context of FDI.

**Keywords:** *human rights, foreign investment, due diligence laws, developing countries, accountability*

## **A comparative analysis of divorce law in Sri Lanka and Singapore through ‘Therapeutic Jurisprudence’.**

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In their work on mental health law, Professors David Wexler and Bruce Winick introduced the concept of ‘Therapeutic Jurisprudence,’ referred to as TJ, in the late 1980s. Now, it applies to numerous fields of law, including family law. The focus of TJ is the social force of the law. It acknowledges that the legal system (including rules, procedures, and actors) can have therapeutic or anti-therapeutic effects and seeks to modify its roles in order to increase the positive impact on an individual’s well-being while preserving due process principles. It is an interdisciplinary approach to law that encourages investigation of the impact of the law on the psychological and emotional well-being of those it affects. This research aims to examine the current divorce law under general law in Sri Lanka and its impact on the parties and children (if any) through the lens of TJ. The general law recognises three fault-based grounds for divorce: adultery, malicious desertion, and incurable impotency. Even though the Judicature (Amendment) Act No. 34 of 2022 reintroduces a ‘Family Court’ and a ‘Family Counsellor’, the three fault-based grounds for divorce and the hearing under the adversarial system remain the same. For the purpose of this research, a desk review of international human rights instruments will be followed by a comparative analysis of Sri Lankan and Singaporean domestic and foreign legislation, academic articles, and case law. Singapore was chosen as a comparative jurisdiction because it has recently implemented TJ in the context of divorce. In conclusion, the research suggests that policymakers must reconsider the divorce laws in Sri Lanka in light of TJ. The research provides recommendations based on its findings.

***Keywords:*** *adultery, divorce, incurable impotency, malicious desertion, therapeutic Jurisprudence*

# Unravelling the Complexities of Pure Economic Loss: Exploring Assumption of Responsibility under English Law

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Within English law, pure economic loss refers to financial harm arising from negligence or breaches of contract, without physical injury or property damage. This study examines liability for such loss through the principle of ‘assumption of responsibility.’ While this principle is prevalent in English negligence law, its potential ambiguity poses a significant challenge that requires careful consideration. Through critical examination of the complexities surrounding the assumption of responsibility theory, including factors such as causation, duty scope, reliance, and foreseeability, this research aims to enhance our understanding of resolving disputes involving pure economic loss. The objectives of this study are twofold: first, to analyse the challenges inherent in resolving such disputes, and second, to propose solutions that consider these factors and overcome the associated challenges. To achieve these objectives, this research adopts a methodological approach based on doctrinal analysis, utilising primary and secondary legal sources. The analysis of case law plays a pivotal role in this research, providing valuable insights into the factors considered by courts when calculating pure economic loss. By incorporating the insights gained from case law analysis, this study captures the nuances of judicial decision-making and offers practical implications for legal practitioners, policymakers, and courts. It emphasizes the importance of a balanced and nuanced approach when addressing disputes involving pure economic loss, with particular consideration given to factors such as foreseeability, the defendant's knowledge, and the nature of the parties' relationship.

**Keywords:** *Negligence, Pure economic loss, Assumption of responsibility, Causation, Foreseeability.*



**Piercing the Technology Veil: An attempt to decode the modern employment contracts of digital economies.**

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We have entered into the most unusual working arrangement of this generation. *Labour Digitalization* due to technological advancement has changed the aspects of the traditional world of work. The more crucial would be the adoption of novel employment arrangements which have led to the emergence of new classes of workers such as click workers, crowd workers, digital nomads, teleworkers, etc. The flexibilities and novelty in these employment arrangements have led employers to create “false” or “bogus” self-independent contracts to govern their employment relationships with the workers who connect and serve them through technological mediums. As the classification of contractual relationships functions as *finium regundorum* in employment law, this trend helps employers evade their employment obligations. Therefore, the workers of digital economies lack proper protection, which they would have enjoyed in a traditional work setup by rendering the same set of services. Therefore, this study aims to decode the bogus self-independent contracts to enable the workers of digital economies to enjoy their protection under an employment contract. For this purpose, the study involves a qualitative approach with doctrinal, comparative, and case law studies. The study suggests utilizing the functional analysis to decode the employment contract to differentiate the workers of digital economies between workers and self-independent contractors. To achieve this objective the study recommends the adoption of functional equivalence and technology neutrality principles from modern contract law to the employment law sphere. These principles could logically stand to decode the bogus self-independent contractors and widen the employment protection to the workers of the digital economies, as they strive to focus on the function as opposed to the medium in which the performances are carried out.

**Keywords:** *Functional equivalence, Technology veil, Technology Neutrality*

## **Development of the Common Law of Sri Lanka: A Review of the Judicial Approaches with Specific Reference to the Law of Delict**

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The Roman Dutch law is the common law of Sri Lanka. The law of delict is a part of the common law. Delict involves general principles of Roman Dutch law as introduced to Sri Lanka during the Dutch period and thereafter, developed in the hands of English judges, during their rule. The intervention of the Legislature in the area of delict has been minimal up to now. Although delict cases do not consistently find their way to the courts for interpretation, a few significant cases have come up for review recently. Some argue that the law of delict is a dead law, which has no relevance to modern life. Litigants are moving away from delictual remedies and seeking more popular and instant alternative ones. Contrastingly, others argue that delictual actions are not utilized to the maximum in this country. In this backdrop, this research examines to what extent the judicial approach to delictual liability has evolved in the common law in Sri Lanka in the colonial and post-colonial era. It will further explore how the development of common law can be assessed and whether there is any criterion to determine such development. This study is significant as it sheds light on the past and reviews the progress of the judge-made law in delict for future reforms. This is a qualitative study which adopts a case law analysis. Further, a comparative method is used to determine the evolution of the common law in South Africa and English law in the area of delict and tort. The review encloses primary and secondary data to showcase the diverse phases of the common law, in the colonial and post-colonial periods in Sri Lanka. The findings of the study will inform public policy and law reform.

***Keywords:*** *Common law; Roman Dutch Law; Delict*

## **Land-for-Land and Cash-for-Land Compensation in Land Acquisition from a Sri Lankan Perspective: A Comparative Analysis with India**

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The only justice available to owners who have been deprived of their land ownership through compulsory land acquisition is the right to fair compensation. This compensation can be monetary or land equivalent to the value of the land deprived. It is a well-established principle that the deprivation of this land ownership can be justified on the eminent domain of the State for a public purpose. However, relinquishing one's rights for a public purpose through no fault of one's own but for the benefit of the general public is a fair approach that the deprived rights should be restored by providing a better position than the existing condition. This is especially the case when people who are already well-settled have been forced to resettle due to being relocated. The research problem sought to be addressed is that although the Land Acquisition Act No. 09 of 1950, Sri Lanka National Involuntary Resettlement Policy in May 2001, and National Policy on Payment of Compensation in November 2008 clearly state how compensation should be given for the acquired land based on the culmination of the market value of land acquired, severance and injurious Affected to land retained, disturbance and other losses, there is a gap in the fact that the socio-economic factors are not considered while calculating the compensation and it would be more crucial due to the ongoing higher economic inflation in the country where land value remains unchanged compared to all other goods and services. Therefore, the objective of this research is to inquire about the possibility of considering socio-economic factors in calculating adequate compensation in the acquisition of land for public purposes based on having a proper balance between private and public interests, and this reasoning can be adequately substantiated by social engineering theory. While adopting the doctrinal approach, this research examines the necessity of establishing a comprehensive framework for Land-for-Land and Cash-for-Land compensation or a combination of them for the acquired land in the Sri Lankan context. The results show that countries like India have successfully implemented compensation mechanisms considering socio-economic factors in computing compensation for acquired land. Such an approach could also be adopted by Sri Lanka to confirm the effective implementation of justice.

***Keywords:*** *Compensation, Economic Inflation, Justice, Land Acquisition, Public Purpose*

## **The Impact of the Buddhist Temporalities Ordinance No. 19 of 1931 on Sri Lankan Society: Shaping Religious Practices and Social Dynamics through Legal Frameworks.**

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Since ancient times, Sri Lanka has been adorned with a plethora of Buddhist temples and monuments, all enshrined and protected by the country's supreme law, ensuring the preservation of Buddhism. The laws governing temple properties in Sri Lanka have been shaped by a blend of Buddhist traditions, legal precedents, and statutory laws. One notable influence on Sri Lankan society has been the Buddhist Temporalities Ordinance No. 19 of 1931, which has played a significant role in shaping various aspects relating to the temple properties, aims to preserve Buddhist traditions, ensure efficient management of temple assets, and promote social harmony in a religiously diverse society. The study delves into the impact of the Ordinance on the authority and functions of the Buddhist clergy in managing both communal and private properties, resource allocation within temples, and the dynamics between temples and their neighbouring communities. Furthermore, the paper explores the effects of the legislation on religious practices and social cohesion in Sri Lanka. Through qualitative legal analysis, this study unveils the wider implications of the Buddhist Temporalities Ordinance No. 19 of 1931 in shaping social dynamics and cultural norms, especially concerning property.

In conclusion, this study highlights the substantial influence of the Buddhist Temporalities Ordinance No. 19 of 1931 on Sri Lankan society, providing valuable insights into how legal frameworks shape religious practices and societal interactions, with a specific focus on temple properties and the role of Buddhist monks in this context. The research underlines the importance of comprehending the relationship between law, religion, and society, and its impact on cultural heritage preservation. The research contributes to the ongoing discourse on the influence of law in diverse cultural and religious contexts, paving the way for further interdisciplinary exploration in this field.

**Keywords:** *Buddhist Temporalities Ordinance, Sri Lanka, Religious practices, Social dynamics, Law*

## **The Conceptual Divergence of Domicile, Nationality, and Residence in Private International Law: A Memo to the Sri Lankan Civil Procedure**

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University of Colombo*

Domicile, Nationality, and Residence are three different concepts in the application of Private International law rules. Nationality is a political and legal bond that eliminates the problem of statelessness, and it ensures the protection and enjoyment of fundamental rights and diplomatic protection from the state. Further, nationality is a universal concept mostly found in Public International law, which is distinct from Domicile and Residence which are the fundamental principles under Private International law. Nonetheless, no exclusive statutory provisions or definitions are provided in the Civil Procedure Code No. 2 of 1889 (as amended) of Sri Lanka for these three divergent concepts. The more challenging situations in the interpretation of civil procedure laws would arise due to increasing the number of cross-border transactions because of the developing figures of nonresidents in Sri Lanka as the country opens the gateways for investments and the rapid growth of the migration rate of the country due to the economic [in]stability. Moreover, the application of personal laws in Sri Lanka would provide more complicated circumstances in conflict of law matters with the change of nationality, domicile, and residence of the parties. This research aims to provide a conceptual understanding of the fundamental principles of Private International law on domicile, nationality, residence, and their application in a plural legal system and to suggest possible reforms to amend the Civil Procedure Code of Sri Lanka. The black letter research method will be used to conduct this research with a comprehensive analysis of primary data sources.

**Keywords:** *Civil Procedure Code, Conflict of laws, Domicile, Nationality, Residence, Sri Lanka*

## **The Right To A Healthy Marine Environment And Emerging Marine Pollution Threats: A Law Of The Sea Perspective**

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This study centers its attention on the significance of the right to a healthy marine environment (RHME) as a crucial component of Sustainable Development Goal 14 (*Life Below Water*), while also exploring the consequences of escalating marine pollution under the provisions of the United Nations Convention Law of the Sea (UNCLOS). In October 2021, the United Nations Human Rights Council acknowledged, , the inherent status of a clean, healthy, and sustainable environment as a basic human right. Thus, the objective of this research is to identify the challenges arising from pollution-induced deterioration of the marine environment and to examine the connection between the concept of RHME and the establishment of a legal framework within UNCLOS. To achieve this, an extensive analysis is conducted, evaluating the effectiveness of UNCLOS provisions, regulatory frameworks, enforcement mechanisms, and monitoring practices utilized to uphold environmental standards and safeguard the marine environment. The primary goals are to ascertain the responsibility of States in preserving RHME, establish liability frameworks for addressing pollution incidents, and outline dispute resolution procedures that hold polluters accountable while pursuing compensatory measures for environmental harm. The findings underscore the fact that RHME encompasses the basic human right of individuals to inhabit a clean, sustainable, and ecologically balanced marine environment, which benefits from the presence of a healthy and resilient marine ecosystem. In conclusion, this study stresses the significance of a clean and healthy ocean in fulfilling commitments to human rights pertaining to a clean, healthy, and sustainable environment. Consequently, the study recommends States shall take all measures required to prevent, mitigate, and control pollution of the marine environment from any source, in accordance with UNCLOS obligations, using the best practical methods at their disposal in order to preserve the health and integrity of marine ecosystems for present and future generations.

**Keywords:** *Right to a healthy marine environment, emerging marine pollution threats, Law of the Sea, environmental protection, sustainable development*

**Colonial Cultural Property as War Booty – Postcolonial Reflections on the Restitution  
Debate with special reference to Sri Lanka and the Netherlands**

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<sup>1</sup>*Department of Commercial Law, University of Colombo*

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When faced with requests for restitution of cultural property taken from former colonies, the possessors of such objects maintain that much of it was taken as war booty, attempting to justify their continued possession of it. However, when examining these objects in light of the definition of war booty, it is found that many of these objects do not fall within the interpretation of the term. Another problem is that the former definition of war booty itself was determined at a time when the home States of colonial cultural property were rendered defenceless, and it is likely that the interpretation would better serve the interests of the colonial powers. Since restitution of colonial cultural objects has been requested (most specifically, six objects housed at the Rijksmuseum Amsterdam were requested by Sri Lanka from the Netherlands in December 2022) it is pertinent to examine the validity of the argument that cultural property was war booty at the time of its taking. Accordingly, the paper defines war booty, with reference both to the laws in force during colonial domination, as well as in modern times. It then attempts to prove that colonial cultural property does not qualify as war booty, under either of these regimes. Consequently, the paper argues that the taking of the cultural property was illegal and that the ownership in such property continues to vest in the home State of the property. The methodology used in the study were mixed, with both doctrinal and socio legal approaches being taken. Both qualitative and quantitative methods were used, with desk-based research being supplemented by empirical modes of inquiry including interviews with experts.

**Keywords:** *Cultural Property, Restitution, Postcolonialism, Sri Lanka, Netherlands*

## **The Inconveniences Related to Flag of Convenience: A Critical Reflection of the Law**

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<sup>1</sup>*Department of Public and International Law, Faculty of Law.*

As the high seas are not under the authority of any single state, the principle of exclusive jurisdiction of the flag State governs the activities there and the responsibility of compliance with rules and regulations therein is the responsibility of such States. While the Article 91 of the United Nations Convention on Law of the Sea of 1981 envisages a genuine link between the ship and the country of its registration, this requirement is not always followed since the term ‘genuine link’ is not properly defined. Most of the time, registration is done upon convenience than with the existence of a genuine link. A State who suffers a loss due to non-compliance of a ship registered in a country without a genuine link suffers many inconveniences in enforcing the obligations of the flag State. Using a doctrinal approach this research endeavors find out as to what inconveniences are caused by the notion of a ‘flag State of convenience’ and how such inconveniences may be overcome. Results reveal that the global community has not yet adopted a legally binding document to determine the existence of a genuine link. International courts and tribunals have tried to strike a fair balance between the sovereignty of a country which makes it possible to grant its nationality a ship according to its laws, and to make compliance with such an undertaking through various mechanisms. These have included reporting back on incidents that are complained of by other countries against non-compliance. However, such mechanisms have become futile in certain instances. Therefore, it is suggested that a proper legal definition be developed concerning “genuine link” to address the issues identified above to alleviate the inconveniences caused by the concept of a ‘flag state of convenience’.

***Key Words:*** *Flag of Convenience, Genuine Link, Ocean Governance*



# Faculty of Management and Finance



*Management in turbulent times: The way forward*

17<sup>th</sup> November 2023

## MESSAGE FROM THE DEAN

**Professor M.P.P. Dharmadasa**



I am delighted to send this message regarding the Annual International Research Conference on Management and Finance (IRCMF) 2023 and the Doctoral Colloquium of the Faculty of Management and Finance at the University of Colombo.

The Faculty of Management and Finance at the University of Colombo is hosting IRCMF 2023, the annual research conference of the Faculty. This conference, which will be held for the seventeenth consecutive year on November 17<sup>th</sup>, 2023, will take place in virtual mode. A growing body of research is vital for management practices and improving organizational outcomes. Certainly, conferences and colloquiums of this nature bring all researchers to one platform and instill a research culture among the academic community, thereby contributing to the nation's development. In this light, IRCMF aims to foster a research culture among academics and serves as a platform for them to discuss and debate scholarly dilemmas from different theoretical, methodological, and practical perspectives. It brings together different ideologies under one roof to provide opportunities for face-to-face idea exchange and the establishment of research relationships. The abstracts submitted here align with the overarching objective of our conference and colloquium and have undergone a peer-review process to maintain the quality of the abstracts.

I am confident that conferences and colloquiums of this nature will cultivate the much-needed research culture among academics and researchers, fostering interactions among them to exchange ideas about recent advances in management. I take this opportunity to express my gratitude to the conference and colloquium chairs, staff, reviewers, and the organizing committee for their contributions to the successful organization and management of this event.

I wish the Annual International Research Conference on Management and Finance (IRCMF) 2023 and the doctoral colloquium a grand success.

## MESSAGE FROM IRCMF CO-CHAIRS – 2023

**Dr. Ruwangi Chandrasekara**  
Department of Marketing



**Dr. H.M.S. Amanda N. Herath**  
Department of Business Economics



It is our pleasure to warmly welcome you to the 18<sup>th</sup> International Research Conference on Management and Finance – 2023 (IRCMF 2023), organized by the Faculty of Management and Finance, University of Colombo, Sri Lanka.

This year's theme for the conference is 'Management in turbulent times: The way forward'. Indeed, in today's fast-paced world, organizations face unprecedented disruptions, uncertainties, and complexities. Effective management in such turbulent times is not just a necessity but a critical skill that can shape the future of businesses, industries, and economies. This conference brings together thought leaders, researchers, and practitioners to share their expertise, experiences, and innovative solutions.

We are happy to announce that 38 local and international papers have been carefully reviewed and selected to be presented under five tracks: Accounting and Management Information Systems, Business Economics and Finance, Human Resources Management, Marketing, International Business, and Hospitality Management and Management, Organization Studies, and Interdisciplinary Research. We encourage you to engage in lively discussions, exchange ideas, and network with fellow attendees, with the hope that the collective wisdom and collaboration that emerge will inspire new perspectives and approaches to management in turbulent times.

While we congratulate all local and international authors representing various faculties, universities and countries on being selected to be a part of our conference, we would like to extend our sincere gratitude to all those involved in making IRCMF 2023 a success: the Vice Chancellor, University of Colombo, Dean, Faculty of Management and Finance, Deputy Registrar, Deputy Bursar, the chairpersons, track chairs, coordinators, secretaries, members of the academic staff and non-academic staff, for extending your support in making this event a success. We also thank the Keynote Speaker, Dr. Jannine Poletti Hughes, for accepting our invitation despite her busy schedule. Thank you for being a part of this exciting journey. We hope you find the conference proceedings both enlightening and enriching as we collectively explore "The Way Forward" in the realm of management.

## MESSAGE FROM DOCTORAL COLLOQUIUM CO-CHAIRS

**Dr. Sujeewa Damayanthi**  
Department of Accounting



**Dr. Gimhani Ekanayake**  
Department of Accounting



It is our pleasure to warmly welcome you to the Doctoral Colloquium 2023 organized in parallel with the 18th International Research Conference on Management and Finance (IRCMF 2023).

The key purpose of the sixth Doctoral Colloquium is to provide a unique interactive platform for PhD, DBA, and MPhil students to present their work-in-progress to a wider audience of academics and receive expert comments from a scholarly panel. The event will also provide an opportunity for the doctoral students to network with each other and academics.

The keynote speech will be delivered by Emeritus Professor Tudor Silva from the University of Peradeniya, Sri Lanka, which will provide participants with useful insights to succeed in their Ph.D./DBA journey.

While we congratulate the doctoral candidates representing various universities for being selected to be a part of our conference, we would like to extend our sincere gratitude to all those involved in making this colloquium a success: the Vice Chancellor, University of Colombo, Dean, Faculty of Management and Finance, Senior Assistant Registrar, Faculty of Management and Finance, scholarly members of the reviewing panels and all other members of the academic staff, for extending their support in making this event a success. We are also grateful to the Keynote Speaker for accepting our invitation to the inaugural session despite his busy schedule. We hope you will have a fruitful experience in the IRCMF Doctoral Colloquium – 2023 and wish all participants success in their research journeys!

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## PROGRAMME

<b>Agenda – 17<sup>th</sup> November 2023</b>	
09:00 AM	Inauguration of the 18 <sup>th</sup> IRCMF 2023 Conference
09:00 AM	Welcome Address by the Conference Co-Chairs
09:10 AM	Address by the Dean
09.20 AM	Address by the Vice Chancellor of University of Colombo
09.35 AM	Keynote Address by Dr Jannine Poletti Hughes
10.35 AM	Guest Session Emerald, academic partner
11.05 AM	Vote of thanks
11.30 AM	Panel Presentations
01.00 PM	Lunch Break
01.30 PM	Panel Presentations
04.00 PM	Industry Dialogue



## INTRODUCTION TO KEYNOTE SPEAKER

### **Dr Jannine Poletti Hughes**

PhD (York), MSc (York), BA (Universidad Intercontinental, Mexico)

*Associate Professor in Accounting and Finance*

*Management School*

*University of Liverpool, UK*



Dr. Jannine Poletti-Hughes is an Associate Professor and Chair of the Equality, Diversity and Inclusion committee at the University of Liverpool Management School. She worked as a Financial Analyst at the National Banking and Securities Commission in Mexico before joining the academic sector having obtained a PhD in Corporate Finance from the University of York in the United Kingdom. Her expertise is in corporate governance, diversity on boards of directors, corporate fraud and performance. Jannine's research has been highly commended and prize-winning by the Mexican Institute of Executives in Finance and Ernst & Young (IMEF-EY), as well as for the UDEM Adalberto Viesca Sada Award. She is currently an executive member of the Business Association of Latin American Studies and the treasurer the Society of Latin American Studies (SLAS) and has provided consultancy services on the fairness of drug-pricing to the Markets and Consumer Authority in the Netherlands. Dr. Jannine Poletti-Hughes has been a board director for Fideres (multinational company) and an adviser to Mexican parliamentarians on the business case for gender diversity on boards of directors on private companies. She has published widely in leading academic journals including the British Journal of Management, International Journal of Finance and Economics, International Review of Financial Analysis, The European Journal of Finance, Management Accounting Research, among others.

## **ABSTRACT OF THE KEYNOTE ADDRESS**

### **Forging Resilience: Embracing Diversity in Human Capital and Minimizing Default Risk**

**Dr Jannine Poletti Hughes**

In today's dynamic and uncertain business environment, effective management strategies are imperative, especially in emerging markets with heightened uncertainties. For corporations, gender diversity on boards of directors plays a pivotal role in mitigating default risk, but its significance extends beyond symbolism, particularly in cultures where traditional gender stereotypes persist. Embracing external female directors broadens the talent pool for leadership positions, offering fresh insights, diverse perspectives, and valuable skills that enhance risk management and corporate governance. By strategically including independent female directors, organizations in emerging markets can not only bolster their overall performance but also increase their resilience amidst uncertainty, making gender diversity a crucial element for businesses forging a path forward in turbulent times.

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Firm-specific determinants of integrated reporting quality: Evidence from listed companies in Sri Lanka

*W. A. T. Ravindya, S. B. Rajapaksha*

Impact of integrated reporting disclosure on firm performance- evidence from listed companies in Sri Lanka

*W. U. S. Vaas*

The role of internal auditor in corporate Governance: Case evidence from a Government-owned bank in Sri Lanka

*R. A. N. N. Ranathunga, K. J. D. Samanthi*

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Impact of capital adequacy on the performance of licensed finance companies in Sri Lanka

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The economic cost of learning losses of transgender individuals: A qualitative study in Sri Lanka

*W.M.P.M. Wijayawardhana, J. W. D. Chaminda, D.R.J. Siriwardhane*

## **Factors that impact employee's commitment in hospitality and tourism sector, Sri Lanka**

M. Yogarajah

*Department of Human Resources Management, University of Colombo, Sri Lanka*

Over the past few decades, Sri Lanka has witnessed an increase in the number of precarious employments. The hotel industry in Sri Lanka is one such sector that employs seasonal, casual, and temporary workers. Organisations in the hospitality sector to be successful, employees need to be motivated and committed to provide consumers with the best services. Due to the greater detrimental effects precarious work has on individuals, whether these workers will show commitment or a positive attitude towards the organisation is being questioned. However, results from earlier research have been inconsistent about the commitment level of these precarious workers compared to permanent employees who possess standard work. Hence, the main aim of this study is to find the factors that impact the commitment level of precarious employees. Accordingly, research was designed to identify the commitment level of precarious employees in comparison to permanent employees; personal factors that impact precariously employed employees' level of commitment; organisational factors that impact precarious employed employees' level of commitment. Taking a quantitative approach in conducting the research, questionnaires were used to investigate the commitment level of precarious and permanent employees from 204 non-managerial workers in the hospitality sector. This study found that the commitment level of precariously employed employees was lower than that of permanent employees, the nature of the job employees perform significantly influences commitment. It identified four factors that positively impact a precarious employee's level of commitment. They are age, supervisor support and fringe benefits. The study identified marital status has a substantial impact on commitment level of precarious employees, married precarious employees were more committed than unmarried precarious employees. It was also found that gender did not seem to have an impact on the commitment of precarious employees. Further, the study found total years worked, flexible working hours and working environment did not seem to have a major influence on the commitment level of precariously employed employees in the hospitality industry.

**Keywords** : *commitment, precarious employees, individual and organisational factors, quantitative research*

## **Can spirituality extend the retirement age? The effect of workplace spirituality on post-retirement work intentions**

Y. Perera

*Department of Human Resources Management, University of Colombo, Sri Lanka*

Occupying after formal retirement increasingly becomes inevitable. It is important to ascertain the readiness for the post-retirement employment of existing mid and late-career employees in organizations. The dual purpose of this study is to investigate how spiritual interventions at work influence post-retirement work intentions of public officers in Sri Lanka and how these intentions are stimulated by their retirement self-efficacy. A significant empirical gap in the literature was noticed in the realm of post-retirement employment in the public sector. Hence, a quantitative study was designed, and data were gathered from 145 senior public officers. Data were analyzed through correlation and linear regression. Further, it was found that workplace spirituality significantly impacts determining favorable post-retirement work intentions of mid and late-career employees in the public sector in Sri Lanka, while these intentions are stimulated by their retirement self-efficacy. Implications of the study are discussed at the end.

**Keywords:** *Post-Retirement Employment, Public Sector, Retirement, Self-Efficacy, Workplace Spirituality*

## **Firm-specific determinants of integrated reporting quality: Evidence from listed companies in Sri Lanka**

W. A. T. Ravindya<sup>1</sup>, S. B. Rajapaksha<sup>1</sup>

*<sup>1</sup>Department of Accountancy, University of Colombo Sri Lanka*

This paper aims to examine the firm-specific determinants of Integrated Reporting (IR) quality in listed companies in Sri Lanka. Integrated reports of 141 listed companies in Sri Lanka covering the period of 2018/19 to 2020/21 are analysed using the Integrated Reporting (IR) scoreboard and the coding framework to find out the firm-specific determinants of IR quality. The various determinants and their impacts are examined using a regression analysis. The results indicate that only firm size has a significant positive impact on the level of IR quality in Sri Lanka and profitability, financial leverage, fsize and independence of the audit committee do not significantly impact the IR quality. This study has considerable implications for policymakers in identifying which type of listed companies' regulations need to be changed for better-integrated reporting and recognizing the characteristics of companies that prepare quality integrated reports to enhance investment decisions. Even though several studies have been conducted to examine the determinants of IR quality in a few European countries and the countries where the adoption of IR is mandatory, so far, a limited studies have partially explored the determinants of IR quality in emerging economies where the adoption of IR is voluntary. Therefore, this paper has attempted to address this gap, testing the strength of various firm specific determinants of IR quality using listed companies in Sri Lanka. Further, the aforementioned IR scoreboard has the originality in assessing the quality of integrated reports in Sri Lanka.

**Keywords:** *Integrated Reporting, Integrated Reporting Quality, Firm-Specific Determinants, Listed Companies, Sri Lanka*

## **Impact of integrated reporting disclosure on firm performance- evidence from listed companies in Sri Lanka**

W. U. S. Vaas

*Department of Management and Organization Studies, University of Colombo, Sri Lanka*

This paper aims to investigate the impact of integrated reporting disclosures on firm performance measured in the form of return on assets (ROA) in the voluntary disclosure regime of Sri Lanka. This research is quantitative, based on a panel data regression analysis of 50 firms listed in the Colombo Stock Exchange for eleven financial years from 2010 to 2020 with 500 firm-year observations. An integrated reporting disclosure index was employed based on a manual content analysis method to identify the disclosure levels in the corporate annual reports. The research model consists of the independent variable which is denoted by integrated reporting disclosure index, and the dependent variable ROA. The four control variables used in the model are the debt-to-asset ratio, debt-to-equity ratio, total assets, and asset growth ratio. The findings derived from the empirical results indicate that there is a significant negative relationship between IR disclosures and firm performance measured by ROA. Further, results show a high level of disclosures of content elements in the integrated annual reports of the sample firms. The findings indicate that governance and performance have a higher level of compliance rate for the IR Content elements and strategy and resource allocation, and risk and opportunity have a lower level of compliance rate for the IR Content elements.

Capital market regulators and policymakers can gain valuable insights regarding the suitability of implementing IR in Sri Lanka. As the majority of Sri Lankan listed companies have not fully adopted the integrated reporting framework. This study adds value to the existing limited literature on IR disclosure and firm performance in Sri Lanka by incorporating content analysis and panel data regression to understand IR's impact on companies' financial performance.

**Keywords:** *Integrated Reporting disclosure, IR adoption rate, Firm Performance, Return on Assets, Sri Lanka*

## **The role of internal auditor in corporate Governance: Case evidence from a Government-owned bank in Sri Lanka**

R. A. N. N. Ranathunga<sup>1</sup>, K. J. D. Samanthi<sup>1</sup>

<sup>1</sup>*Department of Accounting, University of Colombo, Sri Lanka*

The recent corporate collapses and the financial scandals upfront capture the vital role of internal auditors (IA) and corporate governance (CG) in companies. Banks, as one of the key institutions in the economy must establish an effective internal audit function aiming to achieve corporate governance. Hence, this study explored the role of internal auditors in corporate governance cascading down to a state-owned bank in Sri Lanka. Following qualitative methodology and case study approach, the study adopted agency theory as the lens to explore an in-depth view of the content. The data collection process involved both semi-structured and unstructured interviews, along with documentary analysis. Face-to-face interviews were employed as the primary method to gather data. The collected information was later analyzed using thematic analysis. As per the findings, internal auditing has been recognized as a value adding function, which is designed to improve organizational efficiency and effectiveness through detailed internal processes, policies, and procedures. Further, the role of the internal auditor positively contributes towards creating an effective corporate governance establishing effective policies and guidelines. As researchers have identified maintaining objectivity has been recognized as the main challenge. Since every function has started to evolve with information technology, it has become necessary for internal auditing functions to adopt digital solutions including big data, artificial intelligence, and integrated auditing were highlighted. This study contributes to the prevailing literature providing evidence on the role of internal auditor towards effective corporate governance and the bank can integrate the findings to develop the effective function of internal audit towards CG integrating information technology further.

**Keywords:** *Internal Audit, Corporate Governance, State-owned Banks, Agency theory*



**Impact of consumer ethnocentrism on the purchase intention towards foreign brands:  
Special reference to Sri Lankan skincare product market**

M. Singarachchi<sup>1</sup>, S. Weerasekera<sup>1</sup>

*<sup>1</sup>Department of International Business, University of Colombo, Sri Lanka*

The primary objective of this study is to examine the impact of consumer ethnocentrism on the purchase intention towards foreign skincare brands in Sri Lankan consumers, with an emphasis on identifying if there are significant differences in the level of ethnocentric tendencies among different demographic groups of Sri Lankan consumers. The data was obtained using a self-administered structured questionnaire from 225 consumers who live in urban areas in Sri Lanka. It was later analysed using various statistical techniques such as descriptive analysis, correlation analysis, simple linear regression, independent sample T test and One Way ANOVA test. The findings demonstrated that consumer ethnocentrism negatively influences the purchase intention towards foreign skincare brands in Sri Lankan consumers and that males are more ethnocentric, with gender significantly influencing the degree of ethnocentrism. The findings further suggest that age, income, and education have no significant impact. Accordingly, this study would help to advance the understanding and application of consumer ethnocentrism in a variety of contexts, in this case, the Sri Lankan market for skincare products, by extending on the social identity theory.

**Keywords:** *Consumer Ethnocentrism, Purchase Intention, Foreign Brands, Skincare Product Market*

## **Does receiving proximity-based SMS marketing messages affect customers' intention to visit an outlet?**

R. Perera<sup>1</sup> , D. Wijetunga<sup>1</sup>

<sup>1</sup>*Department of Marketing, University of Colombo, Sri Lanka*

Mobile advertising is considered as one of the most widely used advertising mediums in the world. In this domain, the options for location-based marketing/advertising (LBM/A) on smartphones are expanding, making it easier to deliver such services. Proximity-based SMS marketing a push-based LBM/A in which marketing messages are delivered to the mobile phones of consumers in close proximity to a retail outlet even when the user has not requested such messages. Receiving such messages from outlets might seem intrusive, a violation of privacy, and therefore, could influence the consumer's intention to visit the relevant outlet. Literature has discussed privacy and intrusiveness concerns of LBM in general, and in relation to pull-based techniques. However, these concerns could be stronger for push-based techniques; thus, this study explored the impact of perceived intrusiveness and perceived privacy concerns of receiving a proximity-based SMS on the mobile user's intention to visit an outlet that utilizes this technique. It also examined whether these concerns could differ for older and younger consumers since younger consumers tend to be more receptive of digital marketing efforts. The study employed a cross-sectional survey utilizing 208 Sri Lankan consumers and data were analysed using regression techniques. Findings indicate that older consumers have a significantly higher perception of both intrusiveness concerns and privacy concerns of proximity-based SMS marketing than younger consumers. Further, for older consumers, both perceived intrusiveness and privacy concerns have a negative impact on the intention to visit a retail outlet in response to proximity-based SMS marketing and attitude towards proximity-based SMS marketing mediates both the relationships. In contrast, for younger consumers, neither perceived intrusiveness nor privacy concerns have an impact on the intention to visit a retail outlet in response to proximity-based SMS marketing.

**Keywords:** *Proximity-based SMS marketing, Perceived intrusiveness, Perceived privacy concerns, Attitude, Mobile marketing*

## **The influence of newsjacking practice on consumers' social media engagement**

M. Muthukodiarachchi<sup>1</sup>, T. Senarathna<sup>1</sup>

<sup>1</sup>*Department of Marketing, University of Colombo*

This study discusses the impact of social media on brand advertising and the subsequent decline in consumer engagement due to repetitive marketing strategies. To address this issue, the practice of newsjacking is proposed as a means to capture consumer attention and gain media exposure. Despite the limited existing literature on newsjacking, the researcher aimed to study this practice and explore its impact on consumers' social media engagement. The study collected data from various newsjacking campaigns and their corresponding web comments. Additionally, the opinions of active young consumers were gathered to understand their social media engagement behavior. The data was analyzed using valid techniques and presented within a theoretical framework for consumers' social media engagement. The study identified six key elements of newsjacking: rapidness, relevance to the audience, humour, message comprehension, virality, and creativity. It was observed that these characteristics could influence specific social media engagement activities of consumers, thereby addressing a theoretical gap and supporting the notion that newsjacking influences consumers' social media engagement.

**Keywords:** *Social media, Social media engagement, Newsjacking, Brand advertising,*

## **The impact of Social Media Influencer (SMI) characteristics on consumer purchase intention (cpi) of beauty and personal care (BPC) products in Sri Lanka**

S. A. N. T Senarath<sup>1</sup>, F. J. Ahsan<sup>1</sup>

<sup>1</sup>*Department of Marketing, Faculty of Management and Finance, University of Colombo*

Influencer Marketing is a form of social media promotion that incorporates the promotion of products and the placement of influencers' endorsements. These influencers are known for having a high level of expertise and attractiveness. It is common for people to misunderstand this and confuse Influencer Marketing with celebrity marketing. There may be some overlap, but a person's perceived popularity alone is insufficient to create successful influencer marketing. Many influencers have built huge communities to whom they promote an agreed product or activity. Different SMIs' characteristics lead consumers to have positive purchase intentions towards the products in which they are promoting. However, such effects of influencer characteristics on purchase intention of various products in the Sri Lankan market have not been adequately researched. Moreover, it appears that the BPC product market has not been investigated as well. The purpose of this study is to bridge this research gap by examining the impact of SMIs' characteristics on the purchase intention BPC products among Sri Lankan consumers, with an emphasis on identifying if there are significant impact on the consumers' attitudes towards the influencers as well. The data was obtained using a self-administered structured questionnaire from 202 consumers who uses social media in Sri Lanka. It was later analyzed using various statistical techniques such as descriptive analysis, simple linear regression, multiple linear regression, and mediation analysis. The findings demonstrated that credibility is having a more impact on purchase intention of BPC products promoted by SMIs than the attractiveness of them. The findings also revealed that consumers' attitude towards the SMIs is having a major impact on purchase intention of BPC products promoted by the SMIs through the significant complete mediation.

**Keywords:** *Social Media Influencers (SMIs), SMI Characteristics, Consumer Purchase Intention (CPI), Beauty and Personal Care (BPC), Consumer Attitude, Sri Lanka*

## **Sri Lankan consumer responses towards Online Behavioural Advertising (OBA) on Facebook**

F. J. Ahsan<sup>1</sup>, T. K. D. Jayathunga<sup>2</sup>

<sup>1</sup>*Department of Marketing, Faculty of Management and Finance, University of Colombo*

<sup>2</sup>*Postgraduate and Mid-Career Development unit, Faculty of Management and Finance, University of Colombo*

Online Behavioural Advertising (OBA) is the practice of tailoring advertising based on an individual's online activities such as searching keywords and visiting websites. The purpose of this study is to explore the Sri Lankan consumer's response towards OBA and to examine privacy concerns of OBA. Facebook has been selected, as it is the most famous social media platform in Sri Lanka. Literature depicts privacy concern had a significant trigger on OBA and personalisation factor has also been an indigenous characteristic of OBA. As per Ducoffe's model (1996) on web advertising, entertainment, informativeness and irritation were considered as the perceptual dimensions demonstrating a relationship with attitude towards an advertisement and leading to consumer responses. Lee and Rha's (2013) extended model for OBA depicted privacy and personalisation as two other important dimensions of OBA. Accordingly, the conceptual framework was developed and operationalised using previously used measures. Using data from 390 Sri Lankan respondents who are Facebook users in the age group of 18-34 years, the results show that entertainment, informativeness, and personalisation had a positive relationship between attitudes towards OBA, whereas irritation and privacy concerns had a negative relationship. The results indicate that consumer's attitude towards OBA in fact has a positive impact on the consumer's response to click on an advertisement. The findings will be of utmost importance for advertising practitioners to not only develop information-rich and entertaining advertisements but also personalised content of the advertisements. This research study also contributes to an enhanced understanding of online behavioural advertising on Facebook. The findings of the research will be vital as a steppingstone to research in the area of OBA as it is an upcoming area in digital marketing and is known to be the future of advertising.

**Keywords:** *Online behavioural advertising, Facebook, Sri Lanka, Privacy concerns, Personalization, Sri Lankan consumer attitudes & responses.*

## Viewer responses to clickbait on YouTube: A marketing perspective

S. D. K. Wickramasinghe<sup>1</sup>, D. Wijetunga<sup>1</sup>

<sup>1</sup>*Department of Marketing, Faculty of Management & Finance, University of Colombo*

With YouTube becoming popular as a money-making endeavour, content creators (YouTubers) are increasingly resorting to ‘clickbait’ – attractive, yet misleading, titles and thumbnails to lure content seekers (viewers) to click on their videos. With the increase in this practice, there is also greater scholarly interest in it; however, this interest seems to be limited to identifying methods of detecting clickbait. From a marketing perspective, this is a deceptive marketing practice, and we contribute to the literature by identifying and theorising, using the expectation disconfirmation framework, how content seekers respond to clickbait. We used an interpretive, qualitative approach utilizing focus group discussions to collect data from 21 young YouTube viewers and analysing the data using thematic analysis. The findings indicate that when the videos match with content seekers’ expectations based on the title and thumbnail (confirmation) they are satisfied and generally respond with a ‘like’ (👍) and a positive comment. When what is delivered exceeds expectations (positive disconfirmation), especially with an element of surprise, there is delight and it is rewarded with subscribing to the channel (loyalty) and sharing the content through other social media (positive word of mouth). When there is a mismatch between what is promised and delivered, especially if it is due to reasons other than clickbaiting, content seekers are dissatisfied (negative disconfirmation) and respond with a ‘dislike’ (👎) and a negative comment. Clickbaiting results in extreme negative disconfirmation – disgust – caused by the negative surprise of being fooled, and content seekers retaliate by unsubscribing from the channel (disloyalty) and spreading negative word of mouth through other social media. The findings imply that though clickbaiting might increase short-term revenue, it is counterproductive for YouTubers in the long run.

**Keywords:** *YouTube; clickbait; expectation disconfirmation; online deception*

## **The impact of corporate governance on liquidity risk of commercial banks**

P.D.E.U. Jayathissa<sup>1</sup>, E.M.N.N. Ekanayake<sup>1</sup>

<sup>1</sup>*Faculty of Management and Finance, University of Colombo, Sri Lanka*

Commercial banks are crucial to economies primarily because of their role as financial intermediaries. In this, liquidity remains a crucial factor for the maintenance of bank stability. Witnessing the corporate governance issues in a time of an economic peril, this study aims to investigate the impact towards the liquidity risk of banks from the bank corporate governance practices in Sri Lanka. The study sample consists with 11 commercial banks observed for nine years' period from 2012-2020. Board size, board independence, audit committee meetings, and the number of audit committees represent the independent variable: corporate governance, while liquid assets to deposit ratio measure the dependent variable: bank liquidity. Besides, bank size and bank age are considered as control variables for the study. The collected data were analyzed using EViews and through fixed effect regression model. As to the findings, board size, and number of audit committee meetings have significant positive effect on commercial banks' liquidity risk. There is a positive but insignificant impact from board independence. Audit committee size has a negative but insignificant impact on bank liquidity risk. From control variables, only bank size has a significant negative effect on bank liquidity while bank age is not a concerned factor for the liquidity level of banks. The results are in line with several studies and available literature. The findings give useful insights for future policy decisions for better management of liquidity level of banks.

***Keywords:*** *corporate governance, liquidity risk, commercial banks, Sri Lanka*

## **Impact of capital adequacy on the performance of licensed finance companies in Sri Lanka**

H.D.R Himasha<sup>1</sup>, E.M.N.N. Ekanayake<sup>1</sup>

<sup>1</sup>*Faculty of Management and Finance, University of Colombo, Sri Lanka*

Licensed finance companies play a major role in the financial sector in Sri Lanka as a competitor to commercial banks. Given the instabilities witness in many finance companies in recent years, this study attempts to evaluate the impact of capital adequacy on the performance of licensed finance companies in Sri Lanka. Panel data from 2012-2018 of 18 licensed finance companies of Sri Lanka have been considered in the study. Return on assets, return on equity and Tobin's q are employed to measure licensed finance companies' performance. Total assets to total equity, market value to book value and total debt to total equity ratios are used as independent variables to investigate their relationship with dependent variables via multiple regression model. Further firm size, age and management efficiency are used as control variables. It was identified that licensed finance companies in the country hold more debt compared to equity and therefore are highly levered institutions. Findings suggest that there is a significant positive relationship between capital adequacy and Tobin's Q which means that the higher capital level increases the profitability of finance companies. A negative relationship was identified between the total debt to total equity ratio and Tobin's Q which means that profitability will decrease when debt level increases. Further, the debt to total equity ratio has a negative impact on ROA. Based on the findings it is advisable for the monitoring authorities of the financial sector to be more flexible when implementing minimum capital requirement regulatory with regard to licensed finance companies due to its significant relationship with firm performance.

**Key words:** *Capital adequacy, Licensed finance companies, Sri Lanka*



## **The economic cost of learning losses of transgender individuals: A qualitative study in Sri Lanka**

W.M.P.M. Wijayawardhana<sup>1</sup>, J. W. D. Chaminda<sup>2</sup>, D.R.J. Siriwardhane<sup>2</sup>

<sup>1</sup>*Department of Business Economics, University of Colombo*

<sup>2</sup>*Department of Business Economics, University of Sri Jayewardenepura*

Not all disadvantaged groups including transgender people, a marginalized and vulnerable community in Sri Lanka, shared the benefits of education equally for economic opportunities including labor market entry. This paper examines the economic cost of learning losses of transgender individuals. This qualitative study used snowball sampling to select a sample of 25 transgender participants in early adulthood (20–40 years). In-depth interviews and participatory observation methods were used as the dominant data collection methods, followed by data analysis through the Reflexive Thematic Analysis (RTA) approach facilitated by the NVivo software. Features of critical ethnography were adapted to the research under the participatory research paradigm which is appropriate to study marginalized groups like transgender community. Early-age school leaving, Academic career delays due to gender transition process, school culture of aggression, unsheltered homelessness of transgender children, social isolation, educational personality loss, and the problem of access to tertiary education are recognized as the key causes for learning losses observed among transgender community in Sri Lanka. Moreover, this study identified the impacts of learning losses on Sri Lanka's transgender labor supply to recognize the economic cost of learning losses of transgender individuals. According to further findings, as a result of the under-education and pre-negative school experiences, transgender people tended to prioritize psychological freedom over the financial return when supplying labor and intended to choose transgender friendly working environment instead of a work setting complying with qualifications and passion. This less-paid work behavior and skill mismatch has resulted a substantial under-employment among transgender people. In addition, the glass ceiling effect and poor workplace dominance are found as common challenges faced by transgender people in the labor market due to “weaker leadership” grown at school age.

**Keywords:** *Economic Cost, Labor Supply, Learning Losses, Sri Lanka, Transgender Individuals*

# Faculty of Medicine



*Research, Excellence and beyond: translating  
research into practice*

04<sup>th</sup> -7<sup>th</sup> December 2023

## MESSAGE FROM DEAN

**Vidya Jyothi Senior Professor (Chair)**

**Vajira H. W. Dissanayake**



The Annual Research Symposium 2023 of the University of Colombo is where we gather to celebrate the spirit of research, excellence, and the limitless possibilities that lie beyond. This year's symposium that highlights that spirit under the theme of "Research, Excellence, and Beyond," aims to foster a vibrant intellectual environment that encourages collaboration, innovation, and the pursuit of excellence. Research is not merely a means to an end, but a transformative journey that pushes the boundaries of human understanding and propels us towards a brighter future.

Throughout this symposium, there would be a diverse range of research presentations, lectures, panel discussions and orations, providing a platform for scholars, researchers, and students to share their cutting-edge work and engage in thought-provoking discussions. It is our hope that this event will inspire everyone to think critically, challenge prevailing notions, and embark on new avenues of inquiry. We encourage you to take advantage of these opportunities to exchange ideas, forge collaborations, and build lasting relationships with fellow researchers and scholars.

As we gather here today, let us acknowledge and celebrate the incredible dedication and passion that each participant brings to their respective fields. Your commitment to advancing knowledge and driving positive change is what propels our society forward and shapes the world we live in. Together, let us transcend the boundaries of research and strive for excellence that extends far beyond the confines of academia.

## MESSAGE FROM CONGRESS CHAIRPERSON

### Senior Professor Pujitha Wickramasinghe



It gives me great pleasure to send a message to this important annual event, the research symposium 2023, of the Faculty of Medicine, University of Colombo, which gives the opportunity to showcase the research potential of our institute. The conference commonly known as the Colombo Medical Congress, is held under the theme “Research Excellence and Beyond: translating Research into Practice” which is aligned with the University congress theme as we realize that all research should have a functional potential to harness its true outcome.

The annual congress provides a platform for students and the academia to present their research. The full engagement of all departments as well as student groups gives us the opportunity to provide an expanded array of topics, not only confining to medicine, but also areas covering medical education, environmental sustenance, laboratory technology, administration etc. We try to address issues faced by humanity as well as medical and university education in Sri Lanka in these difficult times. The conference spans over five days, giving the opportunity to a wide group of resource persons to share their experience and expertise. Pre-congress workshops will be held on first three days. On first two days induction of new chair professors will take place with mini symposia organized by the departments. On the third day the pre-congress workshop has been dedicated to expatriate alumni from Australia, UK and Bhutan taking the congress to a different level and giving the flavor of hybrid congress.

The conference is packed with parallel symposia on different tracks. A post-congress workshop with a major involvement of non-academic staff would provide the opportunity to share the experience and advance their knowledge and improve their services. Students will have a hackathon on the post-congress day.

The conference will be held in the newly built UCFM tower, which has the state of the art conference facility. Taking forward of where we left from last conference, we will try to contribute to environmental sustenance as much as possible. We will not print the abstract book, but have QR code driven web-based document made available to the participants to read on their palm held devices at real time. Further we will try to restrict single use plastics to the greatest extent. We hope all participants will benefit from the congress as it will be packaged with insightful and inspiring content. The congress will fortify the local and international network of researchers and professionals who are mostly our alumni. With the collaboration and support of all attendees and with the spirit of partnership and working together, we are optimistic in achieving the goal of CMC 2023.

I welcome all of you to CMC 2023 congress.

## ORGANISING COMMITTEE

	<b>Faculty nominee</b>	<b>CoMSAA nominee</b>
<b>Co-chairs</b>	Vidya Jyothi Senior Professor Vajira H. W. Dissanayake	Prof. Sanath Lamabadusooriya
<b>Scientific Committee Co-chair</b>	Prof. Pujitha Wickramasinghe	-
<b>Co-secretaries</b>	Dr. Meran Keshawa Ediriweera	Dr. Dineshani Hettiarachchi
<b>Editors</b>	Prof. Kalum Wettasinghe	Dr. Chiranthi Liyanage
<b>Treasurer</b>	Dr. Vipula Batuduwaarachchi	-
<b>Assistant Treasurer</b>	Dr. Thushan Gunaratne	-
<b>Coordinator of social events</b>	Dr. Nilanka Wickramasinghe	-
<b>Coordinator of IT activities</b>	- Dr. Roshan Hewapathirana	-
<b>Coordinator of Audio visual events</b>	Prof. Dakshitha Wickramasinghe	-

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- Prof. Dilshani Dissanayake (Director, RPFC, Chairperson RC)
- Prof. Prasad Katulanda (Editor, Faculty Journal)
- Prof. Priyanga Ranasinghe (Faculty Representative for ARS- member RPFC)
- Prof. Ranil Jayawardena (Secretary, RHDC, Faculty Representative for ARS- member RPFC)
- Dr. Gayani Ranaweera and Dr. Yamuna Rajapakse (Co-secretaries ERC)
- Mr. Ajitha Bandara (Deputy Registrar)
- Ms. Himani Rajapakse (Senior Assistant Bursar)
- Ms. Malkanthi Fernando (Secretary, RPFC)
- Ms. Iroshini Malkanthi (Management Assistant, Research)
- Ms. Hasini (Coordinator, Business team)

### Student representatives from MFRC

- Ms. Momoko Welikala (AL 2018)
- Ms. Damsara Medhavi (AL2019)

## Programme of Sessions

<b>4<sup>th</sup> December 2023</b>	
09:00 AM-14.30 PM	<p>Pre-congress symposium</p> <ol style="list-style-type: none"> <li>1. Induction of the Chair Professor of Biochemistry and Molecular Biology</li> <li>2. Induction of the Chair Professor of Physiology</li> <li>3. Induction of the Chair Professor of Medical Microbiology and Immunology</li> </ol>
<b>5<sup>th</sup> December 2023</b>	
09:00 AM-16.00 PM	<p>Pre-congress symposium</p> <ol style="list-style-type: none"> <li>1. Induction of the Chair Professor of Community Medicine</li> <li>2. Induction of the Chair Professor of Clinical Medicine</li> <li>3. Induction of the Chair Professor of Obstetrics and Gynaecology</li> <li>4. Induction of the Chair Professor of Pharmacology</li> </ol>
<b>6<sup>th</sup> December 2023</b>	
09:00 AM-14.30 PM	<p>Alumni day and inauguration</p> <ol style="list-style-type: none"> <li>1. Session by Colombo Medical School Alumni Association (CoMSAA) Australia</li> <li>2. Session by Colombo Medical School Alumni Association (CoMSAA) Bhutan</li> <li>3. Session by Colombo Medical School Alumni Association (CoMSAA) UK</li> </ol>
15.00	Inauguration and faculty oration
<b>7<sup>th</sup> December 2023</b>	
9.00-17.00 AM	Main congress, oral and poster presentations and symposia by the departments
17.00	Closing Ceremony and COMSAA oration
19.00	Colombo Medical Congress reception

## INTRODUCTION TO KEYNOTE SPEAKER



### **Mr. Sanjeewa Weerawarna**

Founder and CEO of WSO2

Sanjiva has served as the Founder and CEO of WSO2 since 2005, driven by a visionary goal to revolutionize the development, sales, delivery, and support of enterprise middleware through an open-source model.

Before embarking on his journey with WSO2, Sanjiva dedicated nearly eight years to IBM Research, focusing on groundbreaking innovations in middleware and emerging industry standards. Within IBM, he co-founded the Web services platform, contributing to the co-authorship of numerous Web services specifications such as WSDL, BPEL4WS, WS-Addressing, WS-RF, and WS-Eventing. His outstanding technical leadership led to his election to the IBM Academy of Technology in 2003.

Sanjiva has long been a passionate advocate for open-source development. He's an elected member of the Apache Software Foundation and the original creator of Apache SOAP. His contributions extend to projects like Apache Axis, Apache Axis2, and various Apache Web services initiatives.

In 2003, Sanjiva founded the Lanka Software Foundation, a non-profit organization aimed at fostering open-source development by Sri Lankan developers. He currently holds the position of Chief Scientist and Director. Notable achievements of the Lanka Software Foundation include active involvement in several Apache Web services projects and the creation of Sahana, a prominent disaster management system worldwide. In recognition of his role in encouraging open-source participation in developing countries, Sanjiva was elected to the board of the Open Source Initiative (OSI) in April 2005, where he served for two years.

Sanjiva also dedicates part of his time to teaching and mentoring student projects within the Computer Science and Engineering department of the University of Moratuwa. Furthermore, he is a member of the university's Faculty of Engineering Industry Consultative Board. Prior to his tenure at IBM, Sanjiva spent three years as visiting faculty at Purdue University, where he successfully earned his Ph.D. in Computer Science in 1994.

## MESSAGE FROM KEYNOTE SPEAKER

It is an honor and a pleasure for me to be part of this year's medical research congress. We live in a world where all kinds of technology is dramatically and rapidly changing the world. Accelerated development in artificial intelligence, quantum computing, gene medications, nanotechnology and space travel (amongst others) is leading to potentially dramatic cutovers such as the singularity (AI becoming more intelligent than us) and quantum supremacy (quantum computing solving previously unsolvable computing problems) will mean the world of the next generation will be nothing like ours.

At the same time the world is "moving east" both politically and values-wise with greater leadership by eastern nations and with eastern values becoming more accepted and recognized in an increasingly wealthy, yet unsatisfied and lonely world.

Medical research is critical to making the world a better place for the current and future generations. There isn't a better time to be a medical researcher in a culturally rich, historical country. It is time to look beyond narrow lenses that our colonial rulers put on us and at the broader opportunities that we have in front of us.

I look forward to the congress!

Sanjiva Weerawarana, Ph.D.

Founder & CEO, WSO2 Founder & Chairman, Lanka Software Foundation,

Lanka Data Foundation and Avinya Foundation

Board Member, Sampath Bank

Fellow, National Academy of Sciences of Sri Lanka



## LIST OF ABSTRACTS OF ORAL PRESENTATIONS

### THEME : NONCOMMUNICABLE DISEASES NCDS

- OP1 External breast prosthesis use, its influencing factors, and the association with quality of life among postmastectomy patients in Sri Lanka**  
*C. Perera, D. Perera , U. Pitigala, C. Arambepola*
- OP2 The ability of Waist -Triglyceride Index to Identify Metabolic Syndrome among Adults from Jaffna**  
*T. Paramanathan, T. Kumanan, V. Arasaratnam*
- OP3 Factors associated with Gastroesophageal Reflux Disease by comparison of diagnosed patients and healthy controls**  
*N. Wickramasinghe, N. Devanarayana, D. Wickramasinghe, A. Thuraisingham, A. Jayalath , N. Samarasekara, E. Yazaki.*
- OP4 The association between gastroesophageal reflux disease and stress: A countrywide study of Sri Lanka**  
*Wickramasinghe N, Devanarayana N, Wickramasinghe D, Thuraisingham A, Jayalath A, Samarasekara N, Yazaki E*
- OP5 Prevalence of maternal obesity at booking visit and associated maternal and neonatal complications among mothers with children aged up to one year attending Child Welfare Clinics in Pitakotte MOH area**  
*Jayawardhana T, Jayawardana S, Jayasekara D, Samaranayake D*
- OP6 Effect of oral nutritional supplement (ONS) on frailty and barthel index in institutionalised older adults with malnutrition: a randomized controlled trial**  
*Wickramawardhane P, Dalpatadu C, Hills A P, Ranasinghe P, Jayawardena R*
- OP7 Comparison of Level of Physical Activity and Quality of Life among Middle-aged and Elderly People with Type 2 Diabetes Mellitus**  
*Noordeen F, Wettasinghe A*

### THEME : PHYSIOTHERAPY AND OCCUPATIONAL HEALTH

- OP8 The associations of knowledge and practice of computer work-related posture and ergonomics with musculoskeletal pain among engineering undergraduates of University of Moratuwa**  
*Pathirana J R V, Perera R S*
- OP9 Prevalence of ergonomic factors related to sitting postures in home and office work setups among bank officers in selected banks in Colombo district**  
*Widyapathige TO, Pathmanathan C, Chadratilaka KRM*

**OP10** **Body mass index and its relationship with static and dynamic balance in the older adults residing in elders' homes in Ambalangoda, Galle district.**

*Gimhan SMYM, Dalpatadu C*

**OP11** **Relationship between musculoskeletal pain and health related quality of life among nurses in a selected government teaching hospital**

*Purage NSL, Atapattu PM*

**OP12** **Biomechanics of foot, ankle and knee between patients with mechanical low back pain and age-matched volunteers without low back pain attending District General Hospital Matale**

*Karunathilake D, Ranasinghe C, Thilakarathne A*

#### **THEME: NEUROLOGY**

**OP13** **Factors leading to febrile convulsions in children presenting with fever: A case control study from a children's hospital, Colombo, Sri Lanka**

*Somasekara S, Sivapalan K, Siyambalapitiya N, Walpita Y*

**OP14** **Knowledge regarding hearing aid use and factors associated with it among elders diagnosed with age-related sensorineural hearing loss attending Ear, Nose, Throat (ENT) clinics at National Hospital Sri Lanka (NHSL)**

*Muhunthan K, Milinda S, Siriwardene Y*

**OP15** **Relationship between Physical activity level, Depression and Sleep quality of patients with Parkinson disease**

*Kawmadi PPD, Dahanayake DMA*

**OP16** **Knowledge Regarding Stroke and Caregiving Among Caregivers of Stroke Patients**

*Lakshitha KHYS, Anthony DJ*

**OP17** **The Impact of the Foveal Avascular Zone on Visual Acuity Outcomes in Anisometropic Amblyopia Management with Binocular Vision Therapy**

*Chandrasekera A, Pathirana H, Wijerathne G, Goyal A*

**OP18** **Association of Cognitive Functions and Peripheral Neuronal Functions in Type 2 Diabetes Mellitus**

*Wettasinghe A, Gunaratne H, Anantharajah H, Dissanayake D*

**OP19** **Effects of a meditation based protocol on seizure frequency on patients with drug resistant epilepsy: A randomized controlled trial**

*Vithanage K, Dissanayake D, Chang T*

## **THEME : GENETICS & HAEMATOLOGY**

- OP20 Knowledge and Attitudes on Thalassemia and Practice of Pre-Marital Thalassemia Screening among Newly-Married Couples in Kurunegala Medical Officer of Health area**  
*Gallage N, Galhena T, Gamage D, Senerath U*
- OP21 Quality of life and factors associated with it among paediatric haemophilia patients attending a tertiary care children's hospital in Sri Lanka.**  
*Siriwardena H, Siriwardena R, Siriwardene D, Walpita Y*
- OP22 Diversity of pharmacogenomic variants affecting the efficacy, metabolism and toxicity of anti-cancer drugs in a South Asian population from Sri Lanka**  
*Vishnukanthan T, Ariadurai J N, Thilakaratne S, Ranasinghe P, Sirisena N, Dissanayake V H W*
- OP23 A study on genetic variants associated with Retinoblastoma in a cohort of Sri Lankan populations**  
*Athige RSG, Wettasinghe K, Dissanayake M*
- OP24 Correlation of the methylation status and expression of the genes related to inflammation in healthy long-term meditators**  
*Dasanayaka N, Sirisena N, Samaranayake N*

## **THEME: PUBLIC HEALTH**

- OP25 The quality of life and associated factors of Leprosy patients attending the Leprosy clinic and dermatology clinics at the National Hospital of Sri Lanka**  
*Arudchelvam U, Pulendran T, Sirimanne M, Pabasara S, Kahavita I, Chandraratne N*
- OP26 The stigma and associated factors of Leprosy patients attending the Leprosy clinic and dermatology clinics at the National Hospital of Sri Lanka**  
*Arudchelvam U, Pulendran T, Sirimanne M, Pabasara S, Kahavita I, Chandraratne N*
- OP27 Implications of the economic crisis in Sri Lanka on the management of patients with kidney failure undergoing haemodialysis**  
*Dias MI, Sudusinghe I, Karunarathne HT, Wijewickrama E*
- OP28 The assessment of asymptomatic cutaneous leishmaniasis in Sri Lanka using serological methods**  
*Karunathilake C, Alles N, Piyasiri S B, Weerasinghe L, Chandrasiri N, Devasurendra R, Karunaweera N*
- OP29 Prevalence of Musculoskeletal and Respiratory complications in post-COVID- 19 patients in selected MOH areas in Galle district, Sri Lanka**  
*Udara S, Jayalath L*

**OP30 Community of Practice around digitally reported Morbidity and Mortality statistics: Sri Lankan case study on eIMMR**

*Sahabandu MPW, Hewapathirana RH*

**THEME: MENTAL HEALTH AND SPORTS MEDICINE**

**OP31 Factors affecting Home Based Intervention for children with Autism Spectrum Disorder attending tertiary care centers of Western Province**

*Pathirage A, Parindya M, Pahanage R, Ranawaka R, Dahanayake D*

**OP32 Prevalence and Patterns of Sports injuries among senior School Cricketers after prolonged training restrictions of COVID 19 pandemic in Jaffna district Sri Lanka**

*Thanapalasingam S, Chandrathilake K R M, Gobchanger T, Srigrishna P*

**OP33 Academic Procrastination, Problematic Internet Usage and Factors Associated with Academic Procrastination among 3rd Year Engineering Undergraduates of a Selected University in Sri Lanka**

*Samaranayake M, Samarakoon S, Sandalika D, Jayawardena D*

**OP34 Perceptions of the importance of sports nutrition knowledge: a qualitative study among athletic stakeholders in Sri Lanka**

*Weerasinghe K, Jayawardena R, Madhujith T, Hills A P, Kalupahana N*

**OP35 Development of a sports nutrition knowledge questionnaire for Sri Lankan athletes**

*Weerasinghe K, Jayawardena R, Trakman G, Madhujith T, Hills A P, Kalupahana N*

**OP36 Association of meditation with mindfulness skills in terms of observing and non-reactivity to inner experiences: A correlational analysis from Sri Lanka**

*Outschoorn N O, Jeevani HM, Herath C, Amarasuriya SD*

# Faculty of Nursing



## *Healthcare in the Era of Globalization and Digitalization*

12<sup>th</sup> October 2023

## MESSAGE FROM DEAN

**Prof. S.S.P. Warnakulasuriya**

Dean

Faculty of Nursing

University of Colombo, Sri Lanka



It is a great pleasure to write this message on the occasion of the 2<sup>nd</sup> International Nursing Conference (INC), 2023 of the Faculty of Nursing, University of Colombo Sri Lanka under the theme of “Healthcare in the Era of Globalization and Digitalization”. Conducting the Annual Research Symposium is a regular event of the Faculty, and it has been a great success during the past five years. The 2<sup>nd</sup> International Nursing Conference has a special significance this year as the theme of the symposium is very relevant to the current healthcare landscape as healthcare is being digitalized globally with new inventions and innovations. In addition to that, the first student group of the Faculty of Nursing who passed out recently will also present their research projects at this symposium. I strongly believe that the 2<sup>nd</sup> International Nursing Conference would be a very successful event as this time we have organized two technical sessions and the number of abstracts has been increased and therefore more scientific dialogues are expected to occur. I would like to express my sincere gratitude to the organizing committee of the 2<sup>nd</sup> International Nursing Conference and their all efforts to make this event a reality. I also wish to convey my sincere gratitude to the heads of the departments, academic staff, assistant registrar and non-academic staff of the Faculty of Nursing for extending their fullest support and cooperation to show up the 2<sup>nd</sup> International Nursing Conference. I also congratulate all the presenters who are presenting their research at this symposium. Special thanks to the Keynote Speaker, Associate Professor Janet H. Davis, College of Nursing, Purdue University Northwest, USA, and all the plenary speakers of the 2<sup>nd</sup> International Nursing Conference. I would like to place a special thanks to Senior Professor H.D. Karunaratne, Vice Chancellor, University of Colombo for his moral support, visionary leadership, correct guidance and inspiration for the development and smooth running of the Faculty of Nursing. I wish all the participants to enjoy the glamor of the 2<sup>nd</sup> International Nursing Conference organized by the Faculty of Nursing and hope it will be a great success!

## MESSAGE FROM SYMPOSIUM CHAIR

### **Dr. Thanuja Asurakkody**

Senior Lecturer

Department of Fundamentals of Nursing

Faculty of Nursing

University of Colombo



On behalf of the Organizing Committee of the 2<sup>nd</sup> International Nursing Conference 2023 (INC 2023), I would like to express my warm welcome to all of you. I am very happy to note that we have organized the 2<sup>nd</sup> International Nursing Conference in 2023 under the theme “Healthcare in the Era of Globalization and Digitalization”. I believe that this 2<sup>nd</sup> international conference on Nursing will give opportunities for the researchers, research students, and experts in disciplines related to healthcare to share and exchange their original research ideas and expertise opinions about education, practice, management in nursing, evidence-based practice, global health, and informatics used in healthcare communities. INC 2023 focuses on the development of education, clinical practice, informatics used in nursing care, management and leadership in nursing. Along with the 3 guest speeches, the proceedings contain 24 abstracts. I express my sincere gratitude to the Vice Chancellor, Senior Professor H.D. Karunaratne, University of Colombo for encouraging the 2<sup>nd</sup> International Nursing Conference. I extend my heartiest thanks to Prof. Sudath Warnakulasuriya, Dean of the Faculty of Nursing, University of Colombo for grant us to organize the 2<sup>nd</sup> International Nursing Conference 2023. I thank all the reviewers and editors for their invaluable service in finalizing the proceedings.

I express my sincere appreciation to the keynote speaker Prof. Janet Devis from College of Nursing Purdue University Northwest, USA for being with us at the conference. I acknowledge Dr. Sharon Armour and Dr. Sarath Rathnayaka for conducting guest speeches on their expertise. I extend my most sincere thanks and congratulate to all the authors who have submitted their excellent works to our conference to share their opinions with the international research community. In particular, I would like to be grateful to all the main organizing committee members, all the staff, and the students of the Faculty of Nursing for their valuable contribution to the INC 2023. I wish good luck to all the presenters!

## MESSAGE FROM SYMPOSIUM SECRETARY

**Mrs. H.M.C.M. Herath**

Lecturer

Department of Clinical Nursing

Faculty of Nursing

University of Colombo, Sri Lanka



It is with great pleasure and enthusiasm that I compose this message for the 2<sup>nd</sup> International Nursing Conference (INC 2023) organized by the Faculty of Nursing, University of Colombo, Sri Lanka under the theme “Healthcare in the Era of Globalization and Digitalization”, and I extend my warmest greetings to all of you.

As we embark on this exciting journey of knowledge sharing and exploration, it is important to emphasize the significance of our theme. Healthcare is undergoing a profound transformation, influenced by globalization and accelerated by digitalization. This symposium provides a unique platform for us to collectively understand, analyze, and address the challenges and opportunities presented by this evolving healthcare landscape. The INC 2023, hosted by the Faculty of Nursing, promises to be an intellectually stimulating and enlightening event, bringing together local and international experts, researchers, and scholars to delve into the complex and ever-evolving landscape of healthcare in the era of globalization and digitalization. Throughout the symposium, you will have the privilege of hearing from pre-conference workshops, the distinguished keynote speaker, invited speeches, and witnessing the presentation of cutting-edge research. I would like to take this opportunity to express my gratitude to all those who have contributed to the preparation and planning of this symposium. Your dedication and hard work have been instrumental in making this event possible. Especially, I convey my gratitude to our keynote speaker, Prof. Janet S. Devis from the College of Nursing, Purdue University Northwest, USA, and all the other invited speakers for spending their valuable time to contribute to INC 2023. Further, my compliments go to our sponsors, and our organizing committee who worked tirelessly to ensure that this event is not only informative but also interesting. We are confident that this symposium will not only be professionally enriching but also a memorable experience. Let us come together to create a future of healthcare that is both globally connected and digitally empowered.



## **ORGANIZING COMMITTEE**

### **Conference Chair**

Dr. Thanuja Asurakkody

### **Conference Secretary**

Ms. Chandrani Herath

### **Conference Co-Secretaries**

Ms. Nushka Ubhayawardana

Ms. Shereen Senarathne

Dr. Thilina Gunathilaka

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Dr. Thanuja Asurakkody

Dr. Thilina Gunathilaka

Dr. Nirosha Edirisinghe

Ms. Nilushi Nisansala

Ms. Ishara Senanayake

# Programme of Sessions

12<sup>th</sup> October 2023

<b>Agenda</b>	
8.30 am- 8.45 am	Inauguration of the 2 <sup>nd</sup> International Nursing Conference 2023 Arrival of the Guests
8.45 am- 8.55 am	Welcome Address Dr. Thanuja Asurakkody – Chairperson, INC 2023
8.55 am- 9.05 am	Address by the Dean – Faculty of Nursing Prof. S. S. P. Warnakulasuriya
9.05 am- 9.10 am	Introduction to the Chief Guest by the Dean – Faculty of Nursing
9.10 am- 9.25 am	Address by the Chief Guest Senior Professor H. D. Karunaratne, Vice-Chancellor, University of Colombo
9.25 am - 9.30 am	Introduction to the Keynote Speaker
9.30 am- 10.05 am	Keynote Speech Professor Janet H. Davis, College of Nursing, Purdue University Northwest, USA
10.05 am- 10.15 am	Vote of Thanks Ms. Chandrani Herath, Secretary, INC 2023
10.15am-10.50 am	Refreshment
10.50am-11.25 am	Guest Speech- 01 Dr. Sharon Armour, School of Nursing and Midwifery, Edith Cowan University, Australia

11.25 am- 12.00 pm	<p>Guest Speech- 02</p> <p>Dr. Sarath Rathnayaka, Senior Lecturer, Department. of Nursing, Faculty of Allied Health Sciences, University of Peradeniya</p>
12.00 am- 12.45 pm	Lunch
12.45 pm onwards	Technical Sessions
3.00 pm - 3.30 pm	Awarding of Certificates for the presenters and closing remarks

## INTRODUCTION TO KEYNOTE SPEAKER

### **Janet H. Davis (PhD, RN, CNA, MBA)**

Associate Professor

College of Nursing

Purdue University Northwest, USA



Janet H. Davis received her BSN from Georgetown University, her MSN from Boston University, her MBA from the University of Illinois at Chicago, and her PhD from Loyola University, Chicago. She has held faculty, dean and director roles at nursing programs throughout the Chicagoland area. She has over 50 publications and has been awarded over 20 grants. Currently, she is an Associate Professor at Purdue University Northwest. While there, she led the first College of Nursing education abroad trip to Nicaragua in 2015. She has given invited papers across the United States, Australia, Brazil, Canada, the Czech Republic, India, Japan, Netherlands, Scotland, and Thailand. She has been a Certified Nurse Educator through the National League for Nursing since 2018. In 1991, she received the Award for Excellence in Teaching and has received the A. J. Del Vecchio Endowment Fund/ Duneland Health Council Faculty Scholarship Fund for Nursing, which is a Founders' Award for Nursing Excellence. The Purdue University Center for Intercultural Learning, Mentorship, Assessment and Research recognized her work in developing transformational leadership in students with support for creating a Portable Intercultural Module for use across the university system. She is an Advance Quality Consultant Evaluator to evaluate the Higher Learning Commission Program and a Nursing program evaluator in the National Accreditation Commission for Education. In 2020, she was appointed to the Expert Panel on Diversity, Equity and Inclusion advisory group of the American Nurses Association Illinois. In 2021, she was awarded Susan Bulkeley Butler Center for Leadership Excellence at Purdue University for her project, “An Exploratory Study of Nursing Faculty Transformational Leadership”, she is the first nursing faculty member to receive this competitive grant award. Dr. Davis is committed to preparing nurses as leaders.

## **ABSTRACT OF THE KEYNOTE ADDRESS**

**Janet H. Davis (PhD, RN, CNA, MBA)**

### **Nursing Leadership in The Digital Age**

Globally, investment in artificially intelligent health technology (AIHT) is predicted to exceed \$36 billion by 2025. This trend is due in part to the growing demand from the public for a modernized health system. Artificial Intelligence uses sophisticated algorithms to uncover clinically relevant information from a large volume of healthcare data. It is capable of learning and is equipped with self-correcting abilities to improve accuracy based on feedback. Artificial Intelligence systems may reduce errors in clinical practice. AIHT examples include virtual avatar apps, smart homes, predictive analytics, virtual or augmented reality, and robots. Artificial Intelligence humanoid robots are positioned to play a role in improving efficiency in healthcare by taking over tasks that are repetitive, monotonous, and require attention to detail. Some of these tasks are currently being performed by nurses but with Artificial Intelligence, these tasks might be delegated to machines. Virtual nursing assistants are among the top humanoid robots thought to have practice potential. Robots could perform some aspects of care such as transferring a patient between a bed and a wheelchair. Emerging AIHT constitutes a major paradigm shift for healthcare with broad implications for nurses. Transformational nursing leadership is required for the decision-making about AIHT that improves health or poses health risks from the individual to the systems level. Transformational leaders inspire followers to achieve extraordinary outcomes and, in the process, develop their own leadership capacity. Transformational leader competencies are Builds Trust, Acts with Integrity, Encourages Others, Encourages Innovative Thinking, and Coaches & amp; Develops People. Evidence supports the use of transformational leadership as an effective framework for advancing nursing leadership behaviors. The International Council of Nurses aims for strategic leadership to advance the nursing profession to meet the current and future needs of populations, health systems, and nurses. Strong and proactive nursing leadership in all roles and sectors is required to influence decisions about aspects of nursing care that can be safely performed by AIHT. Using transformational leadership, the 28 million nurses around the world can influence how AIHT changes nursing practice in the digital age of healthcare. The future is already here and the time to act is now.

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## **The level of Anxiety and associated factors during the COVID-19 pandemic among science undergraduates in selected state universities in Sri Lanka**

Rishana H.D.M<sup>1</sup>, Madushika G.V.G<sup>1</sup>, Dissanayaka D.M.T.D<sup>1</sup>, Prasadini S.W.I<sup>1</sup>, Wijerathna N.A.M.P<sup>1</sup>, Sankavi N<sup>1</sup>, Karunarathna K.M.D.D<sup>1</sup>, Subhasingha S.P.K.T<sup>1</sup>, Nadeeshani K.M.D<sup>2</sup>,  
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**Background:** Various societal aspects including mental health were significantly disrupted by the COVID-19 pandemic and its consequences, globally. Undergraduates were major victims of COVID-19-related mental stressors such as anxiety.

**Objective:** This study aimed to assess the level of anxiety and associated factors among science undergraduates in Sri Lankan state universities during the COVID-19 pandemic.

**Methodology:** A descriptive cross-sectional study was conducted among 370 undergraduates at Faculties of Science in various universities; namely, the University of Colombo (UOC), Sri Jayewardenepura, Jaffna, Kelaniya, and Ruhuna. A purposive sample of 40 undergraduates at the Faculty of Nursing, UOC was pre-tested for the self-administered questionnaire. Participants' anxiety levels were measured using the 21 Depression Anxiety Stress Scale (DASS) 21. SPSS version 26.0 software was used to analyze the data.

**Results:** The mean age of the population was 24.43 ( $\pm 1.5$ ) years. Mild, moderate, severe, and extremely severe anxiety were identified as 3.5%, 14.9%, 8.9% and 41.1% respectively. A high percentage of males (51.18%) and females (49.38%) had severe to extremely severe anxiety. The prevalence of severe to extremely severe anxiety among science undergraduates was 50%. Majority of those who had extremely severe anxiety were Sinhalese (83.6%). High level of anxiety was significantly associated with living in university hostels, living with friends ( $p < 0.05$ ), studying in the fourth year ( $p < 0.05$ ), having no social relations ( $p < 0.05$ ), in a romantic relationship ( $p < 0.05$ ), having long term illnesses ( $p = 0.005$ ), inadequate family income ( $p < 0.05$ ), no scholarships ( $p < 0.05$ ), unemployed ( $p = 0.019$ ) and inadequate sleep ( $p < 0.05$ ).

**Conclusion:** A substantial proportion of undergraduates suffered from extremely severe levels of anxiety. Various psychosocial factors including living conditions, relationships, academic level, chronic comorbidities, financial status, and sleep quality were significantly related to anxiety. Steps should be taken to modify these associated factors among science undergraduates while educating them to identify effective coping strategies to overcome anxiety.

**Keywords:** Anxiety, COVID-19, Associated factors, Undergraduates



## **Knowledge and attitudes regarding Basic life support among the final year undergraduates in selected faculties of the University of Colombo (UOC)**

Nishara M. G. S.<sup>1</sup>, Hettiarachchi K. U. W.<sup>1</sup>, Weerasinghe W. M. M. U. S.<sup>1</sup>, Lakmali J. K. S.<sup>1</sup>, Sivanathan P.<sup>1</sup>, Samarakkodi L. P. T. G.<sup>1</sup>, Hulangamuva P. W. R. M. D. M.<sup>1</sup>, Balasooriya M. B.<sup>1</sup>, Prathapage A. M.<sup>1</sup>, Nettasinghe N. A. R.<sup>2#</sup>, and De Silva H.R.T.<sup>3</sup>

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**Background:** Globally sudden cardiac arrest is an outstanding public health concern for morbidity. For the client's survival in an out-of-hospital setting, early intervention of Basic Life Support (BLS) with Cardiopulmonary Resuscitation (CPR) is crucial. Universities are ideal settings for disseminating knowledge of BLS due to diverse student enrollment. As key stakeholders, they are well-positioned to advocate and disseminate BLS practices entirety of the nation.

**Objective:** To assess knowledge and attitudes regarding BLS among final-year undergraduates in the selected faculties of the University of Colombo.

**Method:** A cross-sectional descriptive study was conducted among final-year undergraduates of UOC, using an online questionnaire to gather data regarding; demographics, knowledge, and attitudes toward BLS. The chi-square test, independent samples T-test, and one-way ANOVA test were used to determine significant differences and associations of the variables statistically using SPSS 27.0 software.

**Results:** From the total sample size of 380, 46.1% were accountable for poor knowledge, and 39.7%, and 14.2%, for adequate and good knowledge respectively. A statistically significant difference was observed between the participant's age ( $p < 0.05$ ) category and the faculty ( $p < 0.05$ ) with the level of knowledge. Final year undergraduates of medicine (79.21 ( $\pm 14.46$ )); nursing (73.53 ( $\pm 22.59$ )) faculties have higher mean knowledge of BLS compared to other faculties. Attitude levels were categorized as positive ( $> 75\%$ ) and negative ( $< 75\%$ ) according to their total scores for attitudes. The majority of the participants depicted a positive attitude (86%) toward BLS.

**Conclusion:** Medical and nursing undergraduates have significantly better knowledge compared to the final-year undergraduates of other faculties as they have BLS in their basic degree program curriculums. Despite their low knowledge levels, the majority of final-year undergraduates have a positive attitude toward BLS. It is vital to include the BLS training program in advanced level /university curriculum regardless of the educational stream.

**Keywords:** BLS, knowledge, attitudes, Final-year-undergraduates

## **Perception, motivational factors and barriers for Continuous Professional Education (CPE) among nurses in two teaching hospitals in Colombo, Sri Lanka**

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**Introduction:** Continuous Professional Education (CPE) is considered as the systematic maintenance, improvement and broadening of knowledge and skills, and the development of personal qualities necessary for the execution of professional, technical duties throughout the individual's working life.

**Objective:** To examine the nurses' perception, motivational factors and the barriers to Continuous Professional Education (CPE) among nurses in two teaching hospitals in Colombo, Sri Lanka.

**Method:** A descriptive cross-sectional study was conducted by randomly recruiting 507 registered nurses with more than one year of experience from the nurses' registry at Colombo South Teaching Hospital and Sri Jayewardenepura General Hospital. A self-developed and pretested self-administered questionnaire was used to collect data after receiving Ethical approval and analyzed by SPSS version 23.0 software.

**Result:** The majority were Female (91.3%). Among them, 99.5% perceived CPE as a valuable and worthwhile strategy for maintaining clinical competence and efficient care. Good public image (99.5%), Developing leadership capabilities (95.8%), Peer encouragement (93.9%), Obtaining skills and allowance (90.9%), Opportunity for promotion (91.7%), Role model who demonstrates the value of career development (95.5%) were identified as the motivational factors for CPE. Lack of supportive work environment (90.3%), Lack of opportunities for promotion (88.9%), Lack of information about the educational programmes (83.2%), Lack of funding (91.5%), Lack of motivation to study again (87.8%), Inability to cope well with academic studies (77.1%), Negativity due to unpleasant past experiences in academia (73%), Lack of funding (91.5%) and Lack of time because of job responsibilities (92.1%) were the identified barriers for CPE.

**Conclusion:** This study highlighted nurses' strong recognition of CPE's importance for clinical proficiency. Motivations included a positive image, leadership growth, peer encouragement, and career advancement. Barriers encompassed work environment issues, limited promotion avenues, and personal obstacles. Socio-demographic factors significantly influenced motivations and barriers, emphasizing the need for targeted strategies to enhance nurses' CPE engagement, ultimately elevating patient care quality.

**Keywords:** *continuing professional education, registered nurses' perceptions, motivational factors, barriers, and associated factors*

**Knowledge, attitude, practices, and associated factors on self-medication among final year non-health related undergraduates in the University of Colombo, Sri Lanka**

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**Background:** Self-medication practice (SMP) is a global crisis that requires global awareness all over the world. Besides, the practice of self-medication (SM) among university undergraduates is notably high. The attitude towards SM among undergraduates can vary significantly based on cultural, social, and individual factors.

**Objective:** To assess the knowledge, attitudes, practices, and associated factors on self-medication among Final Year Non-Health related Undergraduates in the University of Colombo, Sri Lanka.

**Methods:** A descriptive cross-sectional study was carried out among randomly selected 349 final-year non-health-related undergraduates from UOC, Sri Lanka. Data on socio-demographics, knowledge, attitudes, practices, and associated factors relevant to SM was gathered using a validated and pre-tested self-administered questionnaire. After obtaining ethical approval from the Faculty of Medicine, University of Colombo, data was collected and analyzed by Descriptive and inferential statistics.

**Results:** Around 63% of the study sample denoted an SM behavior. Among them, the majority were Science faculty undergraduates (n=56, 25.45%). Antipyretics (86.8%) and drugs for cough and the common cold (65.6%) were the most commonly reported types of medications consumed, which were obtained from pharmacies most frequently. Headaches and migraines (86.8%) were the major ailments for practicing SM among them. The urgency of problems (72.5%) and previous experience (65.3%) were the most common reasons for SM. Most of the undergraduates had good (49%) and moderate (35%) levels of knowledge with positive attitudes. There is a significant association between gender (p=0.002), selected faculties (p<0.001), and family member enrollment in the health care setting (p=0.005) with the mean knowledge of the study participants.

**Conclusion:** The knowledge and attitudes are moderately satisfactory but the practices on SM are unsatisfactory. University-based interventions such as awareness programs must be implemented to remedy this situation.

**Keywords:** *Self Medication, Knowledge, Attitudes, Practices, Final year undergraduates*

**Energy drinks consumption-prevalence, associations, awareness on health risks and its potential relationship with subsequent substance use among residential students in University of Colombo**

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**Introduction:** The global Energy Drink (ED) market is continuously expanding, and the ED market is more often oriented toward youth and young adults. This has raised concerns among healthcare professionals that young adults who consume ED may harm their health. Currently, there is a correlated trend for subsequent substance use with this ED consumption, but it has not been well studied.

**Objective:** To assess the prevalence of ED consumption, associations, awareness of health-related risks, and its potential association with the use of substances among residential undergraduates at the University of Colombo.

**Methods:** This study was a descriptive cross-sectional and 361 undergraduates who reside in university hostels were enrolled. An online self-developed, pre-validated questionnaire was distributed to gather information on socio-demographic data, frequency of ED consumption, reasons, and associations behind the consumption, awareness of the negative effects, correlation between ED consumption and subsequent substance use. Data were analyzed to obtain percentages, frequencies and relationships.

**Results:** 38.8% of participants were males while majority (52.9%) were aged between 23 -25 years. The prevalence of ED consumption was 31% and most were infrequent consumers (47.3%) and the primary reason for consumption was to enjoy the taste. 89.8% of the participants had poor awareness regarding health-related effects. Level of awareness, age, gender, monthly income of the family, academic year, part-time jobs, and sexual activity status ( $p < 0.05$ ) were positively associated with ED consumption. ED consumption was statically significant ( $p < 0.05$ ) with Alcohol, Cigarettes, Cannabis, Marijuana, and Tobacco use.

**Conclusions:** This study showed a comparatively high incidence of ED intake among undergraduate hostellers of the university. The majority of the hostellers had poor awareness regarding health-related risks linked with ED consumption. The findings of this study demonstrate that consuming ED is a potential risk factor for substance abuse and highlight the necessity of educating young adults about the harmful effects of ED consumption.

**Keywords:** *Energy drinks, Undergraduate hostellers, Association, Substance use*

## **Sexual health knowledge, attitudes and practices of third-year undergraduates in non-health related faculties at the University of Colombo**

Lewliyadda L. M. U. L.<sup>1</sup>, Nandupa D. B. T.<sup>1</sup>, Kumarasiri W. P. M.<sup>1</sup>, Anantharajah K.<sup>1</sup>, Silva E. D. A.<sup>1</sup>, Vithanage A. M.<sup>1</sup>, Rupasinghe D. A.<sup>1</sup>, Nelummali T. D. K. O.<sup>1</sup>, Garumanna G.D.T.<sup>1</sup>, Warnakulasuriya S. S. P.<sup>1#</sup>, Senarathne H. S.<sup>2</sup>

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**Introduction:** Sexuality is a crucial component of healthy development for young people and an intrinsic part of human life in general. Sexual behaviours in youths are intimately related to both physical and mental health and they are more vulnerable to engaging in sexual activities. The majority of university students are at high risk for many health issues related to their sexual behaviour such as sexually transmitted infections, unwanted pregnancies, and illegal abortion which ultimately results in poor academic performance and psychological issues.

**Objective:** To determine the sexual health knowledge, attitude, practices, and associated factors among third-year undergraduates in non-health-related faculties at the University of Colombo (UOC).

**Methods:** An institution-based descriptive cross-sectional study was conducted using 366 3<sup>rd</sup> year undergraduates from six non-health-related faculties at UOC. A stratified random sampling technique was applied probability proportionate to size according to sex disaggregation. Data was collected using a self-administered online questionnaire. This study was carried out in the month of January 2023.

**Results:** Totally 366 students (86.7%) completed the survey. The majority of participants (n=259, 70.8%) exhibited a satisfactory knowledge on sexual health. Unfavorable attitudes toward sexual health were exhibited by the major proportion of the participants (n=189, 51.6%). Many participants were not willing to talk about their premarital sexual practices (64.5%).

**Conclusions:** The results showed that most of the students possess satisfactory knowledge about sexual health. However, unfavourable attitudes are still prevalent among the participants. Thus, it is imperative to enhance knowledge on sexual health, and promote favourable attitudes, by implementing sexual health interventions and programs.

**Keywords:** *Sexual knowledge, sexual attitudes, sexual practices, undergraduate student.*

## **Predictors for perceived competence of breast self-examination among undergraduate female students**

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**Introduction:** Breast cancer is the most common cancer among women in Sri Lanka, and Breast Self-Examination (BSE) has the potential to detect 90% of breast cancers. Despite the benefits of BSE, limited numbers of women engage in it, and many do not know how to perform it. According to the previous literature and Statistical findings related to breast cancer show that BSE is not popular among women in Sri Lanka.

**Objective:** To explore the predictors on perceived competence for BSE among female undergraduates.

**Methods:** The study was descriptive cross-sectional research conducted on 427 female undergraduate students from the Faculty of Nursing, Medicine, and Science at the University of Colombo. Data was collected through an online questionnaire and analyzed using SPSS software.

**Results:** Approximately two-thirds of participants (67.2%) were between the ages of 20 and 25 years. The majority of the study's participants were single (90.4%). Ethnically, 87.1% were Sinhalese, and the majority were Buddhist (77.3%). The study found a weak positive significant linear correlation between motivation for BSE ( $p < .05$ ) and perceived competence and a moderate positive significant linear correlation between perceived competence and knowledge of BSE ( $p < .05$ ). Additionally, Faculty, Academic year and participants' religion were significantly associated with perceived competence in BSE ( $p < 0.05$ ).

**Conclusion:** Motivation of BSE, Knowledge of BSE, Faculty, Academic year, and religion of the participants were the predictors for the perceived competence. The conclusion highlights the need for promoting BSE to reduce breast cancer mortality and further research to address the factors affecting BSE among female undergraduate students in Sri Lanka.

**Keywords:** *Knowledge, Motivation, Breast self-examination, Perceived Competence*

## **Knowledge, Practice, and Attitudes of Self-medication of Antibiotics among Medical and Nursing Undergraduates of University of Colombo, Sri Lanka**

Chathurika J. N<sup>2</sup>, Darshika P. G. K<sup>2</sup>, Kajipan B<sup>2</sup>, Lakrandi P. P. M<sup>2</sup>, Prabhani S.D. D<sup>2</sup>, Sanjayath K<sup>2</sup>, Thanuraj T<sup>2</sup>, Wijayananda P. T. A<sup>2</sup>, Nayanamali M. A. A<sup>2</sup>, Menike W. A. R. P<sup>1</sup>

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**Background:** Antibiotic resistance is a worldwide emergency with a substantial healthcare and economic burden resulting in multi-drug resistant infections. Knowledge, attitude and practices of healthcare undergraduates can significantly influence antibiotic use as future healthcare professionals.

**Objective:** To study Knowledge, Attitude, and Practices (KAP) of Self-Medication of Antibiotics (SMA) among medical and nursing undergraduates of the University of Colombo, Sri Lanka.

**Methods:** A descriptive cross-sectional study was conducted from March 2022 to January 2023 among 401 nursing and medical undergraduates. Data was collected using a pre-designed self-administered questionnaire and was analyzed using SPSS version 26. A significant level was set as  $p < 0.05$  and results were presented in terms of descriptive statistics. Associations between demographics and KAP were defined in terms of Pearson's chi-squared test. Mean comparisons of KAP between two faculties were performed using an independent sample t-test.

**Results:** The study participants have a female majority (62.30%) aged 23-26 years (63.10%). Among the study subjects, only 19.10% of medical undergraduates and 23.30% of nursing undergraduates have good knowledge of SMA with a mean score of 9.79 (SD =2.10). Most participants (64.80%) have positive attitudes with a mean score of 7.71 (SD=1.69) and 64.58% have good practices toward SMA with a mean score of 8.45 (SD=2.28). Statistically significant associations were found between knowledge and the academic year ( $p=0.001$ ) and age groups ( $p < 0.001$ ). Moreover, 46.1% have self-medicated themselves within the last year whereas Amoxicillin (15%) has the highest frequency. A significant association was identified between knowledge and practice of SMA ( $p < 0.001$ ) and between attitude and practice of SMA ( $p < 0.001$ ).

**Conclusion:** Results showed that participants with good knowledge have significantly good practices of SMA. Participants with positive attitudes tend to follow good practices related to SMA. Despite having a good knowledge of antibiotics, the majority of the undergraduates have an average attitude regarding SMA which is not satisfactory in a healthcare-related undergraduate population.

**Keywords:** *antibiotic use, attitude, knowledge, practice*

**Awareness towards COVID-19 and preventive strategies practiced during the COVID-19 pandemic among employees in four divisional secretariats in Matara district, Sri Lanka**

D.M.O.T.K Bandara <sup>1</sup>, J.M.L Shavindi <sup>1</sup>, H.M.H.I Herath <sup>1</sup>, U.K Uyangoda <sup>1</sup>, W.M.D.U.L Mudalige <sup>1</sup>, H.N.I.G Rupasinghe <sup>1</sup>, H.S Abeywikrama <sup>1</sup>, R.L Kumarasinghe <sup>1</sup>, U.G.N.

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**Introduction:** COVID-19 is a respiratory disease caused by the SARS-CoV-2 virus. It is an important and urgent threat to global health. Public awareness on COVID-19 and its prevention is one of the feasible strategies to prevent the spreading of the disease.

**Objective:** To assess the awareness towards COVID-19 emergence and the preventive strategies practiced during the COVID-19 pandemic among permanent employees in Devinuwara, Malimbada, Matara and Thihagoda Divisional Secretariats in Matara district, Sri Lanka.

**Methods:** A descriptive cross-sectional study was conducted over a one-year period from December 2021, among 319 participants selected using the systematic sampling technique. Data were collected using pre-tested and validated interviewer-administered questionnaires. Descriptive and inferential analyses were performed using SPSS version 26.0, with a significance level set at  $p < 0.05$ .

**Results:** Most of the participants (80%) were females (79.6%) and 85% of them were married. Of the participants, 85% showed a high awareness towards COVID-19. The Mean awareness score was  $78.14 \pm 7.98$ . There were significant associations between gender, age, and civil status with the level of awareness towards COVID-19 emergence ( $p < 0.05$ ). Females ( $78.98 \pm 7.77$ ) had a higher mean awareness score than males ( $74.88 \pm 8.05$ ) (Independent sample t-test). Nearly 92% of the participants reported good adherence to preventive strategies during the COVID-19 pandemic with a mean practice score of  $86.22 \pm 8.64$ . There were significant associations between gender, age, and civil status with the mean practice scores towards COVID-19 emergence ( $p < 0.05$ ). Forgetfulness, busyness, and lack of resources were identified as factors contributing to poor hygiene practices.

**Conclusion:** Even though a high level of awareness towards COVID-19 and favorable adherence to preventive strategies among participants have been observed in the study, there were few factors associated with poor hygienic practices. Relevant authorities need to address these gaps by providing health education and continuous awareness creation.

**Keywords:** *COVID-19 pandemic; Awareness; Practice; Preventive strategies*



## Cross-Cultural Adaptation and Validation of Sinhala Version of Quality of Nursing Work Life Scale

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**Introduction:** The quality of work life refers to the quality of the relationship between employees and total work environment of an organization. As there is no scale to determine the work-life quality of Sri Lankan nurses, a measurement tool is essential which is culturally acceptable.

**Objective:** To validate Brook's Quality of Nursing Work Life Scale (QNWL) in Sinhala language, to assess the quality of work life of Sri Lankan nursing professionals.

**Methodology:** A descriptive cross-sectional study was carried out at the Lady Ridgeway Hospital for children in Sri Lanka. A total of 369 nurses were selected using simple random sampling. After a 2-week interval, 73 nurses were retested. The translate-retranslate method was used to determine language and content validity of the scale and expert opinion was sought. The reliability of the scale was determined with the test-retest reliability. After obtaining the Ethical approval, data on socio-demographic characteristics, work-related information and QNWL were collected using a self-administered questionnaire. Data were analyzed using SPSS version 25.

**Results:** The validity of the Sinhala version of Brook's quality of work life was considerably very high. The scale was tested for content validity of the Sinhala adaptation taking into consideration expert opinion. The overall Cronbach alpha coefficient was 0.85, whereas the subscales ranged between 0.35 and 0.86. The test-retest correlation for the total scale was  $r = 0.99$ . There was not a significant difference between test administration sessions given two weeks apart.

**Conclusion:** The study findings revealed that there was a moderate QNWL. The results of the present study show that the Sinhala version of the Quality of Nursing Work-Life Scale is a valid measurement tool for determining the quality of the work-life among nurses in Sri Lanka.

**Keywords:** *Quality of nursing work life, Nurses*

## Knowledge, attitude and practices toward leptospirosis among the farmers in Ma-Eliya, Kurunegala

B.P. Hewarathna<sup>2</sup>, E. Shopijen<sup>2</sup>, S.W.C.R. Jayarathne<sup>2</sup>, W.I. Chamara<sup>2</sup>, W.S.D. Lakmali<sup>2</sup>, S.M. Nizran<sup>2</sup>, V.W.A. Sampath<sup>2</sup>, A.W.K.S. Weerawarna<sup>2</sup>, T.S. Amarasinghe<sup>1</sup>, G.A.S. Premakumara<sup>1#</sup>

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**Background:** Leptospirosis is a major zoonotic disease caused by the bacteria *leptospira* which is considered as a public health threat globally. Poor Knowledge, Attitude and Practices (KAP) towards this disease can lead to increased morbidity and mortality.

**Objective:** To assess the KAP related to leptospirosis among the farmers in Ma-Eliya, Kurunegala district.

**Methodology:** A descriptive, cross-sectional study was conducted among 327 farmers in Ma-Eliya, Kurunegala, Sri Lanka. A pretested, interviewer-administered questionnaire was used to assess the KAP toward leptospirosis. Cutoff scores for knowledge were 75%, 50-74%, and 50%, which were regarded as good, satisfactory, and poor respectively. For attitudes toward leptospirosis,  $\geq 70\%$  was considered as satisfactory and  $< 70\%$  unsatisfactory, while  $\geq 60\%$  was considered as satisfactory and  $< 60\%$  unsatisfactory for practices on leptospirosis. Data analysis of the data was done using SPSS version 26.0. The level of significance was considered to be  $p < 0.05$ .

**Results:** The majority of the study participants were male (69.70%). The mean age of the farmers was  $50.49 \pm 12.34$ . The majority of the study participants (60.6%) had been educated about leptospirosis by the Public Health Inspector. It was found that most of the study participants (82.60%) had poor knowledge  $37.38 \pm 12.86$  related to symptoms, transmission, complications and prevention of the disease. Unsatisfactory attitudes were demonstrated by the majority of the participants (43.63%) and 58.15% of the farmers showed unsatisfactory practices towards disease prevention. Gender was statistically significantly associated with the level of knowledge ( $p=0.003$ ), attitude ( $p=0.014$ ) and practices ( $p=0.001$ ) regarding leptospirosis.

**Conclusion:** The overall knowledge regarding leptospirosis was poor, while attitude and practices of the farmers of Ma-Eliya were unsatisfactory. Thus, improvement in knowledge needs to be achieved through health education sessions and information dissemination which could lead to improved attitude and practices towards the management and control of leptospirosis.

**Keywords:** *Attitude, farmers, Knowledge, leptospirosis, Practice*

# **Faculty of Science**



**Research Excellence in Science and Beyond**

**3<sup>rd</sup> November 2023**

## **MESSAGE FROM THE DEAN FACULTY OF SCIENCE**

**Senior Professor Upul Sonnadara**



I am pleased to extend my sincere congratulations to the staff and students on the occasion of the Technical Sessions of the Faculty of Science, University of Colombo, scheduled for the 3<sup>rd</sup> of November 2023.

The theme for the research sessions this year ‘Research Excellence and Beyond’ portrays the emphasis that the Faculty of Science places on research. Our academics and postgraduate students have strived to generate knowledge in cutting-edge fields of science which are both nationally and globally relevant. The research spanning across a spectrum of seven disciplines of science leads to a considerable number of publications annually in high ranking local and international journals reiterating the high standard of research. Research has also led to many innovations and international patents which have contributed to the development of locally applicable products and practices. At any given time, over 500 postgraduates are enrolled in masters and research degree programmes offered by the faculty, and we have taken many important steps to elevate the effectiveness and quality of research, one of which is the establishment of the Centre for Postgraduate Studies (CPGS). Many other quality control checks and mechanisms have also been introduced through the years that further strengthen the capacity of postgraduates to undertake research work in the chosen discipline.

While focusing on research, we have also attempted to produce holistic postgraduates who are distinguished by their professionalism, committed to ongoing learning and personal development, capable of spearheading research, confident, adaptable, and able to aptly communicate and blend into the wider contexts in which they work. We continuously strive to equip them to be globally competitive, effective, and productive.

The postgraduate research sessions will without doubt provide a platform for knowledge-sharing. Hence, I am confident that this year’s scientific sessions, where over 30 abstracts are scheduled to be presented, would prove to be very productive. I extend my very best wishes for a fruitful deliberation and wish the Annual Sessions every success.

## Organizing Committee

Prof. C. D. Tilakaratne	Director Postgraduate Studies
Prof. CD Wijerathna	Dept. of Chemistry
Dr. DR Jayewardene	Dept. of Mathematics
Dr. KGSU Ariyawansa	Dept. of Plant Sciences
Dr. JMDR Jayasundara	Dept. of Physics
Prof. G. Galhena	Dept. of Zoology & Environment Sciences
Dr. P. Lakraj	Dept. of Statistics
Dr. J. Jeyasugiththan	Dept. of Nuclear Science

**Annual Research Symposium, University of Colombo**  
**Technical Sessions - Faculty of Science**  
**03 November 2023**

**SCHEDULE**

8.30 - 9.00 a.m.		<b>INAUGURATION</b>	
9.00 – 9.30 am		<b>REFRESHMENTS</b>	
<b>CLT - TECHNICAL SESSION 1</b>			
<b>Session Chairpersons: Prof. D. P. Dissanayake &amp; Dr. Sashiprabha M. Vithanarachchi</b>			
<b>Department of Chemistry</b>			
1	9.30 - 9.45 a.m.	Evaluation of heavy metal specificity and bioremoval capacity of a recombinant strain constructed with heavy metal Resistant <i>cadD</i>	N.M Wijayawardhana, D. M. D. C. Dissanayake, C. D. Wijayarathna
2	9.45 - 10.00 a.m.	Fabrication of novel electrospun polycaprolactone/zeolite/reduced graphene oxide/titanium dioxide nanofiber membrane for water desalination for agricultural purposes	N. G. S. Nimesha, Rohini M. de Silva, K.M. Nalin de Silva
3	10.00 - 10.15 a.m.	Fabrication and investigation of physiochemical properties of biopolymer-based TiO <sub>2</sub> nanocomposites for food packaging applications	D.N.A Arachchi, Rohini M. de Silva, K.M. Nalin de Silva
4	10.15 – 10.30 a.m.	Biocompatibility studies of electrospun PCL/Curcumin/ Hap-Cs composite nanofiber mats	S.P.P.M. Perera, Dinesh C. Aluthge, Rohini M.de Silva, K.M. Nalin de Silva
5	10.30 - 10.45 a.m.	Antimicrobial activity of endophytic fungi isolated from <i>Plectranthus hadiensis</i>	W. S. N. Alwis, C. M. Hettiarachchi
6	10.45 - 11.00 a.m.	Investigation of antimicrobial properties from selected plant species in Fabaceae and Solanaceae plant families	Ms. D. V. S. M. Waidyatillake, C.M. Hettiarachchi
7	11.00 - 11.15 a.m.	Establishment of an efficient tissue culture independent <i>Agrobacterium</i> mediated <i>in planta</i> transformation method for Sri Lankan rice variety Bg 250	K G W W Bandara, G.H.C.M.Hettiarachchi W.S. S. Wijesundera

8	11.15 - 11.30 a.m.	Development and characterization of a paper-based amperometric biosensor using metallothionein for the determination of $Pb^{2+}$	C.N.A. Wijenayake, L.H.R. Perera, C. D. Wijayarathna
9	11.30 - 11.45 a.m.	Integrating Gold nanoparticles for enhanced remediation of Imidacloprid using a SERS based photocatalytic substrate and on-site monitoring thereof	U. D. Rodrigo, Arunoda Lakmal, Hiran Jayaweera, Neranga Abeyasinghe, Sumedha Jayanetti and Siyath Gunewardene
10	11.45 – 12.00 noon	Development of a heavy metal sensitive genetic circuit in Zebrafish for environmental monitoring	H.M.L.P.B. Herath, Rohini M. de Silva, K.M. Nalin de Silva
<b>LUNCH</b>			
<b>SLT B - TECHNICAL SESSION II</b>			
<b>Session Chairpersons: Prof. I.M.K. Fernando &amp; Dr. K. A. D. Deshani</b>			
<b>Department of Physics</b>			
11	9.30 - 9.45 a.m.	Residence Times of Water Molecules in the vicinity of Collagen Fibrils	Subodha Rangana, W.A.M. Madhavi
12	9.45 - 10.00 a.m.	Optical Design of Compact High-Resolution Spectrograph for Cassegrain Telescopes with Alt-Azimuth Mount	M. Viveganandam, J. Adassuriya, K.P.S.C. Jayaratne
13	10.00 - 10.15 a.m.	Vortex-Tracking of Tropical Cyclones: Case from Cyclone Gaja	T.D. Gamage, D.U.J. Sonnadara
14	10.15 – 10.30 a.m.	Characterization of electrical and morphological features of graphene oxide traces dispensed on photo papers	R.M. Manamendra, G.C. Wickramasinghe, D.R. Jayasundara, D.L. Weerawarne
<b>Department of Mathematics</b>			
15	10.30 – 10.45 a.m.	An estimation of market shares of competitive brands by using brand switching probabilities	M.H.K.M. Hameem
<b>Department of Statistics</b>			

16	10.45– 11.00 a.m.	Determinants of intimate partner violence on women in Sri Lanka	R.M.K.P. Weerasekara, S.D. Viswakula
17	11.00 – 11.15 a.m.	Forecasting monthly Gross Sale Average of low elevation tea factories in Sri Lanka: A panel data approach	H. D. S. Sandamali, C. D. Tilakaratne
18	11.15 - 11.30 a.m.	Assessing protein level changes with Left-Censored Data in a limited sample size	P.A.L.A. Anurangi, S.D. Viswakula, D. Amaratunga
19	11.30 – 11 45 a.m.	Relationship between the demographic variables and academic performance of Information Technology undergraduates under a Loan Scheme Program at a non-state university: A case study	D. W. Hettiarachchi, E. R. A. D Bandara
20	11.45 – 12.00 noon	Factors associated with homework completion among advanced level students: A case study	JMVM Jayamanne, JHDSP Tissera
21	12 00 – 12.15 p.m.	A study on COVID-19 cases and deaths in Sri Lanka during 2021/22	Hamsananthy Jeevatharan, C. D. Tilakaratne
<b>LUNCH</b>			
<b>PLT - TECHNICAL SESSION III</b>			
<b>Session Chairpersons: Dr. Sameera Ariyawansa &amp; Prof. Mayuri Wijesinghe</b>			
<b>Department of Plant Sciences</b>			
22	9.30 – 9.45 a.m.	A potential Eucalyptus foliar pathogen reported from the Hanthana range in Sri Lanka	Rashika S. Brahmanage, Nalin N. Wijayawardene, Siril Wijesundara, Chandrika M. Nanayakkara, C.K. Muthumala, Kahandawa G.S.U. Ariyawansa.
23	9.45 – 10.00 a.m.	Potential role of endophytic fungal isolates from Sri Lankan black pepper ( <i>Piper nigrum</i> ) in plant growth promotion	W.G.N.A. Wimalarathna, K.G.S.U. Ariyawansa, A.M. Wickramasuriya, H.D.D. Bandupriya, N.N. Wijayawardene, Dong-Qin Dai, T.D. Silva.



<b>Department of Zoology &amp; Environment Sciences</b>			
24	10.00 – 10.15 a.m.	A novel polyherbal distillate stimulates melanogenesis: A Safe and Cost-Effective Alternative for Depigmentation Disorders and skin tanning alternatives	P. Ratnayake, U. Samaratunge, I. Perera, J. Seneviratne, P. Udagama
25	10.15 – 10.30 a.m.	Preliminary study to detect the associations between FLT3 positivity/negativity on peripheral blood mononuclear cells, FLT3 ligand level in plasma, and peripheral white blood cell counts in newly diagnosed NHL patients and healthy individuals	C.K. Nandasena, P.W.D.C.C. Jayathilake, S. Suresh, A.D. De Silva, I.C. Perera, D.U. Kottahachchi
26	10.30 – 10.45 a.m.	Intake estimation of antioxidant constituents (total phenolics and flavonoids) through consumption of cooked rice ( <i>Oryza sativa L.</i> ) using dietary data from Sri Lankan households	J.W. Gunawardana, I.C. Perera, C.W. Witharana, S.A. Gunawardana
27	10.45 – 11.00 a.m.	Identification of potential areas for aquaculture using spatiotemporal dynamics of water quality in the Rekawa Lagoon	W.K. Suwandhahannadi, D. Wickramasinghe, D.D.G.L. Dahanayaka, Loic Le De, M Gammanpila
28	11.00 – 11.15 a.m.	Community perception of lagoon Ecosystem Services and conservation priorities: a case study from Rekawa Lagoon, Sri Lanka	W.K. Suwandhahannadi, D. Wickramasinghe, D.D.G.L. Dahanayaka, Loic Le De
29	11.15 – 11.30 a.m.	LULC changes in urban wetlands: Case study in Muthurajawela wetland, Sri Lanka using intensity analysis method	Harsha Dahanayake, D.D.G.L. Dahanayaka, Paul Hudson, Deepthi Wickramasinghe
30	11.30 – 11.45 a.m.	Optimization of a qPCR to detect six avian respiratory viruses	C. S. Sepalage, W. B. Yapa, N. Dayawansa, S. S. Seneviratne, A. Nitsche, C. Kohl, I.C. Perera,
31	11.45 – 12.00 noon	Proposals for robust e-waste management law for Sri Lanka: Perceptions of experts	P.M.M. Sajeewa Kumari, Deepthi Wickramasinghe, Sanath Wijesinghe, Julie Trafford, Michael Petterson
32	12.00 – 12.15 p.m.	Genetic affiliations of the Sri Lankan aboriginals (“Veddahs”) to local ethnicities based on seven X-chromosomal short tandem repeat loci	S. A. Ranasinghe, K. L. N. S. Perera, G. H. Galhena
<b>LUNCH</b>			

## Evaluation of heavy metal specificity and bioremoval capacity of a recombinant strain constructed with heavy metal Resistant *cadD*

N.M Wijayawardhana, D. M. D. C. Dissanayake, C. D Wijayarathna

*Biotechnology Laboratory, Department of Chemistry, University of Colombo, Sri Lanka*

Bioremediation, an eco-friendly and sustainable method, holds significant promise in minimizing the impact of heavy metal pollution on the environment. In prior research study, the *cadD* gene, known for metal resistance, which was extracted from *Staphylococcus epidermidis* TWSL\_22 and cloned into *E. coli* BL21 (*E. coli/cadDET*), and this was employed in the current study. The study evaluated the *E. coli/cadDET* heavy metal bioremediation potential compared to non-recombinant *E. coli/pET*, analyzing MIC values and metal accumulation assays for metal specificity with  $Zn^{2+}$ ,  $Cd^{2+}$ ,  $Cu^{2+}$ , and  $Pb^{2+}$ . MIC values were determined to assess the tolerance of *E. coli/cadDET* to heavy metal exposure by growing the strain on LB agar plates incorporated with heavy metals ( $Zn^{2+}$ ,  $Cd^{2+}$ ,  $Cu^{2+}$ , and  $Pb^{2+}$ ) in different concentrations (50-2000 ppm). The *E. coli/cadDET* exhibited remarkable tolerance with MIC values of 400 ppm, 125 ppm, 200 ppm, and 1500 ppm for  $Zn^{2+}$ ,  $Cd^{2+}$ ,  $Cu^{2+}$ , and  $Pb^{2+}$  respectively. The bio removal percentages (BR %) were determined using Atomic Absorption Spectroscopy (AAS) to assess the extent of metal reduction by growing the strain in LB broth spiked with metal ions. Results demonstrated that the *E. coli/cadDET* has significantly higher BR % values for  $Zn^{2+}$ ,  $Cd^{2+}$ , and  $Cu^{2+}$  ions, reaching 89%, 79%, and 77%, respectively, compared to the *E. coli/pET* which does not harbour the *cadD* gene with BR % values of 32%, 19%, and 26%. The enhanced metal-binding capacity of *E. coli/cadDET* indicates its potential as an effective bioremediation agent for environments contaminated with these metals. Notably, *E. coli/cadDET* exhibited a lower specificity for  $Pb^{2+}$  removal, with a BR % of 40.5%. The study also revealed that *E. coli/cadDET* demonstrated a higher specificity towards  $Zn^{2+}$  ions, indicating its enhanced affinity for zinc removal. The enhanced metal-binding capacity of the recombinant strain indicates its potential as an effective bioremediation agent for environments contaminated with the tested heavy metals.

**Keywords:** Heavy metal ions, *cadD*, Metal specificity, Bio removal capacity

## **Fabrication of novel electrospun polycaprolactone/zeolite/reduced graphene oxide/titanium dioxide nanofiber membrane for water desalination for agricultural purposes**

N.G.S.Nimesha, Rohini M. de Silva, K.M. Nalin de Silva  
*Department of Chemistry, University of Colombo, Sri Lanka*

The application of desalinated seawater in agriculture has been the trend worldwide. The membrane distillation method was the subject of the present study, and the electrospinning technique is one approach which has been used to facilitate the fabrication of nanofiber membranes for water desalination. This work aims to fabricate a novel electrospun polycaprolactone/zeolite/reduced graphene oxide/titanium dioxide (PCL/Zeolite/rGO/TiO<sub>2</sub>) nanofiber membrane for desalination of water for agricultural purposes. The PCL/Zeolite/rGO/TiO<sub>2</sub> membrane was fabricated via electrospinning technology. Synthesized materials were characterized using FT-IR, XRD, SEM, and Energy Dispersive X-Ray Analysis (EDAX). The thermal behaviour of the membranes was studied using thermogravimetric analysis (TGA). Perm-selectivity, point of zero charges (pzc), and ion exchange capacity were measured, and desalination performance in electrodialysis was studied by measuring the conductivity changes in the feed solution with time. The zeta potential data reveals that the point of zero charge of the PCL/Zeolite/rGO/TiO<sub>2</sub> membrane is 6.2, and hence, at pH values above 6.2, the membrane can act as a cation exchange membrane as it contains many fixed anionic sites. A PCL/anion exchange resin (a resin with quaternary ammonium functional groups attached to the styrene-divinylbenzene copolymer chains) was fabricated by solution casting and acted as an anionic membrane for the desalination study. The PCL/Zeolite/rGO/TiO<sub>2</sub> nanofiber membrane shows 60.95% perm-selectivity, whereas the PCL/anion exchange resin membrane shows 63.93% perm-selectivity. The cation exchange capacity of the PCL/Zeolite/rGO/TiO<sub>2</sub> membrane and the anion exchange capacity of the PCL/anion exchange resin membrane are 0.171 mmol/g and 0.670 mmol/g, respectively. The prepared membranes were employed for the electro-dialytic removal of NaCl (3.5 wt%) feed solution at a constant applied voltage. NaCl feed solution showed a gradual decrease in conductivity as the number of ions inside slowly decreased as the electrolysis proceeded. The PCL/Zeolite/rGO/TiO<sub>2</sub> shows remarkable potential for use as a membrane for water desalination for agricultural purposes.

**Keywords:** *Polycaprolactone, reduced graphene oxide, anion exchange resin, electrodialysis, desalination*

## **Fabrication and investigation of physiochemical properties of biopolymer-based TiO<sub>2</sub> nanocomposites for food packaging applications**

D.N.A Arachchi, Rohini M. de Silva, K.M. Nalin de Silva

*Department of Chemistry, University of Colombo, Sri Lanka*

Biopolymer-based packaging films have promising applications in food packaging due to their versatile advancements. The present work aims to fabricate three biopolymer-based TiO<sub>2</sub> nanocomposites, each with a novel triad combination with a main focus on investigating their physiochemical properties. Nanocomposites of Chitosan/Alginate/TiO<sub>2</sub> (CS/AL/TiO<sub>2</sub>), Chitosan/Pectin/TiO<sub>2</sub> (CS/PC/TiO<sub>2</sub>), and Chitosan/Gelatin/TiO<sub>2</sub> (CS/GL/TiO<sub>2</sub>) were synthesized using the solvent casting method. Physiochemical properties were compared based on film thickness, moisture content, water absorption, film solubility, film opacity, oil permeability coefficient (OPC), and water vapor permeability (WVP). Film thickness measurements of the synthesized CS/AL/TiO<sub>2</sub>, CS/PC/TiO<sub>2</sub>, and CS/GL/TiO<sub>2</sub> have the values of 0.20, 0.13, and 0.16 mm, respectively, implying no considerable variation in the film thickness. Although there is no significant variation in WVP and film solubility, AL-based film exhibited slightly higher values, giving  $7.44 \times 10^{-11} \text{ g m}^{-1} \text{ s}^{-1} \text{ Pa}^{-1}$  for WVP and 60.62% for film solubility. This may mainly be due to the poor water resistance of AL. Due to the high swelling nature of gelatin, the water absorption ability of film with GL is slightly higher, with a value of 51.42%. No considerable variation was observed in the calculated moisture content of films. The synthesized membranes have shown trivial variations in the film opacity, with the PC-based film having a slightly higher opacity of  $11.20 \text{ mm}^{-1}$  due to its lesser film thickness. Slight variations can be identified for the AL-based film in OPC, recording a slightly higher value of  $34.78 \text{ g.mm/m}^2$  per day, probably due to the abundant lipophilic groups in AL. According to the results, it can be concluded that fabricated packaging films show potential use as food packaging materials due to their compatible results.

**Keywords:** *Chitosan, Alginate, Pectin, Gelatin, TiO<sub>2</sub>*

## **Biocompatibility studies of electrospun PCL/Curcumin/ Hap-Cs composite nanofiber mats**

S.P.P.M.Perera, Dinesh C. Aluthge, Rohini M.de Silva\*, K.M. Nalin de Silva

*Department of Chemistry, University of Colombo, Sri Lanka*

Electrospun nanofibrous scaffolds have versatile applications in many fields. As polymers are the most suitable materials to fabricate electrospun scaffolds, the present study is based on using polycaprolactone (PCL), one of the promising candidates to fabricate scaffolds. To enhance the biocompatibility of the electrospun PCL scaffolds, hydroxyapatite (Hap) was introduced. For this application, Hap was synthesized as a composite with chitosan (Cs) in different weight ratios (Hap/Cs -20/80 and 80/20) to enhance its biodegradability. To intensify the antimicrobial properties of the PCL scaffolds, curcumin was incorporated. Hence, with the incorporation of those two materials, two novel PCL scaffolds known as PCL/Cur/Hap-Cs (20/80), and PCL/Cur/Hap-Cs (80/20) were fabricated by electrospinning. To investigate the biocompatibility, zebrafish embryo toxicity experiments were carried out. This experiment measured survival rate, hatching rate, rate of heartbeat, and embryonic abnormalities in zebra fish. Both scaffolds were 100% biocompatible compared to the negative control sample. Considering the hatching rate, embryos in both treatments showed 100 % hatching at 48 hours post fertilization (hpf), showing no interruptions from the two samples. The embryos treated with both mats show heartbeats closer to embryos with negative treatment. In both these samples, no discernible embryonic abnormalities were observed. Hence, the combinations of PCL curcumin with both ratios of Hap/Cs have no noticeable effect on cardiovascular development. Hence, these results express the suitability of using electrospun mats with PLC, Curcumin, and Hap/Cs with both compositions (20/80 and 80/20) for humans, in biomedical applications.

**Keywords:** *Electrospinning, Caprolactone, Hydroxyapatite, Curcumin, Scaffolds*

## Antimicrobial activity of endophytic fungi isolated from *Plectranthus hadiensis*

W. S. N. Alwis, C. M. Hettiarachchi

*Department of Chemistry, University of Colombo, Sri Lanka*

Fungi that colonize living plant tissues without causing any immediate detrimental effects are known as endophytic fungi. It has been demonstrated through research that endophytic fungi can produce substances that are comparable to the secondary metabolites formed by their host. *Plectranthus hadiensis* is a herb in the Family Lamiaceae which was found to have antimicrobial properties. This study aimed to isolate endophytic fungi from *P. hadiensis* and to study antibacterial and antifungal properties of their metabolites as using microbes to extract substances is efficient and profitable. To isolate endophytic fungi from plant tissues, surface sterilized tissue segments were cultured on PDA media for 10-14 days at room temperature. Seven strains of endophytic fungi were isolated. Antibacterial activity of crude extracts was assessed against Gram positive *Bacillus subtilis*, *Staphylococcus aureus*, and Gram negative *Escherichia coli*, and *Pseudomonas aeruginosa* using agar disc diffusion assay. Gentamicin was used as the positive control. The results showed that L4, S3 and S4 crude extracts possess antibacterial activity against the tested bacteria. The highest inhibitory activity was found in S3 crude ( $11.11 \pm 0.3$  mm for 250  $\mu\text{g}/\text{disk}$ ) against *B. subtilis*. The positive control displayed an inhibition zone of  $18.22 \pm 0.3$  mm. Antifungal assays were carried out against *Aspergillus spp.*, *Rhizopus spp.*, and *Fusarium spp.* through dual culture assay and *Candida spp.* through disc diffusion assay. Amphotericin B was used as the positive control. The highest antifungal activity against *Fusarium spp.* and *Rhizopus spp.* was found in L4 fungi (Inhibition percentage: 35.48% and 69.62% respectively) and against *Aspergillus spp.* in S2 fungi (Inhibition percentage: 46.43%). Antifungal activity against *Candida spp.* was displayed only by the S4 crude extract ( $7.00 \pm 0.2$  mm for 250  $\mu\text{g}/\text{disk}$ ) and the positive control showed an inhibition zone of  $13.78 \pm 0.3$  mm. In conclusion, endophytic fungi of *P. hadiensis* could be a good candidate plant to isolate novel antibacterial and antifungal compounds.

**Keywords:** *Antibacterial activity, Antifungal activity, Endophytic fungi, Plectranthus hadiensis*

## Investigation of antimicrobial properties from selected plant species in Fabaceae and Solanaceae plant families

D. V. S. M. Waidyatillake, C. M. Hettiarachchi

*Department of Chemistry, University of Colombo, Sri Lanka*

Plant species *Bauhinia racemosa*, *Senna alata*, *Cassia fistula* and *Tamarindus indica* (Fabaceae) and *Datura metel* (Solanaceae) are commonly used to treat infectious skin diseases, and diseases in respiratory and gastrointestinal systems in Ayurveda medicine. Most of those diseases are caused by microorganisms. Therefore, this research was conducted to investigate antifungal and antibacterial properties of these plants. All plants were authenticated from National herbarium, Peradeniya. The leaves of the plants collected were cleaned, dried, pulverized and subject to extraction. Crude extracts were prepared using the dichloromethane/ methanol (1/1, v/v) solvent mixture. Crude extracts were assessed for their antifungal activities against *Rhizopus spp.*, *Aspergillus spp.*, and *Fusarium spp.* by poisoned food assay. Among the crude extracts tested, *D. metel* displayed the highest antifungal activity for all fungal strains with 53.41%, 51.64% and 32.36% of mycelial growth inhibition against *Rhizopus spp.*, *Aspergillus spp.* and *Fusarium spp.*, respectively. The positive controls (Nystatin for *Rhizopus spp.*/ *Aspergillus spp.* and Amphotericin B for *Fusarium spp.*) showed 100% antifungal activity against corresponding fungal species. Antifungal activity of crude extracts was tested against *Candida spp.* using the agar disc diffusion assay and all crude extracts did not show antifungal activity against *Candida spp.* Crude extracts of all plant species were screened against *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Escherichia coli* to determine their antibacterial activity via the agar disc diffusion assay. Of the five crude extracts, *S. alata* ( $8.8 \pm 0.08$  mm), *C. fistula* ( $8.0 \pm 0.16$  mm) and *D. metel* ( $10.8 \pm 0.08$  mm) exhibited antibacterial activity against *B. subtilis*. None of the crude extracts displayed antibacterial activity against the other three bacterial species. All together these results revealed that the *D. metel* with both antifungal and antibacterial properties could be a potential candidate to conduct further research on exploring the bioactive constituents.

**Key words:** *Crude extracts, Poisoned food assay, Agar disc diffusion assay, D. metel*

**Establishment of an efficient tissue culture independent *Agrobacterium* mediated *in planta* transformation method for Sri Lankan rice variety Bg 250**

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Biotic and abiotic stresses limit the rice growth and productivity. There is a huge demand for improving local rice varieties. The *in planta* transformation technique is a novel and simple technique that directly delivers the foreign DNA into intact plant tissues without the need for *in vitro* tissue culture. In the present study, we have established a simple, efficient and tissue culture independent *Agrobacterium* mediated *in planta* transformation method for the agronomically important Sri Lankan rice variety Bg 250 using developing embryos as the transformation target. *Agrobacterium tumefaciens* strain GV 3101 harbouring the pCAMBIA 1303 binary vector was used for transformation. *A. tumefaciens* was inoculated into the embryo region of soaked seeds by piercing the embryo twice to a depth of about 1-1.5 mm with an ultra-fine needle dipped in the *A. tumefaciens* inoculums. The pierced seeds were then dipped in the *A. tumefaciens* inoculum containing 100 µM acetosyringone for 30 minutes. Inoculated seeds were placed on wet filter papers in jam bottles containing sterilized distilled water to cover the seeds. They were incubated at 24 °C in the dark for 3, 5, 7 and 9 days. The seedlings were then transferred to pots containing paddy soil and grown to maturation under nonsterile conditions. Transformation efficiency of T<sub>1</sub> plants were determined by hygromycin resistance. The maximum transformation efficiency of 52 % was obtained with the co-cultivation for 5 days. During the 5-day co-cultivation period 93 % of the inoculated seeds germinated into seedlings. Transgenic plants were confirmed by polymerase chain reaction. The established transformation protocol is simple, efficient and tissue culture independent, and could be useful for transferring agronomically important traits into the Sri Lankan rice variety Bg 250.

**Keywords:** *Bg 250, co-cultivation, in planta, transformation*



## Development and characterization of a paper-based amperometric biosensor using metallothionein for the determination of Pb<sup>2+</sup>

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Lead has a wide range of unfavorable effects on humans including causing high blood pressure, and brain, kidney and reproductive health issues. Consequently, it is important to determine the quantity of lead in the human body. Lead monitoring in biological fluids requires a simple and sensitive technique. Here a paper based amperometric biosensor is introduced for the determination of Pb<sup>2+</sup> using metallothionein (MT) as an ionophore. An OHP (overhead projector) sheet marked with polyurethane varnish was used as the hydrophobic demarcation on paper-based platform. Working and counter electrodes were developed using an optimized mixture of polyurethane varnish and graphite powder. A silver wire coated with AgCl was used as the reference electrode. MT was applied on a filter paper and was kept in contact with the three electrodes. The loading volume of MT (15 mg/mL) on filter paper was 6  $\mu$ L. The optimal pH for binding MT to metal ions was determined to be 7.0. To test this system a sensor with linear responses in 10 mM KCl at pH 7 ranging from  $10^{-6}$   $\mu$ M –  $10^{-5}$   $\mu$ M to  $10^2$   $\mu$ M -  $10^3$   $\mu$ M were used in several different ranges. The highest sensitivity of the paper based analytical device is 12.24  $\mu$ A/ $\mu$ M in the concentration range  $10^{-4}$   $\mu$ M –  $10^{-3}$   $\mu$ M. The LOD and LOQ values of the developed biosensor were  $9.66 \times 10^{-6}$   $\mu$ M and is  $3.22 \times 10^{-5}$   $\mu$ M, respectively. Experiments revealed the reproducibility and repeatability of the biosensor. The selectivity of Pb<sup>2+</sup> ions towards amperometric biosensors was investigated in the presence of metals such as Ca<sup>2+</sup>, Zn<sup>2+</sup>, Cd<sup>2+</sup> (ranging from 0.02  $\mu$ M – 0.005  $\mu$ M). The MT-based metal ion biosensor can be successfully used for the amperometric determination of Pb<sup>2+</sup> ions over a wide concentration range.

**Key words:** *amperometric biosensor, Heavy metals, Metallothionein*

## **Integrating Gold nanoparticles for enhanced remediation of Imidacloprid using a SERS based photocatalytic substrate and on-site monitoring thereof**

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The utilization of gold nanoparticles (Au NPs) as a photocatalyst and a substrate to conduct Surface-Enhanced Raman Spectroscopy (SERS) presents a promising avenue for enhancing the efficacy of pesticide remediation. In this preliminary study, the development of a combined SERS and photocatalytic substrate was explored as a means of on-site detection of pesticides at very low concentrations. The methodology involves the use of Au NPs to serve as both a SERS-enhancing substrate and a photocatalyst under UV light illumination for the degradation of imidacloprid, a harmful pesticide commonly found in the environment. Commercially available imidacloprid was selected as the model compound for degradation experiments. Incorporating Au NPs as the SERS based photocatalytic substrates has effectively doubled its efficiency of photodegradation of Imidacloprid compared to the experiments conducted without the presence of the photocatalytic substrate. Additionally, the diminished intensity of the Imidacloprid Raman spectrum of post-degraded samples with respect to the initial concentrations illustrates the potential of detecting Imidacloprid, and the possibility of precise quantification of pesticides through Raman vibrational spectroscopic technique. This integrated approach holds promise for the development of a robust system capable of both efficient pesticide degradation and on-site detection, addressing concerns related to pesticide pollution and enabling proactive environmental monitoring. Further optimization and validation efforts could pave the way for practical applications in field-deployable remediation and monitoring systems.

**Key words:** *SERS, Pesticides, Imidacloprid, Remediation, Photocatalyst, Au NPs*

## Development of a heavy metal sensitive genetic circuit in Zebrafish for environmental monitoring

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Environmental contamination from heavy metals poses a significant threat, necessitating robust monitoring approaches. Zebrafish (*Danio rerio*), known for their sensitivity and genetic manipulability, offers a promising model for such monitoring. This study presents the development of a heavy metal-sensitive genetic circuit in zebrafish, utilizing the *metallothionein2* gene (*mt2*) promoter to drive the expression of the *Dsred* reporter gene in response to heavy metal exposure. The *mt2* promoter was annotated through bioinformatics analysis, and regulatory elements were identified. The genetic circuit, designed and synthesized, was successfully integrated into zebrafish embryos via the Tol2 transposon system. Transgenic confirmation was achieved in 72 hpf zebrafish larvae (hatched) through PCR with the specific primers designed for *mt2-Dsred* heavy metal sensitive genetic construct and fluorescence microscopy done with secondary eGFP based transformation confirmation fluorescent reporter, confirming successful circuit integration. Transgenic larvae (72 hpf) exhibited robust fluorescent responses corresponding to Cd<sup>2+</sup> and Zn<sup>2+</sup> exposure, showcasing a minimal detection level of 4 ppb for each metal, affirming the circuit's functionality. In contrast, the control wildtype groups of larvae did not exhibit any significant *Dsred* fluorescent signals towards heavy metal treatments. This study demonstrates the feasibility of using zebrafish as living biosensors for heavy metal detection, contributing to innovative environmental monitoring tools.

**Keywords:** *Zebrafish, genetic circuit, heavy metals, environmental monitoring, transgenic.*

## Residence Times of Water Molecules in the vicinity of Collagen Fibrils

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It is well known that the MRI spin relaxation rates measured in ordered collagenous tissues such as cartilage and tendons are anisotropic across the depth of the tissues. This anisotropy termed as the “magic angle effect” is a consequence of incomplete averaging of dipolar spin interactions due to binding of water molecules to the collagen fibers. Two main hypotheses are proposed regarding the microscopic origin of the magic angle effect: the ice-like water bridges and spatial confinement of water molecules in cavities in the collagen network. In this study, we have investigated the nature of the bonds made by water molecules and collagen using two hierarchical structures of collagen, tropocollagen and a microfibril, using molecular dynamics simulations (MD). All-atom MD simulations of a tropocollagen fragment in a water box and a collagen microfibril in a water box were carried out. The radial distribution function of water molecules was calculated to determine the thickness of the different hydration shells. The continuous residence time of water molecules in each hydration shell was calculated and the molecules that are residing a longer time in the first and second hydration shell were considered for further analysis. The translational motion of long residing molecules was studied to understand their bonding nature. The results indicate that, though the thickness of the hydration shells is the same for both collagen structures, the continuous residence times of water molecules in the second hydration shell of the microfibril are considerably longer than the residence time of water molecules in the second hydration shell of tropocollagen. Further studies are being carried out to understand the exact nature of the bonds made between water and collagen. This study will contribute to understanding the molecular origin of the magic-angle effect and hence to develop a quantitative relationship between the collagen microstructure and observed MRI parameters of tendon like tissues.

**Keywords:** *spin relaxation, molecular dynamics simulation, magic angle effect, hydration shell, collagen*

## Optical Design of Compact High-Resolution Spectrograph for Cassegrain Telescopes with Alt-Azimuth Mount

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Spectroscopy is a widely used analytical technique in astronomy for studying the properties of stellar objects. Spectrographs play a key role in this process by separating incoming light into its constituent wavelengths or frequencies and recording the resulting spectra. High resolution spectroscopy can accurately determine the properties of molecules and atoms in astrophysical environments. However, the standard spectrographs are unable to couple with telescopes that have Alt-Azimuth mount and Cassegrain focus. To address this issue, a new compact high-resolution spectrograph has been designed to couple with such telescopes. The proposed model is designed for the 11 inch Cassegrain type Alt-Azimuth mount telescope at the Astronomy and Space Science Unit, Department of Physics, University of Colombo. The design and optimization of the optical system, coupling mechanism, and remote access facility are key phases in the development process. A unique optical design in a compact system has been proposed with a maximum resolution. Testing of the spectrograph through observation of stellar objects and obtaining spectra will also be conducted. The research has made substantial advancements in designing the light path and CAD layout for a spectrograph. Key achievements include finalizing the placement of slits and selecting the collimator mirror. A modified star diagonal, positioned 20 mm from the telescope's edge, redirected the light beam by 90 degrees, focusing it at a point 62.9 mm from the axis. To achieve this, a collimator mirror with a 127 mm focal length and a 25.4 mm diameter was chosen, resulting in the production of a parallel beam measuring 13.3 mm in size. This new compact spectrograph can be used in any telescope with Cassegrain focus and Alt-Azimuth mount.

**Key Words:** *spectrograph, cassegrain focus, alt-azimuth mount, high resolution*

## Vortex-Tracking of Tropical Cyclones: Case from Cyclone Gaja

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Tracking cyclones simulated by the Weather Research and Forecasting (WRF) model is done mainly by identifying the location having the Minimum Sea Level Pressure (MSLP) as the center of cyclone. When cyclones reach land, they get weaker and create multiple local minima making it difficult to forecast the path of a cyclone. The cyclone “Gaja” considered in this study was recorded in the “Bay of Bengal” in November 2018. When it made its landfall in Southern India, it got scattered and was difficult to track using the MSLP. In order to overcome the identification of false minimum, low pressure clusters having a  $0.5^\circ$  radius were identified as probable locations of the cyclone. Absolute Vorticity (AV) provides information on rotational winds caused by the cyclone. The AV at 850 hPa is calculated for each of the identified clusters. An algorithm was developed to select the MSLP cluster location having maximum AV as the center of cyclone. The cyclone locations provided by the International Best Track Archive for Climate Stewardship (IBTrACS) are considered as reference locations. The track mean Direct Positional Error (DPE) is calculated to evaluate the accuracy of track generated with the cyclone tracking algorithm compared to the track generated using the MSLP. The cyclone “Gaja” forecasted with 48 different physics option combinations was used in this work. As a result, there were 48 different tracks for the evaluation. Mean DPE of 87.5% of forecasts are found to be having a higher value for tracks generated using the MSLP. Therefore, it was concluded that the use of AV in combination with MSLP can be used to forecast the improved track location.

**Keywords:** *Tracking Cyclones, WRF*

## Characterization of electrical and morphological features of graphene oxide traces dispensed on photo papers

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The development of numerous printing techniques has opened abundant options for manufacturing innovations in the field of flexible electronics. Precision dispensing has emerged as an ideal way for creating high-quality electronic circuit routes and electrodes by depositing thick paste inks on flexible substrates. This study focuses on the direct printing of graphene oxide (GO) lines onto photo paper using a precision dispenser. The synthesis of the graphene oxide slurry was achieved by employing the improved Hummers method. Through meticulous optimization of the dispenser printing parameters, the study aims to accomplish the utmost precision in line width and investigate the print quality of the GO ink on photo paper. The traces undergo a curing process within a controlled oven environment after deposition, leading to the conversion of GO to reduced graphene oxide (rGO) exhibiting a commendable enhancement in the electrical conductivity. The electrical behavior of the dispensed traces is scrutinized through continuous monitoring of electrical resistance across the samples. Ultimately, the study attains an electrically conductive trace with average resistance of  $51 \pm 7 \text{ k}\Omega$  on photo paper through a dispensing pressure of 70 psi, a dispensing speed of  $100 \text{ mm s}^{-1}$ , and a sintering temperature of  $200 \text{ }^\circ\text{C}$  for 30 minutes. Morphological analysis of the printed conductive lines is executed via image processing techniques utilizing Python programming language and Scikit library. Enhancements in line smoothness and width were observed after the sintering procedure. The percentage increment of line width, from GO to optimal rGO trace at  $200 \text{ }^\circ\text{C}$  was 43.24%. The optimized printing parameters hold promise for the fabrication of flexible electrodes, antennas, and electronic circuits on photo paper using GO/rGO thick pastes.

**Keywords:** *Precision dispensing, Reduced graphene oxide, Electrical resistance*

## **An estimation of market shares of competitive brands by using brand switching probabilities**

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To analyze competition among brands of a good, researchers use two important measures of inter-brand substitutability, namely market shares cross-elasticities and brand switching probabilities. Market shares cross-elasticities determine the market shares of competing brands. However, determining cross-elasticities is difficult mainly due to insufficient data and problems with estimation. Studies have shown market share cross-elasticities and brand switching probabilities contain fundamentally the same information under three assumptions: (1) The brands of the good involved are substitutes, (2) Aggregate market share cross-elasticities are proportional to their corresponding aggregate row-conditional brand switching probabilities with one scaling constant, and (3) Aggregate market share own-elasticities are proportional to one minus their corresponding aggregate row-conditional repeat purchase probabilities with the negative of the same scaling constant. In this study, the brand switching matrix of probabilities  $P = (p_{ij})_{n \times n}$  for  $n$  competing brands of a consumable good is analyzed.  $P$  is a stochastic matrix and it is assumed that; (a) consumer utility for the brands are constants, and hence the switching probabilities  $p_{ij}$  will be constants, (b) the time lag between two consecutive purchases is a constant, and (c) any customer buys only one brand in a purchase period. These satisfy all the above three assumptions. Different types of stochastic matrices are analyzed to determine the market shares in any purchase period and in the long run. If  $P$  is a regular stochastic matrix or a positive-column stochastic matrix, then the fixed-point theorem is used to find the long run market share. If  $P$  is an absorbing Markov chain, then a theorem is established to find the long run market share. A method to find market shares in the middle of any period is discussed. If there is brand or market segmentations, then  $P$  may be expressed as a direct sum of regular or positive column stochastic matrices or absorbing Markov chains. A method has been devised to determine market shares in this case.

**Keywords:** *brand switching probabilities, complements, market share, market share elasticity, substitutes.*



## Determinants of intimate partner violence on women in Sri Lanka

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The present study was based on the Women's Well-being Survey (WWS) 2019 which was the first national survey on violence against women in Sri Lanka. Further, one of the targets under the United Nations Sustainable Development Goals (SDG 5.2) in 2016 to be achieved by 2030 is to eliminate violence against women and girls. This study aimed to determine factors associated with intimate partner violence (IPV) against women in Sri Lanka. The survey was carried out to study all forms of violence against women. A sample of 2264 individuals who were over 15 years, and 1849 women who had a male partner was drawn from the overall survey. The results show that 6.54% of women have faced IPV within the last 12 months prior to the survey. Three main approaches namely, the Support Vector Machine, Random Forest, and Logistic Regression were used to explore the associated factors with IPV. The Support Vector Machine didn't show good performance (Specificity =0, Accuracy =0.5). Of the Random Forest Model and Logistic Regression, the former showed better performance (Accuracy = 0.7351, AUC = 0.7900, Sensitivity = 0.7391, and Specificity = 0.6800 for the testing data set). Random Forest showed a higher importance for Partner's Alcohol Consumption from among the variables which it showed as being important. All variables the logistic model showed as important were also identified as important variables by Random Forest Model. These include alcohol consumption by the male partner and the age of woman, Physical violence since age 15, Partner has been beaten when he was a child were important factors for IPV. In addition, important variables shown by the Random Forest Model in the order of importance was partner's alcohol consumption, respondent's age, partner's age, partner choice (how the partnering happened), age at first union, age gap, ownership of capital, extra marital status, partner has been beaten when he is a child, partner's mother has been beaten by her partner, woman's mother hit by her partner, number. of children, physical violence since the age of 15 yrs, age at first sex, drug use, sector, woman's education level and the family respondent whom they are living with.

**Keyword:** *Intimate partner violence, Random Forest, Logistic Regression, SVM*

## Forecasting monthly Gross Sale Average of low elevation tea factories in Sri Lanka:

### A panel data approach

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The Sri Lankan tea industry is a significant contributor to the country's economy which contributes about 13% to the total export earnings while generating employment for over one million people in the country. Low elevation tea factories are an integral aspect of the industry, accounting for the highest share of national tea production every month which was 61% in 2020. This study aimed to develop a forecasting model for the monthly Gross Sale Average (GSA) of low elevation tea factories in Sri Lanka. Its importance lies in providing valuable insights and a mechanism to mitigate uncertainties faced by low elevation tea factories, specifically regarding tea price determination at the Colombo Tea Auction. The study employed the panel data technique, as it effectively accounts for both time-variant and time-invariant effects on tea prices, ensuring a comprehensive analysis that considers unobservable variables, aligning with the objectives of the study. The analysis was based on secondary data sources, where factory-wise monthly auction data of 14 factories, for a period of 4 years starting from 2017 was used for the model estimation. It was concluded that the Hausman Taylor (Time Effects) Estimation is the best model to predict the GSA of low elevation tea factories in Sri Lanka with a goodness of fit of 82.8%. The model evaluation further evidenced the model's performance and its generalization ability of predictions for unseen data with a Mean Absolute Percent Error of 4%. The study found that the total tea quantity sold by a factory at the auction, the main grade tea composition in total sold quantity, and the GSA of the previous two months, as the significant factors contributing to the prediction of GSA. The practical significance of these findings is wide-ranging, benefiting policymakers and factory owners, where they can leverage these outcomes to improve the competitiveness and productivity of Sri Lanka's tea industry.

**Keywords:** *tea prices, forecasting, gross sale average, panel data, Sri Lankan Tea Industry*

## Assessing protein level changes with Left-Censored Data in a limited sample size

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In laboratory work, low concentrations yield "non-detect" or "left-censored" readings that fall below the detection limit of the measuring instrument, demanding specialized statistical techniques to analyze such data. This study evaluates the impact of a treatment on three proteins while addressing left-censored data in small samples using recommended techniques to assess if higher dosages lead to increased protein responses. The dataset includes paired data from 20 subjects across four groups with increasing dosages, measured before and after treatment, with Group 1 serving as the control. Due to the paired nature of the data points, the censored sign test with Fong correction, censored sign rank test with Pratt modification, Paired Prentice Wilcoxon test, Censored Paired test with Q-Q plots were used to assess differences pre and post treatment. Censored ANOVA assessed mean differences, and Jonckheere Terpstra test evaluated group trends. The paired tests resulted in a significant difference pre and post treatment for all three proteins at 0.05 significance level. Q-Q plots confirmed normality assumption for censored paired test. Censored ANOVA followed by Tukey's contrasts detected a pre-treatment difference in protein 3 between the control and group 4. Post-treatment, all proteins showed group differences between the control group and the other dosage groups (2-1, 3-1, 4-1). Jonckheere Terpstra test, sensitive to subtle changes, confirmed significant concentration increases ( $p < 0.05$ ) in all three proteins, indicating group trends post-treatment. In conclusion, the treatment had a significant effect on protein levels, with dose variations influencing the outcome.

*Key words: left censored data, non-detects, limit of detection, Proteomic studies.*

**Relationship between the demographic variables and academic performance of  
Information Technology undergraduates under a Loan Scheme Program at a non-state  
university: A case study**

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In Sri Lanka, completing the G.C.E. Advanced Level Examination holds great significance for students, but only a few can gain entrance to government universities. To bridge this gap, the Ministry of Higher Education offers interest-free loans, allowing students rejected from government universities to pursue recognized degrees at non-state universities. This initiative benefits both students and the society at large, providing increased opportunities for higher education. The purpose of this study is to investigate the relationship between the demographic factors and academic performance of the undergraduate students in the Information Technology Faculty who are under the loan scheme program at a non-state university. GPA serves as the academic performance metric, while variables such as gender, province, A/L stream, A/L medium, z-score value, and O/L Mathematics, Science, and English results are compared to GPA values. All first - and second-year IT students enrolled in the faculty were included in the study and data was obtained with permission as secondary data from the faculty database and then a comprehensive descriptive analysis was conducted. There were 166 first year students and 121 second year students. Multiple linear regression models were fitted for the two batches using the best subsets regression method based on Mallows' Cp. Separate models were employed to address complexities, such as model assumption violations and intricate interaction effects. Assumptions of both models were also checked. The regression models revealed significant associations between GPA and demographic variables. Variables such as A/L medium, province, A/L stream, z-score, O/L English results, and O/L Mathematics results were significantly related to the GPA of first-year undergraduates, and province, gender, O/L English results, and O/L Mathematics results were significantly related to the GPA of second-year undergraduates.

**Keywords:** *Grade point average, Information Technology, non-state university, z-score value, Advanced Level, Ordinary Level, Mallows' Cp.*

## **Factors associated with homework completion among advanced level students: A case study**

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Research on homework habits of international school students, a fast-growing group within the student population of Sri Lanka, is sparse. This study aimed to fill this research gap at least partially through a complete enumeration of advanced level students (n = 138) in a leading international school on their perceptions about motivational factors, environmental factors, homework design and teacher feedback to investigate which factors were most associated with homework completion. A questionnaire was used to collect information on students' demographics (gender, grade, number of subjects studied, subject combinations and amount of homework regularly assigned), the response variable 'amount of homework completed' (measured under four levels), and their level of agreement with 33 statements (measured on a five-point Likert scale) that served as explanatory variables. Females were more likely to complete homework than males. Science stream students reported higher levels of homework completion compared to the others. A principal component analysis conducted for dimensionality reduction revealed five dimensions associated with homework completion similar to those found in more general studies of homework habits – distraction management, academic success, positive attitude, parental support, and teacher feedback. Ordinal logistic regression was used to model the relationship between these five dimensions and the amount of homework completed. It revealed that positive attitude, management of distractions, and academic success were highly significantly related to the amount of homework completed whereas teacher feedback was less significantly related. The results indicated that having a positive attitude towards homework while handling scholastic and non-scholastic activities and challenges, good management of physical and virtual distractions, and a strong desire for academic success were the factors leading to highest levels of homework completion among advanced level students. Further, the results indicated that teachers could facilitate a higher level of homework completion by marking and providing constructive feedback on homework that students submit.

**Keywords:** *homework, international schools, advanced level students*

## A Study on COVID-19 cases and deaths in Sri Lanka during 2021/22

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A novel coronavirus disease (COVID-19), first reported in Wuhan, China in the late 2019, rapidly spread to become a global pandemic. The newly introduced vaccine influenced the reported COVID-19 cases and deaths. The objective of this study is to investigate the association between the vaccination programme and the number of reported cases and deaths of COVID-19 and to develop suitable statistical models to forecast the weekly number of cases and deaths of COVID-19 in Sri Lanka. Identifying suitable modelling approach for forecasting number of COVID-19 cases and deaths using statistical techniques would be beneficial for the health care system to understand the trend and mitigate the effects of similar pandemic in the future. Secondary data were collected from the official website of Epidemiology Unit, Ministry of Health during January 2020 to December 2021. The dataset included the reported confirmed cases and deaths and the number of people vaccinated on a weekly basis. The time series plots and the cross-correlation plots were used to identify the patterns in data and association between the reported number cases, deaths and the vaccination status. Autoregressive Integrated Moving Average (ARIMA) models were fitted to identify a suitable model to forecast the weekly confirmed cases and deaths for the following three months. Before fitting the models, log transformation was applied to both series to stabilize their variances. Overall, during the study period, the reported number of cases and deaths were associated with the vaccination status of the population in the past. The reported number of deaths decreased after two months of third dose. A low case fatality rate (CFR) was observed after three months of the third dose. The forecasting models identified for the log transformed cases series is SARIMA (1,0,0) (1,0,0)<sub>13</sub> and that for log transformed deaths series is ARIMA (1,0,1). The ARIMA models can be used for short-term forecasting of the weekly numbers of cases and deaths. Future research should focus on applying Vector Autoregressive (VAR) models to investigate the impact of vaccination status on reported COVID-19 cases and deaths.

**Key words:** *novel coronavirus disease (COVID-19), COVID-19 cases and deaths, vaccination status, Autoregressive Integrated Moving Average (ARIMA) models*

## A potential *Eucalyptus* foliar pathogen reported from the Hanthana range in Sri Lanka

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The *Eucalyptus* plant genus was introduced to Sri Lanka in the 19<sup>th</sup> century. Due to its rapid growth, timber value, essential oils, and paper pulp, it is a preferred timber crop globally. However, a variety of root, trunk, and foliar diseases are known to impact eucalyptus plantations worldwide. There aren't many investigations on eucalyptus related pathogenic fungi done in Sri Lanka. This study reports the first occurrence of a putative pathogenic *Neofusicoccum* species in *Eucalyptus* trees in Sri Lanka. *Neofusicoccum* is a well-known fungal pathogenic genus that infects many economically important trees and crops, leading to significant economic losses. The fungus was isolated from leaves and young shoots showing black irregular spots on leaves and shoots of *Eucalyptus microcorys* trees growing in the Kandy (Hanthana) area. A total of 15 leaf and shoot samples were used for pathogen isolation by culturing surface-sterilized infected leaf tissue segments on potato dextrose agar (PDA). A single fungal morphotype was obtained from all tissue samples. The isolated fungus was identified to the genus level via micromorphological characters and rDNA sequencing of the ITS and LSU regions. A preliminary similarity search and phylogenetic analysis indicated that the isolated fungus is a *Neofusicoccum* sp. Pathogenicity tests on *E. microcorys* and other eucalyptus species in Sri Lanka are underway. Our studies thus far suggest that *Neofusicoccum* sp. may be one of the potential causal agents of the leaf spot disease seen in *E. microcorys* trees in the Hanthana range in the Kandy district of Sri Lanka.

**Keywords:** *Eucalyptus*, *Neofusicoccum*, leaf pathogens, Sri Lanka

## Potential role of endophytic fungal isolates from Sri Lankan black pepper (*Piper nigrum*) in plant growth promotion

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*Piper nigrum* L. (black pepper) belongs to the family *Piperaceae* and is referred to as the “King of Spices” and “Black Gold”. Traditional *P. nigrum* cultivars can harbor plant growth promoting endophytic fungi (PGPEF). In light of this, the purpose of this study was to identify and characterize PGPEF from *P. nigrum* cultivars in Sri Lanka. Putative fungal endophytes were isolated from tissues of six *P. nigrum* host plants from Ratnapura and Matale Districts in Sri Lanka and their plant growth promoting (PGP) traits were tested for ACC deaminase (ACCd) activity, siderophore production and inorganic phosphate solubilization. Siderophore type was determined using tetrazolium test (hydroxamates), Arnow’s assay (catecholates) and Vogel’s assay (carboxylates). Phosphate solubilization index (PSI) and siderophore producing index (SPI) were calculated. Each test was carried out in triplicates. Molecular characterization of fungal isolates was carried out by amplifying the ITS region. A total of 1776 endophytic fungi were isolated and based on the colony morphology and growth rate, 86 different morphotypes were identified. Out of 86 fungi, 17 (20 %) tested positive for ACCd production ranging from 741.9 - 3846 nmol g<sup>-1</sup> with a mean of 2107.2 nmol g<sup>-1</sup>. Tukey’s test (P < 0.05) showed significant differences among isolates with ACCd activity. A total of 51 fungi (59%) produced siderophores with SPI ranging from 1.3 – 3.6. Based on the colorimetric assays, 43 fungi (84%) produced hydroxamates, eight (16%) produced a mixture of hydroxamates and carboxylates and none produced catecholates type siderophores. Five isolates solubilized phosphate with an efficiency ranging from 7.89 – 10.46 µg L<sup>-1</sup> g<sup>-1</sup> and a PSI of 2.03 - 2.08. Highest ACCd activity, SPI and PSI were shown by *Fusarium* sp., *Diaporthe* sp. and *Aspergillus* sp., respectively. Based on the results, PGPEF isolated from *P. nigrum* look promising to be used in successful crop improvement. Colonization assays and pot trials for promising PGPEF will be carried out in the future.

**Keywords:** *P. nigrum*, Endophytic fungi, Plant growth promotion



## **A novel polyherbal distillate stimulates melanogenesis: A Safe and Cost-Effective Alternative for Depigmentation Disorders and skin tanning alternatives**

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Vitiligo is an acquired pigmentary disorder characterized by the loss of melanocytes, with a prevalence of 0.1 – 8% globally and 1.22% in Sri Lanka. It imposes a significant psychological impact on patients, with increased vulnerability to skin cancers more than the cosmetic concerns. It affects all age groups of both sexes, commonly in the age range 10-30 years. Treatment modalities including topical treatments and UV-based therapies aim to halt disease progression and encourage re-pigmentation, which are expensive and pose side effects. Furthermore, tanning practices among less pigmented western populations may lead to skin cancer due to excessive UV exposure. We aimed to explore a safe and cost-effective approach to stimulate melanocyte activity for vitiligo treatment and skin tanning alternatives using natural phytochemicals selected based on cues from Sri Lankan traditional medicine. The polyherbal distillate of fresh fruits and leaves of *Ficus hispida* and *Cassia alata* plants (FCD) was prepared by using both plants in 1:1 ratio and tested on primary melanocyte cells isolated from surgical foreskin waste. Both test and control experiments were performed on melanocytes isolated from the same individual. Compared to the control, treatment with FCD concentrations ranging from 1% to 0.0625% demonstrated a significant increase in melanogenesis ( $P < 0.05$ ), with the maximum effect observed in concentrations between 0.75% and 0.25%. Notably, the test group without UV radiation exposure exhibited higher melanin production than the group exposed to UV radiation ( $p < 0.05$ ). Additionally, the FCD treatment also significantly increased the levels of the tyrosinase enzyme, a key regulator of melanin production, at 0.75%, 0.5%, and 0.25% of FCD compared to the controls ( $P < 0.05$ ). Yet again, the group without UV exposure displayed higher tyrosinase levels ( $p < 0.05$ ). Gene expression of the treated melanocytes was analysed with GAPDH normalization. FCD treatment led to significantly upregulated MITF (150-fold) and TyPR1 (17.5-fold) melanogenesis associated genes. In conclusion, FCD showed great potential in ameliorating melanogenesis sans UV exposure. This non-toxic, natural, and cost-effective approach holds much promise for developing novel treatment modalities for depigmentation disorders, particularly vitiligo and for cosmetic tanning.

**Keywords:** *Vitiligo, Melanogenesis, Skin pigmentation, Skin tanning, Phytochemicals*

**Preliminary study to detect the associations between FLT3 positivity/negativity on peripheral blood mononuclear cells, FLT3 ligand level in plasma, and peripheral white blood cell counts in newly diagnosed NHL patients and healthy individuals**

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FLT3 (FMS-related-receptor-tyrosine-kinase 3) and FLT3 ligand (FL) have an important role in the proliferation of leucocytes and FL suppresses lymphomas. Several abnormal cellular mechanisms are governed through mutations/overexpression of FLT3. Therefore, the FLT3/FL system is investigated as a therapeutic target. Even though Non-Hodgkin-lymphoma (NHL) is a major type of lymphoma, this system is not well studied in the peripheral blood of NHL patients. This study aims to detect FLT3 in peripheral-blood-mononuclear-cells (PBMNCs) by flow cytometry, FL levels in plasma by ELISA in new NHL patients, and healthy individuals and compare them with the absolute-white-blood-cell (WBC) counts. The study was carried out at Apeksha Hospital, Maharagama. EDTA blood was analyzed to detect FLT3/FL in NHLs (n=8) and healthy individuals (n=7). Healthy and NHLs were divided into 04 subcategories (Healthy-I; FLT3 negative, FL<10pg/mL), (Healthy-II; FLT3 negative, FL=10-100pg/mL), (NHL-I; FLT3 positive, FL<10pg/mL) and (NHL-II; FLT3 negative, FL=10-100pg/mL) and analyzed by SPSS-26: Mann-Whitney test to detect significant differences in WBC count, Absolute-Neutrophil-Count (ANC), Absolute-Lymphocyte-Count (ALC), Absolute-Eosinophil-Count (AEC), Immature-Granulocytes (IMG), Neutrophils/Lymphocytes (NLR), and Lymphocytes/Monocytes (LMR). Healthy individuals were FLT3(-). Only NHL-I has shown FLT3 (+) since NHL-II has shown FLT3 (-) PBMNCs. Significantly higher (p<0.05) total-WBC, ANC, NLR, IMG, and lower (p<0.05) ALC, AEC, and LMR were detected in NHL-I than in Healthy-II. Significantly higher (p<0.05) ANC, NLR, IMG, and lower (p<0.05) ALC, AEC, and LMR were detected in NHL-I than in Healthy-I. NHL-I has shown significantly higher ANC, IMG, and lower AEC compared to NHL-II. FLT3 (+) NHL-I group has shown a lower ligand level and higher deviation from healthy groups. Abnormalities of FLT3 cause increased severity and also the lower ligand level may cause reduced immunity since LMR was lower in NHL-I. The prognosis of the NHL-I group is currently being monitored and the sample number is increased to gain a strong conclusion.

**Keywords:** *Non-Hodgkin Lymphoma, FLT3/FL, white blood cells and cell ratios*

## Intake estimation of antioxidant constituents (total phenolics and flavonoids) through consumption of cooked rice (*Oryza sativa L.*) using dietary data from Sri Lankan households

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Rice (*Oryza sativa L.*) is the staple cereal grain in Sri Lankan household meals. It is a rich source of bioactive antioxidant compounds such as; phenolics and flavonoids. Dietary intake of these antioxidants may help reduce oxidative damage induced by hazardous chemicals and environmental contaminants implicated in many chronic disorders. This study aimed to estimate the dietary intake of total flavonoids(TFC) and total phenolics(TPC) through consumption of cooked rice, per meal basis using consumption patterns in typical Sri Lankan households. Twenty-five composite rice samples from ten commonly consumed rice varieties were cooked (1:2.25 V/V, rice:water) using a standardized domestic cooking process. Aqueous extracts of lyophilized cooked grain powders were quantified spectroscopically(triplicates) for TPC and TFC using Folin-Ciocalteu and Aluminium chloride assays respectively. Results were expressed as Gallic Acid Equivalents(GAE) and Quercetin Equivalents(QE) mg g<sup>-1</sup> dry weight basis(dw) of cooked grain flour. The moisture content factor(%MC<sub>Lyophilize</sub>) was employed to extrapolate the levels in mg g<sup>-1</sup> wet weight basis(ww). Sri-Lankan household rice intake data across several geographical locations, were used to calculate, per meal estimation of antioxidants. The mean(±SD) %MC<sub>Lyophilize</sub> in cooked rice grains( $n_1=25$ ) was 47.52(±0.56)%. The mean(±SD) and median(IQR) TPC in cooked grains were; 0.91(±0.09), 0.73(1.17–0.5)mgGAEg<sup>-1</sup>ww. For TFC, the mean and median values were; 0.73(±0.03) and 0.70(0.81 – 0.63) mgQEg<sup>-1</sup> ww. The mean per meal rice intake by a Sri Lankan adult( $n_2=41$ ) was 267.41(±60.66)g. The mean and median TPC intake per meal was 242.25(±22.73) and 194.89(311.60–156.81) mgGAEg<sup>-1</sup> ww respectively. The mean and median intake of TFC per meal basis were 195.35(±6.72) and 187.71(215.56–168.63)mgQEg<sup>-1</sup>ww. Consumption of traditional, red, parboiled grains provided an additional 65.64%,39.53%,54.79% of TPC and 28.61%,17.75%,16.58% of additional TFC respectively, compared to improved, white, non-parboiled grains ( $U, p < 0.05$ ). Rice rich Sri Lankan typical household diet would be a good source of natural antioxidants which may help reduce chronic disease burden. Incorporating traditional, pigmented, parboiled grain in daily meals will provide additional Nutra-pharmaceutical benefits.

**Keywords:** Rice, *Oryza sativa L.*, antioxidants, Sri Lankan diet, bioactive compounds, dietary intake

## Identification of potential areas for aquaculture using spatiotemporal dynamics of water quality in the Rekawa Lagoon

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Aquaculture provides many socio-economic benefits to society, including protein supply and livelihood opportunities. Rekawa Lagoon (240 ha) is a shallow brackish water body in southern Sri Lanka, where fishing is the main livelihood of the communities. Several natural and anthropogenic factors affect lagoonal fisheries. This study focuses on identifying the aquaculture potential areas in the lagoon using the spatio-temporal dynamics of water quality collected from January 2021 to July 2023, considering four monsoon periods: North-east (NE), 1<sup>st</sup> inter monsoon (1IM), South-west (SW) and, 2<sup>nd</sup> inter monsoon (2IM). All physicochemical parameters were measured in accordance with the APHA standard methods at eight sampling locations. Data analyses were performed using ArcGIS 10.8 and the SPSS statistical package. The study revealed that the average water temperature of the lagoon was (mean  $\pm$  SD)  $29.66 \pm 1.35$  °C, whereas salinity, pH, DO, depth, EC, nitrate-N, and phosphate-P were recorded as  $7.62 \pm 3.38$  ppt;  $7.81 \pm 0.87$ ;  $8.09 \pm 4.43$  mg/l;  $94.13 \pm 54.97$  cm;  $29.69 \pm 0.51$  mS/cm;  $0.64 \pm 0.33$  mg/l, and  $0.43 \pm 0.13$  mg/l respectively. One-way ANOVA indicated that the mean values of salinity (NE:  $5.69 \pm 2.42$ , 1IM:  $7.63 \pm 2.66$ , SW:  $8.33 \pm 3.2$ , 2IM:  $8.97 \pm 4.65$  ppt), pH, and DO were significantly different ( $p < 0.05$ ) between the four monsoons. Further, it showed that the average values of salinity, depth, and temperature were significantly different ( $p < 0.05$ ) between sampling locations. Results revealed that the salinity levels of the lagoon were increasing from the NE monsoon to the 2IM period. Spatial distribution maps indicated that the highest salinity level was recorded in the narrow channel region of the lagoon in all monsoon periods. Therefore, the maximum depth (1.5-2.5 m) and higher salinity of that region are suitable for introducing seabass cage culture as a livelihood development activity.

**Key words:** Lagoons, aquaculture, physico-chemical parameters

## Community perception of lagoon Ecosystem Services and conservation priorities: a case study from Rekawa Lagoon, Sri Lanka

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Understanding how local communities perceive the importance of lagoon ecosystem services (ES) is essential for empowering communities and supporting decision-makers to define priorities and objectives for the sustainable management of lagoon resources. Most lagoon management activities have failed due to the lack of local participation. Further, community perception of decision-making is very rare in Sri Lankan lagoon management. Therefore, this study was undertaken to reveal local people's perspectives and depth of knowledge on ES in the Rekawa Lagoon, Sri Lanka. The objectives of this research were to identify and prioritize the ES offered by the lagoon and record the recent pressures on lagoon ecosystem. The study was carried out between August and November 2022 with 65 participants. Ten focus group discussions were conducted, and scoring and ranking of ES were used as participatory tools. Twenty-two ES were identified for the lagoon. Provisioning services were the mostly identified ES, accounting for 81% of the overall responses, followed by cultural (53%), supporting (48%), and regulating (25%) services. Lagoonal fisheries were the most important ESs of the lagoon since most locals are artisanal fishermen who depend on fishing for their livelihood and income generation. Women identified some unique ESs including coir retting, supplying water, coconut fronds industry and, providing firewoods. Problems regarding the Kapuhenwala bridge, declining fisheries, illicit fishing, spreading of exotic plants, and conflicts between people over lagoon resource utilization were identified as the main pressures on the Rekawa lagoon. It is recommended to control overfishing by using illegal fishing gear and reduce excessive nutrient inputs to the lagoon. Further, restocking of fingerlings and introducing aquaculture practices are important to enhance fisheries in the lagoon. For sustainable lagoon management, it is essential to develop policies considering community knowledge and experiences. Deeper understanding of local stakeholders' views and knowledge of lagoon ES combined with scientific data will be helpful for effective and sustainable management of lagoon ecosystems.

**Key words:** *Community perception, lagoon management, ecosystem services, fisheries*

## **LULC changes in urban wetlands: Case study in Muthurajawela wetland, Sri Lanka using intensity analysis method**

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Land Use and Land Cover changes (LULC) can be used as a critical indicator to identify developmental pressure on the natural environment. The Intensity Analysis method serves as a mathematical framework to identify the temporal changes of the categories within different LULC classes. Muthurajawela area faces threats from LULC changes hence assessing LULC changes are vital. The present study investigated the spatiotemporal intensity changes in both the Muthurajawela Wetland (MW) and its Buffer zone (ranging up to 5 km). The Remote Sensing images with 30m resolution, from Landsat 5 and Landsat 8 for the years from 2000-2009 (Ta) and 2010-2021 (Tb) were selected, median images were calculated with the Google Earth Engine. Iso Cluster Supervised Classification was conducted with ArcMap 10.8 to classify the area into different classes representing waterbodies, thick vegetation, other vegetation (small bushes, sparsely distributed vegetation etc), settlements, and open area. The Pontius Intensity Calculation method was employed to identify the changes in LULC dynamics. The classification accuracy for the study was over 80%. Land use changes have been different between the wetland and the buffer. In the wetland, waterbodies have decreased by 19.4% and the total gain of settlements was 19.1%. Transition intensity (TI) was highest in the conversion of the water body to open area, reaching 6.75% (Ta). Transformation of other vegetation to settlement demonstrated a rate of 8.1% (Ta) and 5.79 % (Tb). In the Buffer zone, the other vegetation showed a prominent decrease of 33.7% and an increase of settlements by 39.4%, during the entire period. The TI of changes from other vegetation to settlement was 5.97% (Ta), to thick vegetation 3.02% (Tb) and to open area 2.90% (Tb). The results indicate that the buffer zone was under heavy anthropogenic influence compared to the wetland which calls for urgent management actions.

**Keywords:** *Muthurajawela wetland, Land Use Land Cover, Intensity analysis, Remote Sensing*

## Optimization of a qPCR to detect six avian respiratory viruses

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Migratory waterbirds can transmit different pathogens to domestic and wild animals during their migration. Many birds harbor common viral diseases with zoonotic potential. Monitoring and identifying these diseases are important for preventing disease transmission. The objective of this study was to optimize the magnesium concentration and thermal profile of a TaqMan qPCR assay to identify six avian respiratory viruses. In this study, Highly Pathogenic Avian Influenza virus (HPAI), New Castle Disease Virus (NDV), Infectious Bronchitis Virus (IBV), Infectious Laryngotracheitis Virus (ILTV), fowl pox (APV) and avian adenovirus (ADV) specific gene sequences (IFV: PA protein, NDV: Fusion protein, IBV: Spike protein, ILTV: Envelope G protein, APV:P4b protein and ADV: Hexon protein) were used to design these six respiratory viral assays. Primers and probes were designed using selected genes from each viral strain. Synthetic oligonucleotides were designed as positive controls. Synthetic positive controls were diluted from 10<sup>-1</sup> to 10<sup>-9</sup>, and 10<sup>-6</sup> was used as the sample to test the qPCR reaction. Standard qPCR reaction was performed for the designed primers and probes. The qPCR was optimized using different Mg<sup>2+</sup> concentrations (1 mM, 1.5 mM, 2 mM, 2.5 mM, and 4 mM). The annealing temperature of qPCR cycles was changed between 50 °C, 58 °C, and 60 °C. Migratory waterbird specimens were collected from December 2021 to March 2022 by trained ornithologists. Nucleic acids were extracted using QIAmp Viral RNA mini kit. Optimized Mg<sup>2+</sup> concentration and annealing temperature were used with a synthetic positive control to analyze the cloacal swabs of the captured waterbirds. After performing the qPCR, all the primers and probes of six viruses worked with 2 mM of Mg<sup>2+</sup> concentration and 60 °C annealing temperature. The Ct values of each virus varied between 24 to 32 (IFV: 24, NDV: 26, IBV:30, ILTV: 30, APV: 32 and ADV:28). However, samples were found to be negative for the six viruses taken from the wild. For this study, only the ion concentration and annealing temperature increased the reaction performance. After the optimization, these assays can be used to identify emerging zoonotic respiratory diseases.

**Keywords:** *Avian respiratory diseases, qPCR, PCR optimization*

## **Proposals for robust e-waste management law for Sri Lanka: Perceptions of experts**

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Increasingly, the volume of generated solid waste including waste of electric and electronic equipment, has reached a magnitude worldwide. The area is novel and has gained the attention of legal professionals in progressing green laws. The main objective of this research is to assess the perception of subject related experts for the introduction of robust laws for the Sri Lankan legal regime for e-waste management. Key component interview method was utilized to collect data. MS Excel, and QDA miner lite software were used for data analysis. The data analysis revealed that forty seven percent of experts were aware of existing laws and forty five percent were not aware, while eight percent were vaguely aware. Furthermore, thirty two percent strongly advocated for the urgent need of e-waste management related procedures focusing collection, transport, storage, dismantling, recycling, disposal, licensing, domestic and corporate sector and hazardous waste management. Twenty one percent suggested that 3R (Reduce, Reuse, Recycle) and Extended Producer Responsibility principle could be adapted. Out of 52 experts, fifteen percent mentioned that Sri Lanka requires new guidelines/standards in relation to e-waste management and sixteen percent provided other related proposals. Nine percent of the experts stated they do not have clear ideas, and new laws for the import and export of electric and electronic items were urged by seven percent. In conclusion, the survey highlights the findings that: 1) there is a current legal vacuum with respect to current legislation for e-waste management; 2) the existing policies regarding other waste, could be used as a basis for developing e-waste specific legislation; 3) there is lack of awareness among experts with regards to e-waste legislations; 4) it is likely that an optima approach to develop new laws will rely on combining the best of current Sri Lankan environmental legislation with lessons learned internationally.

**Keywords:** *e-waste management, pollution mitigation, Sri Lankan law, EPR principle, 3R principle*



## Genetic affiliations of the Sri Lankan aboriginals (“Veddahs”) to local ethnicities based on seven X-chromosomal short tandem repeat loci

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The Sri Lankan aboriginals (“Veddahs”) despite the supposed importance held as descendants of the first inhabitants of the island, have dwindled in number to a few thousand individuals, while the other ethnic groups have continued to thrive. Nevertheless, their local genetic identity has only been limitedly explored so far, using only a handful of markers. This study aimed at discerning the genetic relatedness of the “Veddahs” to four main local ethnicities (Sinhalese, Sri Lankan Tamils, Indian Tamils, Moors) using neutral but polymorphic X-chromosomal short tandem repeat (STR) markers. Thus, seven X-STR markers of two linkage groups (DXS10148-DXS10135-DXS8378, DXS7132-DXS10079-DXS10074-DXS10075) were utilized. Finger-pricked blood from 50 unrelated “Veddahs” in “Dambana” (50% male) was used to extract DNA by the Chelex-100 method, which was then amplified using a previously published multiplex PCR system. Locus-by-locus analysis of molecular variance (AMOVA) was performed through Arlequin 3.5.2, by comparing the “Veddahs” against present-day descendants of the migrants who settled in Sri Lanka post 543 B.C. based on previously published genetic data. Fis and pairwise Fst were calculated for all pairs of populations using Arlequin 3.5.2. Allele frequencies of each marker showed a large variability; DXS10148(0.0135-0.2027), DXS10135(0.0135-0.1487), DXS8378(0.0541-0.6622), DXS7132(0.0405-0.3919), DXS10079(0.0270-0.3784), DXS10074(0.0270-0.2432), DXS10075(0.0135-0.4730). Locus-by-locus AMOVA indicated the “Veddahs” to significantly differ from the rest of the ethnicities by 1.89% (FCT=0.0189, P=0.0001). The variation among the local ethnicities was only of 0.21% (FSC=0.0021, P=0.0007). Fst (0.0141-0.0246) indicated a similar statistically significant (P=0.0000) genetic subdivision of “Veddahs” from other ethnicities. Fis for the “Veddahs” was recorded as -0.0047 (P=0.5775), denoting the absence of inbreeding among all other populations which depicted positive Fis. This high interpopulation divergence could have been caused by the strong genetic separation of the endogamous “Veddahs” paired with the effects of genetic drift. Despite their strong endogamy, the absence of inbreeding within the population was noteworthy.

**Keywords:** *analysis of molecular variance, Fst, genetic subdivision, local ethnicities, X-STR*

# **Faculty of Technology University of Colombo**



*Research for Technological Advancement*

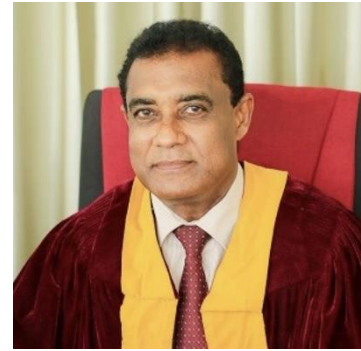
06<sup>th</sup> November 2023

## MESSAGE FROM THE DEAN

**Prof. Ranjana U.K. Piyadasa**

Dean, Faculty of Technology

University Colombo



With an honor and pleasure, I warmly welcome you all to the Annual Research Symposium of the Faculty of Technology 2023. After several years of virtual and hybrid mode conferences due to the pandemic and crisis situations in the country in past few years, this year we gather again for a fully onsite research symposium. Our symposium organized under the theme of “Research for Technological Advancement” provides a space for staff and the students of the Faculty of Technology to present their significant and innovative research findings in diverse disciplines of Technology. Further, this symposium brings together the leaders from industry, academia, government agencies and other institutions to exchange knowledge and ideas of the recent advancements in Technology.

This year we received a notable number of high-quality research articles, covering a wide spectrum of themes related to Agricultural Technology, Environmental Technology, Automation and Instrumentation Technology and Information and Communication Technology. The papers were peer reviewed by a panel of qualified reviewers from academia and the industry. The program of our symposium features two astonishing keynotes by an international and a local eminent scientist. Also, we have a rich technical program comprised of oral presentations delivered in three parallel sessions. I am sure that each one of you will find your interested topic or theme within our program and will benefit from the enriching discussions. Further, an exhibition of the new inventions by the undergraduate students of the Faculty of Technology, is hosted during the symposium to showcase how the knowledge gained by the students during their undergraduate program has led to inventions. In addition, a networking session will also be conducted.

I congratulate and thank the efforts of all the authors and presenters for the excellent technical program of the ARS FOT 2023, and I wish to extend my sincere thanks to the organizers of this symposium for having brought us together through this wonderful event. I hope that you all will have a productive and a memorable symposium.

## MESSAGE FROM THE SYMPOSIUM CHAIR

**Dr. (Mrs.) Poorna C. Piyathilaka**

Senior Lecturer

Department of Environmental Technology

Faculty of Technology

University of Colombo



It is my pleasure to serve as the Symposium Chair of the Annual Research Symposium 2023 of the Faculty of Technology (ARS-FoT 2023) which will be held on the 6th of November 2023 under the theme of “Research for Technological Advancement”. The goal of the ARS-FoT 2023 is to bring together a diverse group of staff and students of the Faculty of Technology to share ideas and explore innovative work carried out by them which leads to Technological Advancement.

We are delighted to have Senior Prof. H.D. Karunaratne, the Vice Chancellor of the University of Colombo as the chief guest and Prof. Takeshi Fujino, Head of the Graduate School of Science and Engineering, Saitama University, Japan and Prof. Mahesh W. Jayaweera, Professor, Department of Civil Engineering University of Moratuwa, Sri Lanka as the keynote speakers of the event.

I would like to greatly appreciate the continuous guidance and support of the Dean, Faculty of Technology, Professor Ranjana U.K. Piyadasa to make this event a success. I wish to thank everybody involved in organizing the Annual Research Symposium 2023 of the Faculty of Technology, particularly the members of the organizing committee, the session chairs, and the numerous volunteers, without whose generous contributions this symposium would not set another new recorded number of publications. I hope this conference would provide an opportunity for the participants to be engaged in a productive discourse for not only in spanning their knowledge but also in sharing their findings of research leading to technological advancements.

## **ORGANIZING COMMITTEE**

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Dr. B. L.S. Thilakarathne, Senior Lecturer, Department of Instrumentation and Automation Technology

## **Annual Research Symposium 2023**

**Faculty of Technology**

**University of Colombo**

**06<sup>th</sup> of November 2023 from 8.15 a.m. to 5.00 p.m.**

### **Agenda**

- 08:15 AM Registration
- 08:30 AM Lighting of the Oil Lamp
- 08.35 AM National Anthem
- 08.40 AM Welcome Address by Prof. Ranjana U.K. Piyadasa  
Dean, Faculty of Technology
- 08:50 AM Video clip - Overview of the Research Activities of the Faculty
- 09.00 AM Address by Senior Professor H.D. Karunaratne  
Vice Chancellor, University of Colombo
- 09.10 AM Tea Break/Innovation Exhibition
- 09.55 AM Keynote Address 01: Creating local SDGs that lead to a future full of  
hope and vitality by Prof. Takeshi Fujino, Saitama University Japan
- 10.55 AM Keynote Address 02: Beyond the lab: Dreaming big for technological  
breakthroughs by Prof. Mahesh Jayaweera, University of Moratuwa
- 11.55 AM Vote of Thanks by Dr. Poorna C. Piyathilaka  
Symposium Chair ARS FOT 2023
- 12.00 PM Lunch Break
- 01.00 PM Parallel Technical Sessions
- 03.15 PM Tea Break
- 03.30 PM Parallel Technical Sessions
- 05.00 PM Concluding Remarks

## INTRODUCTION TO THE KEYNOTE SPEAKER

### **Professor Takeshi Fujino**

Head of Interdisciplinary Education Program for Applied Science  
and Technology in Global Environment  
Graduate School of Science and Engineering  
Saitama University Japan



Professor Takeshi Fujino earned his Bachelor of Engineering degree specialized in Civil Engineering from Utsunomiya University Japan. Later, he graduated his Master of Engineering in Civil Engineering and PhD in Biological and Environmental Sciences from Saitama University Japan. Professor Fujino started his academic career as an assistant professor at the Department of Environmental Science and Technology of Saitama University Japan and currently working as the Head of the Interdisciplinary Education Program for Applied Science and Technology in Global Environment at the Graduate School of Science and Engineering of Saitama University. He also serves as an Associate Professional Engineer (As.P.E.Jp) in Environment, Pollution Control Manager in Water Environment, River Counselor in Ministry of Land, Infrastructure, Transport and Tourism and Class-1 Health Supervisor in Ministry of Health, Labour and Welfare in Japan.

Professor Fujino focusses on the research in Technologies to Reduce Environmental Impact, Water Environment and Ecosystem Conservation, and Biomass Utilization and Urban Thermal Environment Measures. Further, he is an active researcher in the research group for Sustainable Development in East Asia.



## KEYNOTE ADDRESS

**Professor Takeshi Fujino**

### **Creating local SDGs that lead to a future full of hope and vitality**

Saitama University conducts diverse research activities that contribute to the development of a sustainable society in harmony with the environment. Here, integrated approaches to realize a sustainable economy and society, such as domestic cultivation of tropical plants that may contribute to urban greening and water quality conservation, and solutions to the problem of environmental destruction in Africa is introduced.

The amount of CO<sub>2</sub> fixation was calculated for the first time from the amount of growth of a tropical plant, "Moringa" (Japanese name: Wasabi-no-ki), that is cultivated with a local joint venture in a field in danger of being abandoned due to aging.

Three CO<sub>2</sub> kg per tree has more than twice the fixation capacity of a cedar tree. This site fixes approximately 5 tons of CO<sub>2</sub>. After harvesting, Moringa leaves and branches are purchased by food companies and distributed as fresh pasta and health supplements for sports. The remaining large amount of trunks and roots will be turned into activated carbon as biomass. Flowers and pollination have been confirmed, and next year the nation's first domestically produced Moringa will be born.

Fortunately, the moringa forest has been accepted by the surrounding farmers, and although the scale of the project is currently small, it will be involved in the "transition to a decarbonized society," "nature revitalization efforts," and "transition to a circular economy," and will be developed into a regional ESG finance promotion project in the future. In addition, we are currently conducting joint research with Cameroon, Africa, and plan to expand the project to environmental conservation research, as it not only has excellent nutritional value, but also has the ability to purify water.

## INTRODUCTION TO THE KEYNOTE SPEAKER

### **Professor Mahesh Jayaweera**

Department of Civil Engineering

University of Moratuwa



Professor Mahesh Jayaweera earned his B.Sc. in Civil Engineering from the University of Moratuwa, Sri Lanka, and later obtained a Ph.D. in Environmental Engineering from Saitama University, Japan. He has a rich academic background and has collaborated with over ten countries, demonstrating a commitment to global knowledge exchange and cooperation. Currently, Professor Jayaweera is a distinguished Environmental Engineering professor at the University of Moratuwa, Sri Lanka. He is a Chartered Engineer and a member of the Institute of Engineers, Sri Lanka, the Institute of Environmental Professionals, Sri Lanka, and the International Water Association. His dedication to the field of Environmental Engineering spans more than three decades, making him a renowned expert in the domain of environmental technology advances.

Professor Jayaweera recently contributed his expertise as an advisor on environmental-related projects for the Ministry of Megapolis and Western Development, Sri Lanka. Throughout his career, he has undertaken more than 200 governmental and non-governmental assignments related to environmental technology themes. His extensive experience includes involvement in projects funded by prominent organizations such as ADB, AFD, JBIC, and the World Bank.

As a prolific researcher, Professor Jayaweera has explored diverse areas within the field and has made significant contributions, publishing more than 70 journal and conference papers. His dedication to advancing environmental engineering and technology is evident in his impressive body of work and his unwavering commitment to addressing global environmental challenges.

## KEYNOTE ADDRESS

Professor Mahesh Jayaweera

### **Beyond the lab: Dreaming big for technological breakthroughs**

The intersection of technology networking with Biosystems Technology (BT), Engineering Technology (ET), and Information and Communication Technology (ICT) is reshaping our world in unprecedented ways. This note navigates the global implications of research within these domains, revealing how collaborative efforts transcend geographical borders and disciplinary boundaries to tackle pressing challenges and catalyze innovation on a worldwide scale.

***Sustainable energy revolution:*** Across continents, the sustainable energy revolution is taking hold. Europe's offshore wind farms, harnessing ET and ICT for optimal performance, exemplify a global shift toward renewable energy. Meanwhile, Asia leads the way in innovative solar energy technologies incorporating biosystem principles for enhanced efficiency. These developments showcase that the pursuit of sustainable energy is a shared global endeavor, transcending national borders.

***Precision agriculture for global food security:*** The imperative of global food security is being addressed through precision agriculture, an approach that integrates BT, ET, and ICT. North America's adoption of precision agriculture techniques has allowed farmers to optimize yields and reduce resource usage. This model is replicated in Sub-Saharan Africa, where BT and ICT are empowering smallholder farmers to increase productivity and resilience. It is a collaborative effort that transcends continents, with the shared goal of feeding a growing global population.

***Bridging the digital divide for inclusive access:*** The digital divide, which restricts equitable access to information and opportunities, is bridged through technology networking that incorporates ICT and ET. Initiatives like Latin America's "One Laptop per Child" program extend digital education and resources to underserved communities. Simultaneously, Africa leverages mobile technology, interwoven with biosystems principles, to provide access to education, healthcare, and economic opportunities to marginalized populations. These examples exemplify how technology networking is a catalyst for global inclusion, transcending traditional boundaries.

***Global health solutions through biosystems and ICT:*** Global health challenges are being addressed through the integration of BT and ICT, enabling improved healthcare delivery, disease monitoring, and medical research. During the West Africa Ebola outbreak, real-time disease monitoring systems, driven by ICT, facilitated rapid containment efforts. South Asia's development of low-cost diagnostic tools, enabled by BT, extends healthcare access to remote areas. These instances highlight how research in technology networking can have a life-saving global impact.

***Smart cities: A global urban transformation:*** Urbanization is accelerating worldwide, and cities are at the forefront of innovation. The convergence of technology networking with ET and ICT is ushering in smart cities that optimize sustainability, efficiency, and quality of life. Cities like Dubai and Doha in the Middle East and Toronto and San Francisco in North America are embracing technology to enhance urban living. These global initiatives signify a shared

commitment to addressing urban challenges through technology networking transcending national borders for the betterment of urban life.

***Global innovation ecosystems:*** Innovation ecosystems are thriving on a global scale, attracting talent and resources from around the world. Silicon Valley is a prime example, serving as a hub for technology networking that fosters collaboration and entrepreneurship on a global scale. Similar innovation hubs have emerged in Bangalore, Tel Aviv, and Shenzhen, embodying the globalized nature of technology networking. These ecosystems transcend national boundaries, highlighting the collaborative potential of a connected world.

***Cross-disciplinary research for global solutions:*** At the core of my theme is the convergence of BT, ET, and ICT. This cross-disciplinary approach transcends traditional academic silos and unlocks new frontiers of innovation. European researchers in BT collaborate with engineers to develop biocompatible materials for medical devices, leading to groundbreaking advancements. These collaborations, not bound by geography, represent a global effort to address pressing challenges through cross-disciplinary research.

***Environmental conservation and global biodiversity:*** Preserving global biodiversity and conserving natural resources are shared global imperatives. Technology networking, including the utilization of BT, plays a pivotal role in these endeavors. In the Amazon rainforest, advanced BT is employed to monitor wildlife populations and combat deforestation. Similar initiatives are found in Africa, where technology networking aids in protecting endangered species from poaching. These efforts greatly support conservation and environmental preservation's collaborative, international nature.

Technology networking, driven by BT, ET, and ICT, transcends borders and disciplines to shape our world. It fuels global innovation, fosters collaboration, and addresses critical global challenges, paving the way for a more sustainable and inclusive future for all. It is a testament to the power of global collaboration in an interconnected world.

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## Anti-glycation and Sensory Properties of *Costus speciosus L.* (Thebu) Tea

S.H.S.D. Senarath<sup>1</sup>, W.K.S.M Abeysekera<sup>1</sup>

<sup>1</sup>*Department of Agricultural Technology, Faculty of Technology, University of Colombo, Sri Lanka*

Tea is the most widely consumed beverage next to water. Medicinal teas have been linked to potential health benefits in the prevention and management of non-communicable diseases (NCDs). *Costus speciosus L.* (Thebu) is a medicinal plant well reported to have a wide range of pharmacological properties. We have developed Thebu teas from immature, partially mature, and mature leaves of *Costus speciosus L.* and showed that those had desirable physicochemical and a range of anti-oxidant properties. This study evaluated the anti-glycation and sensory properties of said Thebu teas for further value addition. A Thebu tea brew was prepared by adding a tea bag (2.00 g of dried leaves) into 200 mL of boiling water. Freeze-dried tea brew at concentrations of 50, 100, and 200 µg/mL were used to evaluate anti-glycation activity using the Bovine Serum Albumin (BSA)-Glucose model (n=3 each). For sensory evaluation, an in-house trained panel (n=12) at the Faculty of Technology, University of Colombo was used. Seven-point hedonic tests were used in the sensory study. Results showed that Thebu tea prepared from all maturity stages had anti-glycation activity with significant differences ( $P < 0.05$ ) among the samples. The  $IC_{50}$  values of Thebu tea formulated from immature, partially mature, and mature leaves were  $273.79 \pm 6.93$ ,  $185.24 \pm 0.41$ , and  $128.47 \pm 2.82$  µg/mL respectively. The observed activity was moderate compared to the reference standard Rutin ( $IC_{50}$ :  $23.25 \pm 6.08$  µg/mL). In sensory studies, Thebu tea formulated from partially mature leaves exhibited the best sensory attributes in terms of flavor, taste, colour, and overall acceptability compared to the other two maturity stages. Considering all, it is concluded that, Thebu tea formulated from partially mature leaves has the greatest potential as a value-added functional beverage that can be commercialized in the long run.

**Keywords:** *Thebu tea, anti-glycation properties, sensory properties*



# Assessment of the Community Perceptions and Local Knowledge on Socio- ecological Resilience in Urban Wetlands: A Case Study of the Colombo Wetlands, Sri Lanka

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Urban wetlands are essential ecosystems that play a pivotal role in advancing sustainable development within urban eco-environments. Understanding community perceptions is paramount to grasping urban residents' attitudes towards the benefits derived from these habitats, thus shaping effective wetland management strategies. This paper seeks to evaluate shifts in community perceptions concerning the social, economic, and ecological resilience of urban wetlands within the Colombo Wetlands from 2017 to 2023, while identifying influential factors. A systematic ecological approach was employed to define the boundaries of the Colombo Wetlands, in contrast to relying on administrative boundaries. Various factors, including the area's geography, land use, water bodies, and population distribution, were considered to establish a functional boundary. The primary objective was to accurately depict the landscape and prioritize areas with the highest wetland coverage, while also accounting for their vulnerability. Incorporating the indicator-based methodology originating from the Community Development and Knowledge Management (COMDEKS) framework within the International Partnership for the Satoyama Initiative (IPSI), this study was conducted. Data collection encompassed Community Resilience Assessment Workshops conducted in four delineated zones, employing the Resilience Indicators Toolkit across five categories, including landscape diversity, biodiversity, knowledge and innovation, governance and social equity, as well as livelihoods. Results spotlight an overarching enhancement in community viewpoints between 2017 and 2023, notably in the spheres of knowledge and innovation. A zone-based analysis underscored heterogeneous shifts across the four regions, influenced by factors like rapid urbanization and wetland management endeavours. While positive trends have emerged, challenges including issues surrounding stakeholder coordination and conflicts that impact governance and social equity have been persistent. The framework of suggested strategies encompasses the promotion of traditional livelihoods, empowerment of local farmers, monetization of ecosystem services, heightened awareness campaigns, and the augmentation of stakeholder coordination. Through the implementation of these strategies, a more resilient and sustainable trajectory for both communities and urban wetlands can be forged. This research underscores the dynamic interplay between community perceptions, ecological resilience, and sustainable urban development, contributing to a comprehensive understanding of urban wetland management.

**Keywords:** *community perceptions, local knowledge, socio-ecological resilience, urban wetlands*

## Elucidation of Associated Microbial Consortium with *Xanthomonas campestris* pv. *Campestris* the Causal Agent of Black Rot Disease in Cabbage

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Black rot disease, caused by the *Xanthomonas campestris* pv. *campestris* (Xcc) complex, poses a formidable challenge to cruciferous crop cultivation, particularly cabbage, in the world. This study delves into the potential of microbial interactions and hypersensitive responses (Hr) to mitigate the impact of black rot disease demonstrated that microbial elicitation triggers symptoms in vulnerable plants while activating defense mechanisms in resistant counterparts. Control of black rot disease is more difficult because of its seedborne nature, limited effectiveness of chemical treatments, and the absence of resistant cultivars. Therefore, molecular techniques are used to correct identification of pathogen for the development of cultivars resilient to the disease. In this experiment, the cabbage samples were collected from seven Agro-ecological regions in Nuwara Eliya District of Sri Lanka. Biochemical tests such as Gram staining, catalase oxidation, KOH test, starch hydrolysis test, and gelatin hydrolysis test were conducted to identify the associated microbiota. Koch's postulates were followed to confirm the pathogenicity by inoculating healthy cabbage plants with the isolated microbiota. Genomic DNA was extracted from the isolates, and PCR amplification was performed using ITS universal primers. Results revealed that, 75% of microbial agents isolated from the black rot complex were belonging to genera *Pseudomonas* including, *Pseudomonas flavescens*, *Pseudomonas kuykendallii*, *Pseudomonas protegens*, *Pseudomonas cichorii* strain PC1 and *Pseudomonas cichorii* strain ATCC. In addition to that, *Morganella morganii* and *Chromobacterium alkanivorans* were also present in the consortium. Based on the results, we can conclude that genera *Pseudomonas* is frequently associated with the Xcc complex. In conclusion, this study augments our comprehension of microbial interactions and hypersensitive responses in relation to black rot disease. Therefore, Future research will focus more on unveiling the intricate interaction between microbial elicitation and plant defense, underscoring the potential for novel disease management strategies.

**Keywords:** *black rot, Cruciferous crop, Xanthomonas campestris, Pseudomonas spp, associated microbial consortium*

## **Chitosan and Chitosan-functionalized Iron Oxide Nanoparticles for Removal of Nitrate and Phosphate in Beira Lake, Sri Lanka**

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Urban lakes are highly susceptible to the adverse effects of human activities due to their large size, shallow depth, and stagnant nature. With the rise in population, urbanization, and technological advancements, the disposal of sewage has become a major concern, leading to the contamination of surface water bodies with excess amounts of total nitrate and phosphate which will lead to eutrophication. Therefore, it is important to implement a solution to remove nitrate and phosphate from surface waters. This study was carried out to develop a method to remove nitrate and phosphate using chitosan and magnetic nanoparticles functionalized chitosan in polluted water bodies. Even though many organic, inorganic, and biopolymers have previously been used as flocculants, magnetic iron oxide nanoparticles with natural coagulant compounds have been used as a novel and environmentally friendly approach to remove nitrate and phosphate from surface water bodies. In this study, a magnetic coagulant was developed using the co-precipitation method. The Prepared magnetic coagulant was then used in a jar test experiment to determine the optimum conditions required for maximum flocculation efficiency to improve water quality, using water samples collected from Beira Lake, Sri Lanka. A series of different concentration combinations were used to test the optimum condition. The reduction efficiency of total phosphate, and total nitrate was evaluated. The magnetic iron oxide nanoparticle functionalized with chitosan coagulant significantly reduced 56% of total phosphate, and 46% of total nitrate. It was found that prepared magnetic coagulant; the coagulation/ flocculation treatment using magnetic iron oxide nanoparticles functionalized with chitosan coagulant was a better method to reduce total nitrate and phosphate in the water samples collected from Beira Lake, Sri Lanka.

**Keywords:** *iron oxide nanoparticles, chitosan, magnetic coagulant, co-precipitation, total nitrate, total phosphate*

## Simulation-Based Investigation of Advanced Wind Deflectors in Vertical-Axis Wind Turbines (VAWTs) for Enhanced Wind Energy Harvesting Efficiency

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Vertical-axis wind turbines (VAWTs) have emerged as promising alternatives for harnessing wind energy, but their low efficiency and poor self-starting properties have been a persistent challenge. To address these limitations and unlock the full potential of VAWTs, this study presents a comprehensive investigation focused on the design and testing of a Savonius-type VAWT equipped with advanced wind deflectors. The primary objective is to achieve superior performance, especially at lower wind speeds, by comparing the turbine's performance with and without wind deflectors and finding the most performable deflector distance and angle. One of the key obstacles in VAWTs lies in the unproductive negative torque generated by the returning blade during rotation. These wind deflectors facilitate the redirection of upstream wind towards the advancing blade, enhancing the overall efficiency and power output during operation. The research methodology involved conducting simulations across a range of wind velocities, spanning from 1 ms<sup>-1</sup> to 8 ms<sup>-1</sup>. Sophisticated turbine models were created using SOLIDWORKS software and subjected to meticulous analysis through ANSYS Fluent, Computational Fluid Dynamics (CFD) software. Values of moment coefficient, moment, force coefficient, and force acting on the blade, which are critical indicators of turbine performance, were closely examined during the simulations. The study shows a significant boost in power output for the Savonius-type VAWT with the advanced deflector system, especially at lower wind speeds, outperforming the turbine without a deflector system. The deflector system has a higher potential for deploying such turbines in areas typified by consistently low wind velocities, wherein conventional turbines may not attain optimal performance and acquired from this investigation carry substantial ramifications for the future design and optimization of VAWTs. In the examined range, a deflector distance of 125 cm exhibits a higher moment coefficient, while deflector angles between 18-24 degrees demonstrate greater efficiency compared to other values.

**Keywords:** *vertical-axis wind turbine, wind deflectors, computational fluid dynamics, low wind velocity, solidworks, ansys fluent.*

## Estimation of Genetic Variability and Character Association of Sunflower Genotypes Available in Sri Lanka

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Sunflower (*Helianthus annuus* L.) is an important oilseed crop grown worldwide. But in Sri Lanka, it is still not grown as a commercial crop. However, there is a potential in the dry zone of Sri Lanka to grow sunflowers and in order to fill some amount of edible oil requirement in Sri Lanka. The present study was carried out at the Grain Legumes and Oil Crops Research and Development Centre, Department of Agriculture in Angunukolapelessa during the 2021/22 Maha season. The objective of the study was to evaluate the performance of different genotypes of sunflower with respect to stem girth, plant height, head diameter, floret length, seed yield, number of ray flowers, hundred seed weight, number of seeds per plant, number of leaves per plant. Eight genotypes were evaluated in a randomized complete block design with three replicates. A significant difference was reported among genotypes for all studied quantitative traits except for seed yield, seed width, and number of seeds per plant. The average hundred seed weight was  $7.58 \pm 0.29$ , which was statistically significant ( $P = 0.05$ ). Total seed yield and number of seeds per plant were shown significant variation among the genotypes tested, since it is considered as the main yield component in sunflower. Furthermore, stem girth ( $r = 0.441^*$ ), plant height ( $r = 0.484^*$ ), head diameter ( $r = 0.568^{**}$ ), floret length ( $r = 0.453^*$ ) had a positive correlation with seed yield. Head diameter had a positive correlation ( $r = 0.749^{**}$ ) with plant height, and stem girth had a positive correlation ( $r = 0.575^{**}$ ) with the number of leaves per plant. Thus, some of the vegetative characters can be considered as indirect selection criteria in determining genotypes based on yield. In conclusion, this study provides valuable insights into the performance of different sunflower genotypes and their association between measured agronomic traits and seed yield. Therefore, the findings of this study can be used in future breeding programs aimed at developing high-yielding sunflower varieties with desirable agronomic traits.

**Keywords:** sunflower, phenotypic variability, character association

## Air Pollution Stress Tolerant Roadside Tree Species in Kandy Urban Setting

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Kandy City is one of the most highly polluted cities in Sri Lanka especially with related to air quality. The mountainous geography around the city prevents the spreading of air pollutants, creating hotspots of air pollution, mainly in areas of high vehicular traffic. Some roadside tree species are found to have the capacity to tolerate urban air pollution stress by acting as sink for gaseous air pollutants. Identification of such tree species and promotion of their planting in the urban landscapes can help manage the air pollution stress in cities with a limited wind flow, similar to Kandy City. The present study was designed to assess the Air Pollution Tolerance Index (APTI) of five of the roadside tree species *Terminalia catappa* (Indian almond), *Cassia fistula* (Golden shower tree), *Pongamia pinnata* (Indian beech), *Madhuca longifolia* (Butter tree) and *Tabebuia rosea* (Pink poui tree) found in Kandy urban setting, using four biochemical parameters: pH, ascorbic acid content, relative water content and total chlorophyll content of leaves. The least polluted and most polluted spots of Kandy City were identified based on the SO<sub>2</sub>, NO<sub>2</sub> and PM<sub>2.5</sub> levels in ambient air. The leaf samples picked randomly from ten replicates of the five species at above two environmental settings were tested for the chemical parameters to estimate the APIT values. Standard one-way ANOVA followed by Tukey's pairwise comparison was carried out to analyze the data. Results revealed significant differences (P< 0.05) in APTI values among different tree species. The highest APTI values were observed in *M. longifolia*, followed by *C. fistula*, *T. rosea*, *T. catappa*, and *P. pinnata*. Based on the APTI, above species were recommended to grow in urban settings to withstand the air pollution tolerance and for the phytoremediation of the air pollutants.

**Key word:** *air pollution stress, air pollution tolerance index, roadside tree species, Kandy city*

## Anti-protein Glycation Activity of a Range of Sri Lankan Plants

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Protein glycation is a non-enzymatic reaction between carbonyl groups of reducing sugars with amino groups of proteins leading to the production of advanced glycation end products (AGEs). This reaction happens during intrinsic and extrinsic skin aging process and accelerates under oxidative stress. It has been reported that many natural products with the anti-oxidant activity have the potential to prevent or retard the formation of AGEs and thereby delay the skin aging process. In this regard, we have recently investigated a range of Sri Lankan plants for anti-oxidant and skin protection potential via multiple mechanisms. This study evaluated the anti-protein glycation activity of those plants to study their suitability in cosmeceutical applications. Freeze-dried 70% leaf ethanolic extracts of ten Sri Lankan plants namely *Kaempferia galanga*, *Zingiber zerumbet*, *Alpinia galanga*, *Osbeckia octandra*, *Alpinia nigra*, *Melastoma malabathrica*, *Morus alba*, *Alpinia calcarata* Roscoe, *Etilingera elatior*, *Cassia alata* were used in the study. Anti-protein glycation activity was studied using the Bovine Serum Albumin (BSA)-Glucose model in vitro. Concentrations of 25, 50 and 100 µg/mL were used in the assay for each plant extract (n=3 each) and rutin was used as the positive control. Results showed that all the selected Sri Lankan plants had anti-protein glycation activity with significant differences ( $P < 0.05$ ) among the plants.  $IC_{50}$  values of anti-protein glycation activity of selected plant extracts ranged from  $32.32 \pm 1.17$  to  $242.76 \pm 27.15$  µg/mL. Interestingly, *Melastoma malabathrica*, *Obeskia octandra*, and *Etilingera elatior* exhibited the highest ( $P < 0.05$ ) anti-protein glycation activity compared to the other selected plants while *Kaempferia galanga* had the lowest activity. All the plants showed a moderate activity ( $IC_{50}: 21.88 \pm 1.99$  µg/mL) compared to the reference standard rutin. In conclusion, *Melastoma malabathrica*, *Obeskia octandra*, and *Etilingera elatior* the plants with the highest anti-protein glycation activity were found to have the potential for utilization in the formulation of novel cosmeceuticals.

**Keywords:** anti-protein glycation activity, sri lankan plants, cosmeceuticals

## Antioxidant Properties of Value-added Bitter Gourd (*Momordica charantia L.*) Tea

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Herbal or medicinal teas are reported to have beneficial effects in the prevention and management of a variety of diseases. *Momordica charantia L.* (bitter gourd) has been scientifically proven for the treatment of different pathologies including non-communicable diseases. Thus, the development of value-added products from bitter gourd will be immensely beneficial for health-conscious consumers. In this regard, we have previously developed two anti-diabetic bitter gourd (*Momordica charantia L.*) tea products from widely cultivated Sri Lankan bitter gourd variety Preethi. This study evaluated the antioxidant properties (AP) of the above bitter gourd tea products for further value addition. Tea brew of the two bitter gourd tea products (product 1: slice thickness of 1 mm dehydrated at 70°C; product 2: slice thickness of 2.5 mm dehydrated at 50°C) were evaluated for in vitro AP namely Total Polyphenolic Content (TPC; n=3), Total Flavonoid Content (TFC; n=3), Ferric Reducing Antioxidant Power (FRAP; n=3), and 2,2-diphenyl-1-picrylhydrazyl (DPPH) & 2,2-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid (ABTS) radical scavenging activity (n=3 each) using high throughput screening technique. Interestingly, both tea products exhibited all AP tested. The TFC (Product 1: 0.82 ± 0.14 mg QEs/cup; Product 2: 1.08 ± 0.20 mg QEs/cup), FRAP (Product 1: 13.79 ± 0.66 mg TEs/cup; Product 2: 13.53 ± 0.77 mg TEs/cup), and ABTS radical scavenging activity (Product 1: 31.42 ± 2.83 mg TEs / tea cup; Product 2: 28.23 ± 0.95 mg TEs / tea cup) were insignificant (P>0.05) between the two bitter gourd tea products. However, the highest DPPH radical scavenging activity (14.96±1.10 mg TEs /cup) was shown by bitter gourd tea product 1 while bitter gourd tea product 2 showed the highest TPC (16.78±1.20mg GAEs/cup). It is concluded that both bitter gourd tea products have a high potential to be commercialized as value-added functional teas.

**Keywords:** *herbal or medicinal teas, bitter gourd tea, antioxidant properties*



## Development and Evaluation of an In vitro Induced Mutant Population in Baby's breath (*Gypsophila paniculata*) for Crop Improvement

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Baby's Breath (*Gypsophila paniculata*), is popular for its versatile application in floral arrangements. The market demand is higher for new cultivars. This study explores the potential of colchicine-induced mutation breeding to enhance crop attributes in *Gypsophila paniculata*. The variety "New Hope" from the Royal Botanical Garden, Peradeniya, Sri Lanka was used in this study. Three Colchicine concentrations (0.3%, 0.5%, and 0.8%) and three different exposure time periods (5, 15, and 30 min) were maintained as treatments in a CRD design. The control involved the absence of colchicine. Treated explants were regenerated in an MST medium enriched with 1mg/L BAP and 3mg/L IBA. Results indicated that days for callus induction were lower ( $23.5 \pm 0.707$ ) in treated shoot tips compared to treated nodal explants ( $39.5 \pm 0.932$ ). However, nodal segments were the best explant material with the highest callus survival rate ( $99.5 \pm 0.24\%$ ) compared to shoot tips ( $20.7 \pm 0.270\%$ ) under both control and treated conditions. Nodal explants treated with 0.3% colchicine for 30 minutes performed the highest callus survival ( $79.1 \pm 0.50\%$ ), along with the longest shoot length ( $2.74 \pm 0.102\text{cm}$ ), number of roots ( $24.4 \pm 0.322$ ), and optimal calli viability. Morphological evaluations revealed intriguing variations among colchicine-treated explants as well. Nodal explants treated with 0.3% colchicine for 5 minutes gave elongated cells in calli ( $361.163 \pm 23.659\mu\text{m}$ ) and longer shoots ( $4.05 \pm 0.545\text{cm}$ ). In contrast, a longer time exposure of 30 min under the same concentration had rounder-shaped calli cells ( $190.637 \pm 16.49\mu\text{m}$ ). This study concludes that exposure of nodal cultures to 0.3% colchicine concentration for 30 minutes was found to be effective at promoting survival, inducing morphologically different phenotypes in calli/calli cells, and also significant root formation. The low concentration (0.3%) of colchicine for short-time exposure (5min) had a significant effect on the shoot variants. The developed mutants will undergo further evaluation under greenhouse conditions, holding promise for crop improvement in Baby's Breath (*Gypsophila paniculata*).

**Keywords:** floriculture, *gypsophila paniculata*, mutation breeding, colchicine, tissue culture

## Assessment of Groundwater Quality and Development of a Tailored Water Quality Index for Vallipuram Region of Jaffna Peninsula

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The availability and quality of groundwater are critical factors for sustaining communities, particularly in regions like the Jaffna Peninsula where groundwater serves as the primary source of water for various needs. However, the escalating concern over groundwater pollution necessitates a comprehensive assessment of its quality. The Water Quality Index (WQI) is a simple tool and compound indicator, that aggregates information from several water quality parameters to convey water quality information in a single value to planners, policymakers and the public. This study focuses on the development and evaluation of a WQI tailored for the groundwater within the Jaffna Peninsula. For this study, 120 domestic wells were selected in the *Vallipuram* Region. Standard protocols were followed for the collection of water samples and subsequent quality analysis. Spatial coordinates of sampling locations were determined using Global Navigation Satellite System RTK Receivers, and an interpolation technique facilitated the examination of spatial trends in water quality parameters. The Weighted Arithmetic Water Quality Index method was used to find the suitability of water for drinking purposes. According to the physical and chemical parameters, the derived WQI values spanned from 4.5 to 287.2 and microbiological WQI values from 14.8 to 612.4, reflecting a broad spectrum of water quality. The study findings unveiled that 60% of groundwater samples were rated as excellent in terms of drinking water quality, with 23.3% categorized as good, 5% as poor, 3.3% as very poor, and 8.3% as unsuitable based on the WQI. Remarkably, 72 wells were deemed fit for drinking. However, when microbiological parameters were incorporated, a mere 3 wells were deemed suitable for consumption. This underscores the critical need for consistent chlorination-based well disinfection, enhancements in well infrastructure, and the adoption of sealed septic tanks. Additionally, community education initiatives are advocated to raise awareness concerning proper household water treatment procedures.

**Keywords:** *dug wells, drinking purposes, groundwater, water quality parameters, water quality index*

## **The case study on Imported Hybrid Maize Variety RSA-02 Growing in Anuradhapura District of Sri Lanka**

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The abstract presents findings of the study, investigating the perception and adoption of the Indonesian maize hybrid variety RSA-02, among dry zone maize farmers in Sri Lanka. The research aimed to understand adoption factors, yield impact, and food security implications. A cross-sectional survey during the 2021/22 Maha season involved 100 maize farmers in Anuradhapura District, Galenbidunuwewa DS division. The survey explored farmer perception, adoption rates, and yield comparisons with the local Jet 999 variety. Descriptive statistics were used to compare RSA-02 and Jet 999 varieties, and an independent sample T-test was applied to identify significant yield differences. Results revealed a positive perception of RSA-02, driving a 55% adoption rate compared to Jet 999's 45%. RSA-02 displayed significantly higher yields, averaging at  $6.98 \pm 0.074$  Mt/ha, while Jet 999 yielded  $6.09 \pm 0.134$  Mt/ha. This yield discrepancy likely contributed to RSA-02's higher adoption. The study indicates that imported maize hybrid RSA-02 holds promise for enhancing Sri Lanka's dry zone maize cultivation. However, barriers to adoption were identified. To gain broader insights, similar surveys are recommended in other major maize-growing regions. These findings hold significance for policymakers, agricultural extension officers, and stakeholders involved in promoting new maize varieties. Capitalizing on RSA-02's positive perception, higher adoption, and improved yield potential can drive efforts toward augmenting food security and establishing a sustainable seed supply chain in Sri Lanka.

**Keywords:** *maize cultivation, hybrid maize, adoption, perception, food security*

## Evaluation of Bacterial Wilt Resistance in Traditional Tomato Cultivar (Chena tomato) Compared to Commercially Grown Tomatoes in Sri Lanka

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The bacterial wilt caused by *Ralstonia solanaceum* is significant preharvest disease in tomato. It can cause 20% to 100% yield lost in tomato cultivation. Therefore, elucidation of resistance cultivar or crop wild relatives are more important in developing bacterial wilt resistance tomato varieties through crop improvement program. Three tomato varieties namely Thilina, Lanka Sour and Chena Tomato were evaluated in growth chambers using CRD with three replicates to determine their resistance against bacterial wilt. Chena tomato is the wild variety of tomatoes known as *Kala Thakkali*, which is widely cultivated chena lands during the Maha season with rain-fed irrigation. This crop produces tiny fruits that are tolerant of drought and the majority of diseases including bacterial wilt due to hard stem and root system. The bacterial inoculum was made using a pure culture of *Ralstonia solanaceum* on Triphenyl tetrazolium chloride (TTC)+ Casamino acid-Peptone-Glucose (CPG) media. After that suspension culture was prepared by CPG media. The bacterial suspensions were centrifuged to collect the pellets and dissolved in autoclaved distilled water to prepare bacterial inoculation. Three weeks old well grown, healthy tomato seedlings representing all three varieties were uprooted. Then root system was properly washed and drenched overnight in bacterial inoculum. After that seedlings were transplanted in plastic pots containing sterilized potting mixture. Other all agronomic practices were performed according to the Department of Agriculture recommendation. Disease incidence was recorded based on the visual observation of wilting. First incidence was observed 14 days after the inoculation in variety Thilina. After that Lanka Sour variety started to show the symptoms 25 days after the inoculation. Until that chena tomato was not shown any incident. Disease severity, Number of colonized plants, Number of wilted plants, and Number of wilted leaves were considered in selecting the resistance ability of three selected varieties. Statistical of 0.05 was considered statistically significant.

**Keywords:** *tomato, resistance, bacterial wilt, inoculum, incidence.*

## Detection of Post-harvest Damages of Tomatoes Based on Image Processing Techniques for Automated Food Grading Applications

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In this project, an automated conveyor system was developed to detect post-harvest damages on tomatoes (*Solanum lycopersicum*) by employing image processing techniques. The image processing algorithm was developed using Python in unification with OpenCV and NumPy libraries, where two main methods were utilized for damage detection, namely, identification of damages and identification of crushed lines on the surface. These methods were based on colour, shape, edge, and texture analysis. A collection of 100 tomatoes captured in a controlled environment was used for the identification of thresholds. Subsequently, another 100-tomato data set was utilized in testing (50%) and validation (50%). The conveyor system developed allows automation of the entire process, making it possible to grade a large number of tomatoes in a short period of time. In the system, the conveyor is involved in moving tomatoes in front of a web camera located on the top of the conveyor. An infrared sensor is used to detect the presence of a tomato at the loading place of the conveyor, triggering the conveyor to start and move the tomato to the next position. Another infrared sensor was used to detect the presence of the tomato under the camera, stopping the conveyor for one second to allow the capturing of images. The pixel mapping method was used to convert the image data into grading values, which were then displayed on a graphical user interface. The results obtained showed that the damage detection evaluation metrics achieved an accuracy of 93%, a recall of 88%, a precision of 98%, and an F1 score of 93%. Meanwhile, the grading evaluation metrics achieved an accuracy of 90%. Therefore, it can be concluded that an effective and accurate system can be successfully developed based on image processing techniques to detect and grade post-harvest damage in tomatoes to reduce waste and maintain market competitiveness.

**Keywords:** *automated food grading, computer vision, image processing, tomato post-harvest damages*

## **Introduction of a New Protocol to Develop New Anthurium Varieties Achievable in Shortened Time Frame: A Combination of Anther Culture and Protoplast Fusion Technologies**

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Sri Lanka is a small island is highly reputed as one of the best quality floricultural producing industries in the world. Over 150000 persons directly involved in the production process which generates an income of \$17 million annually through exporting floriculture products. Unfortunately, Sri Lanka's position in the global floriculture trade has dropped from 47<sup>th</sup> place in 2009 to 52<sup>nd</sup> place in 2013. According to many surveys and studies, lack of producing novel varieties for local market as well as the global market and depending on same old floriculture products has been highlighted as a major constrain for the development of Sri Lankan floriculture industry. The length of time taken to develop a new variety has become the major issue for this situation. The objective of this study is to develop a protocol combining Plant tissue culture technology and protoplast fusion to develop a new floricultural plant variety within a short period of time. The methodology of this study revolves around Anther culture (Plant tissue culture technology) and protoplast fusion to obtain haploid cells and to combine the protoplasts derived from haploid cells respectively and analytical procedures such as Percentage of successful callus cultures obtained, percentage yield of isolated protoplasts, Percentage of viable protoplasts, Percentage of fused protoplasts, Percentage of regeneration of fused protoplasts were considered. *Anthurium crystalinum* and RBG white Anthurium varieties has been selected for the study considering its physical characteristics The period of analysis is 1 year. As an initiation media for anther culturing, NWT-3 media with 2.5 mg/l concentration has recorded 40% of positive results while for fused protoplast regeneration in Ca-alginate beads has shown positive results.

**Key words:** *anther culture, protoplast isolation, protoplast fusion, plant tissue culture, protoplasts*

**Zero – The Refill Store**  
**Exploring The Customer Perception on An E-Commerce Platform for Waste Minimization**

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This study explores the expanding practise of online refill stores and how it helps to promote eco-friendly living and lessen the consumption of single-use plastics. Online refill stores have become a cutting-edge tactic to promote environmentally friendly purchasing habits and reduce environmental effect. To promote waste reduction and sustainable consumer choices, this study examines the complex interplay between online refill firms and e-commerce platforms. To get insight into customer attitudes and behaviours connected to refills, the research incorporates empirical information from surveys, expert interviews, usability testing, and data analysis. The introduction of the article emphasises the importance of sustainable living practises and the contribution of online refill stores to the advancement of waste reduction. In the zero-waste refill e-commerce sector, it examines earlier studies and comparable platforms, highlighting their parallels and distinctions. The study concept, data gathering procedures, and data analysis strategies used in creating an online refill shop project that aims to promote sustainability and waste reduction are described in the methodology section. Results from user surveys and expert interviews are presented in the results and discussions section, revealing insight on customer preferences, readiness to adopt refill practises, and the practicality of online refill businesses. Consumer preferences for certain product categories, considerable interest in adopting refill practises, and a need for practical payment methods are among the noteworthy results. The conclusion emphasises the significance of collaborations with local companies, the necessity for educational materials to encourage sustainable living, and continuing development in the design of online refill stores. Future study will focus on life cycle analyses, closed-loop packaging, and behavioural analysis. In conclusion, our study adds to the expanding dialogue regarding ecologically friendly purchasing practises and the promise of technologically based solutions. It highlights the value of online refill stores as a strategy for cutting waste and promoting a more sustainable, environmentally friendly future.

**Keywords:** *refill store, waste minimization, sustainable living, eco-friendly, refill*

## Identification of the Capability of Biochar Mediated Nano Zero-valent Iron for Bioremediation of *Salmonella enterica*. C.

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In recent years, the utilization of green synthesis methods for producing biochar-mediated metallic nanoparticles has gained significant popularity due to their remarkable properties and their applicability in diverse scientific and technological fields. One promising approach is the utilization of plants to synthesize biochar-mediated metal nanoparticles, which offers the advantage of eco-friendliness and non-toxicity. This study focuses on the application of nano zero-valent iron (nZVI) particles mediated by rice husk biochar (RH-nZVI) and lignin biochar (lignin-nZVI) for bioremediation of pathogenic microorganisms. Furthermore, the toxicity of biochar-mediated nZVI towards *Salmonella enterica* (*S. enterica*) was assessed. The bacterial suspension was exposed to an nZVI particle suspension at a concentration of 0.5 mg/mL. The findings revealed the effectiveness of RH-nZVI against *S. enterica*, while lignin-nZVI demonstrated limited efficacy. The minimum inhibitory concentration of RH-nZVI particles was determined using the well diffusion assay method, with a value of 0.00625 mg/mL. Additionally, the antimicrobial activity of RH-nZVI was investigated against hospital wastewater and coir samples which are contaminated with *S. enterica*.

**Keywords:** *Salmonella enterica*, biochar mediated nano zero-valent iron, rice husk-nZVI, lignin-nZVI, hospital wastewater, coir sample



## Greenhouse Gas Emissions Associated with Embodied Energy Use in Orthodox Black Tea Manufacturing Process at Mid Country Sri Lanka

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Tea is the second topmost extensively drunk beverage which accounts for 3.5 billion cups per day with a per capita consumption of 2.52–3.16 kg/person per year. Correspondingly, tea plays an important role in the Sri Lankan economy, contributing to 1.1% of the Gross Domestic Production (GDP), while accounting for 19% of the foreign exchange earnings. Existing literature on tea and food industry has highlighted how sustainability certifications have contributed to promote their products as eco-friendly and sustainably without having significant changes to their production practices. Therefore, this study was focused to analyse, (i) embodied energy consumption (ii) Carbon footprint (kg CO<sub>2</sub>e/kg) of mid country tea factories at each processing stage and total orthodox black tea manufacturing process. Three mid country (600-1200m) factories which produce more than 1 million kg and operating throughout the year were purposively selected for the study. The data was gathered to perform the Life Cycle Energy Analysis (LCEA) in each factory according to the gate-to-gate boundary platform. The analyses of Specific Electrical Energy (SEEC) and emission were The British Standards Institution, 2011 and IPCC 2006 guidelines. The highest Specific Energy Consumption was recorded from the factory I, 1.021 kWh per kg of made tea against average which was 0.900±0.183 kWh per kg made tea for mid country tea factories Sri Lanka, which is higher than the standard value of Sri Lankan Sustainable Energy Authority for SEEC in mid country (0.780 kWh per kg made tea). When considering the electrical energy usage in the direct process of orthodox black tea production, the highest was reported for the withering stage (0.340±0.120 kWh per kg of made tea). The highest emissions were identified at the withering and drying stages and the values ranged from 24% to 35% from the total emission of orthodox black tea production. The highest emission reported from firewood usage was 4.461±1.131 kg CO<sub>2</sub>e/kg of made tea and emission due to the diesel was 0.317±0.020 kg CO<sub>2</sub>e/kg of made tea for mid country tea factories. Consequently, total gate to gate carbon footprint of the orthodox black tea production process due to the embodied energy consumption in mid country Sri Lanka was estimated as 6.156±2.252 kg CO<sub>2</sub>e/kg made tea.

**Keywords:** SEEC, greenhouse gas emission, mid country tea manufacturing, orthodox black tea

## Study of Soil Characteristics and Drainage Conditions of the Faculty of Technology University of Colombo Premises

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Soil is a biologically active, porous media which functions as the source of nutrients, water and supports recycling of carbon and other elements through the entire ecosystem. The evaluation of soil and drainage conditions is an important aspect of land development and management. The purpose of this study was to evaluate the soil characteristics and drainage conditions of the Faculty of Technology, University of Colombo Premises to determine its suitability for landscaping, faculty farm development and facilitating the drainage. The study involved conducting field investigations of soil profiling and drainage at three undisturbed locations using standard procedures, and analysis of soil characteristics such as pH, electrical conductivity, organic matter content, soil color, bulk density, soil texture, and soil nutrient content at two different depths (15, 30 cm) of six undisturbed sites each. The study showed the drainage of the faculty site, is at the ideal drainage between 2.5-10 cm/h. The bulk density varied 1.03-1.8 g/cm<sup>3</sup>. Soil color appeared to be related to the ideal soil color of reddish brown (5YR 4/4) to yellowish brown (10YR 5/4). The soil texture was found to be loamy sand which is suitable for cultivation. Soil pH was within the standard range of 6.5-7.5. Electrical conductivity of  $9.7 \times 10^{-6}$  -  $3.18 \times 10^{-5}$  S/m and organic matter content of 6.9-3.2 % were observed and those were within the suitable limits for cropping. According to the results, four sampling locations were identified as the most suitable for landscaping and cultivation. Another sampling location was identified as suitable for a model farming area for lowland cultivation. Only one site was found to have a rapid drainage and marginally suitable for cropping. Overall, evaluation of soil and drainage conditions is a crucial step in the site development process ensuring the suitability for landscaping, farm practices and sustainable land management.

**Keywords:** *soil profile, drainage, soil characteristics*

## Feasibility of Lipid Production from Microalgae in Beira Lake

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The growing energy crisis has spurred increasing concerns about sustainable energy sources. In this study, we investigated the potential of using microalgae bloom for biodiesel production. Microalgae samples, predominantly consisting of *Microcystis* sp., *Scenedesmus* sp., *Chlorella* sp., *Actinastrum* sp., and *Arthrospira* sp. (*Spirulina* sp.) were collected from Beira Lake. The microalgae varieties were identified based on their morphological characteristics. Mechanical grinding, thermal treatment, and high-speed homogenization methods were used for cell disruption. The study focused on microalgae lipid extraction feasibility. Lipid extraction was performed using the Isopropanol: n-hexane solvent system. Several identification tests were performed for extracted lipid identification, including the Sudan III test, solubility test, and translucent spot test. Sudan III test indicates lipids in microalgae via red coloration. Microalgae lipids samples are immiscible in water but mixed with chloroform and ethanol in the solubility test and the presence of translucent spots in the extracted microalgae lipid sample. The results confirmed the presence of lipids in the samples. The thermal and grinding cell disruption methods yielded similar results in oil extraction, whereas the high-speed Homogenization method yielded significantly low results. Based on the qualitative lipid analysis test, microalgae oil is identified as a feasible feedstock for biodiesel production. The study offers insightful information about the potential of microalgae as a sustainable source of lipids, with possible uses in a variety of fields. The qualitative lipid analysis test provided additional support for the use of microalgae oil as a workable source of biodiesel, indicating a high probability of successful microalgae oil-based biodiesel production.

**Keywords:** *microalgae, lipid extraction, biodiesel production, sustainable energy.*

## Application of Population-based Optimization Methods for Tuning PID Controllers

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Metaheuristic optimization algorithms play vital roles in engineering applications such as robot navigation, power system planning, control systems, etc. In this study, the application of such artificial intelligence optimization algorithms is explored in the field of control engineering. Three widely used and popular metaheuristic algorithms namely, Genetic Algorithm (GA), Particle Swarm Optimization (PSO), and Ant Colony Optimization (ACO) are used in this work for estimating the parameters of Proportional–Integral–Derivative (PID) controllers. Different error matrices such as Integral Absolute Error (IAE), Integral Square Error (ISE), Integral Time Absolute Error (ITAE), and Integral Time Square Error (ITSE) are used as the objective function (fitness function) of the algorithms. The PID controller is designed for a mass spring damping system which has a second-order transfer function. The step response results are compared with those of Ziegler-Nichol's method which is a well-established PID tuning method. The results show that PID gains obtained using metaheuristic methods provide more favourable step response characteristics than the Ziegler-Nichols method. The GA method with IAE, ISE, ITAE, and ITSE fitness functions provided good overall performance for the optimization of PID controller parameters i.e., lowest rise time, lowest setting time, minimum overshoot percentage, and minimum peak. When compared to Ziegler-Nichol's method, the GA method with ISE objective function provides PID parameters that can reduce rise time, settling time, and overshoot by 98.1%, 99.6%, and 100%. Further, the PSO method with ISE, ITAE, and ITSE fitness functions provided the same level of output performance. However, ACO could not be able to estimate optimum PID parameters for any of the fitness functions. Although Zeigler Nichol's PID gains can be further optimized, metaheuristic methods such as GA and PSO provide a better starting point for fine-tuning. It is found that the appropriate selection of an optimization algorithm is an application-dependent task.

**Keywords:** *ant colony optimization, control engineering, genetic algorithms, particle swarm optimization, PID control*

## Effect of Dietary Vitamin C on the Growth, Reproductive Performances and Survival Rate in *Poecilia reticulata*

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The study was carried out to assess the impact of dietary vitamin C (Ascorbic Acid –AA) on the growth, reproductive performance, and survival rate of Green Cobra Guppies (*Poecilia reticulata*). Initially, 300 male and female guppies of two weeks old were acquired and acclimated to a commercial diet for two weeks. The fish were separated by gender and their initial weights and lengths were recorded. After the acclimation period, the fish were distributed randomly into 6 breeding tanks, each containing 8 females and 4 males in a 1:2 male-to-female ratio with a Complete Randomized Design arrangement. The fish underwent a 24-hour fasting period prior to the experimental diets. A semi-purified diet incorporated with 30% crude protein was prepared as the basal diet and the supplemented diet was enriched with 300mg of AA per 1 kg<sup>-1</sup>, while the diet of the control group was formulated with 0 mg of AA per 1 Kg<sup>-1</sup>. The feeding trial was practiced for 6 weeks, during which the pellet size was increased from 600µm initially to 1 mm after 3 weeks. The fish were fed with the pelleted feed twice a day at a rate of 5% of their body weight, with the amount adjusted every two weeks. The raw materials of the diets and formulated feed were tested for nutritional quality. The weights and lengths of the fish were measured weekly. During pregnancy, the tanks were observed hourly to monitor the offspring. The offspring were fed with the fish feed *Artemia*. Parameters like Body Weight Increase (BWI), Percentage Body Weight Increase (PBWI), Body Weight Gain (BWG), Specific Growth Rate (SGR), Average Daily Length Gain (AVDL), Survival Rate (SR) %, and Reproductive Performance were calculated. The results indicated no significant differences ( $p < 0.05$ ) in growth performance or survival rates between the two dietary groups. The reproductive performance of fish fed with the supplemented diet was significantly higher ( $P < 0.05$ ) compared to the fish fed with the control diet. However, the mean values of growth-related parameters, and survival rates were higher in the group fed with the supplemented diet compared to the control diet.

**Keywords:** *Poecilia reticulata*, ascorbic acid, growth performance, reproductive performance, survival rate

# Urban Expansion of Colombo City and Its Impact on Land Surface Temperature and Urban Heat Island Formation

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Urbanization involves the conversion of different types of lands into purposes related to the expansion of people and the economy. Urban growth causes soft land cover, such as vegetation and water areas to disappear and be replaced by hard land cover, such as buildings, roads, and paved areas. This change unavoidably redistributes solar energy into the earth and cause an urban rural differential in air temperature and surface radiation. The urban metropolis whose temperature is several degrees higher than the surrounding rural areas are identified as urban heat islands. In Sri Lanka, with the rapid urban expansion occurred over the past decade, Colombo city underwent significant changes to its land cover composition. Consequently, the region is currently experiencing significant levels of heat discomforts throughout the year. The present study investigated the impact of the land use and land cover changes on the land surface temperature (LST) distribution pattern in Colombo city, to identify the urban heat island areas and their expansion over time. Time series imageries of Landsat 8 satellite, from 2013 to 2023, covering the Colombo city area were used in the analysis. Supervised and unsupervised classification techniques were adapted for the identification of main land use types and their spatial extent changes. Normalized difference vegetation index (NDVI) and normalized difference built-up index (NDBI) were used to extract the pixel strengths of vegetation and buildings. LST calculations with the thermal band showed an expansion pattern of urban heat islands to the north, east, and southeast of Colombo City between 2013 and 2023. The area extent suffering from thermal discomfort has been expanded by above 30% over the past decade. Further, an inverse correlation between NDVI and LST and a positive correlation between NDBI and LST were found which indicates that vegetation can weaken UHI, while built-up land can enhance it.

**Key words:** *urban heat islands, land use and land cover, NDVI, NDBI, Colombo city*

## **Development of Biodegradable Eco-Friendly Grass Mats from Kitchen Waste and Banana Fiber: A Sustainable Approach for Waste Utilization**

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The global food waste issue had been a significant concern, with vast amounts of edible food being discarded every year, exacerbating environmental, social, and economic challenges. By 2021, global kitchen and food waste accounted for up to one-third of annual food consumption, making it one of the world's most pressing issues. Therefore, urgent solutions are needed to reduce the amount of organic waste that accumulates. Hence, this study was conducted to develop a grass mat using kitchen waste and banana stem fiber. This process involves converting these sustainable materials into paper, which acts as a base for grass seed germination. Kitchen waste and banana fiber were used in the 1:1 ratio, pulp was formed in the grinder. This pulp was spread and dried on a mold (210 × 297 × 0.5 mm). Creeping bentgrass (*Agrostis stolonifera*) seeds were selected taking into account factors such as mat formation, growth rate and compatibility of the grass variety with overall durability. A total of 100 seeds were evenly distributed across the paper sheets with 5 mm spacing between them, ensuring a consistent and uniform growth of the grass. The germination process was closely monitored to maintain optimal conditions for strong seed development. To foster the most favorable conditions for grass growth, moisture, temperature, and light levels were maintained at room temperature throughout the experiment. Then, once the grass reached the height of 5 cm, it was harvested. According to these research findings, grass mats can be harvested and prepared for use in a variety of environmentally friendly applications such as landscaping, erosion control and sustainable flooring. This study not only promotes sustainable waste management by repurposing kitchen waste and banana stem fiber but also provides an environmentally friendly alternative to traditional grass mat production methods that often rely on non-biodegradable materials. Further research and practical applications of this approach hold promise in contributing to a more sustainable and ecologically responsible future.

**Keywords:** *biodegradable, grass mat, kitchen waste, paper, and pulp*

## Real-time Viability Detection of Chili Seeds with Machine Learning

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Separating non-viable seeds from viable seeds is a crucial step in the production of high-quality seeds. However manual seed sorting is labour-intensive, time-consuming, and inefficient. Automating seed sorting process can significantly improve the accuracy and efficiency while minimizing cost and wastage. In this project, an imaging system capable of detecting the viability of MICH-HY F1 chili seeds was developed.

The system is capable of imaging multiple (>100) chili seeds simultaneously and predicting viability of each seed in real-time. A camera module with a 5-megapixel CMOS sensor and a low-distortion lens was used for imaging. Canny edge detection was used to detect the individual seeds and a cropped image of each seed was saved together with the location. Then the cropped images are passed through a trained convolutional neural network (CNN) capable of classifying seeds as either 'good' or 'bad'. Once the user instructs the system to capture the image of a seed sample via the graphical user interface (GUI), image processing and seed classification is done automatically, and the captured image is displayed with a label at each non-viable seed.

The system was tested using 100 unsorted chili seeds obtained from a commercial chili seed producer. Out of the 100 seeds, the system predicted 54 to be viable and 46 to be non-viable. The seeds were then planted. Out of the 54 seeds that were detected as viable, 53 germinated giving an accuracy of 98% for detecting viable seeds. Out of the 46 seeds that were detected as non-viable, 9 germinated giving an accuracy of 80% for detecting non-viable seeds. The current accuracies are expected to be further improved by retraining the CNN based on germination data and also by improving the imaging setup.

**Keywords:** *non-destructive testing, seed viability, Imaging, CNN*



## Design and Testing of a Poly-tunnel Monitoring and Control System

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Growing high-value, high-yield crops in climate-controlled poly-tunnels can be identified as one of the most viable approaches for urban farming. Furthermore, automation of processes such as fertigation in poly-tunnels can minimize labor costs and improve efficiency. In this project, a monitoring and control system suitable for poly-tunnels in Colombo district, Sri Lanka was developed. The system consisted of an environmental monitoring & temperature regulating sub-system and a fertigation sub-system with a portable wireless soil nutrient monitor (PWSNM). The system measures the temperature and humidity levels inside and outside the poly-tunnel and transfers the readings via Wi-Fi for remote-monitoring. The developed system can control temperature regulating mechanisms used in poly-tunnels such as exhaust fans (with PID-based speed control), water pads and mist systems. The system was programmed to turn on different temperature regulating mechanisms based on the poly-tunnel temperature and the desired temperature set by the user. Temperature regulation capabilities of the system was tested using a prototype poly-tunnel in Pitipana, Colombo district. When a single AC exhaust fan (with a rated air delivery of 8 m<sup>3</sup>/min) was ON, the maximum temperature difference between inside and outside the poly-tunnel reached ~15 °C during day-time. However, by using another DC exhaust fan with PID control, a water pad and a mist system, temperature difference could be reduced to ~2 °C. Temperature in the poly tunnel can be further reduced by using fans with higher flow rates. The fertigation system consisted of a concentrated liquid fertilizer (CLF) tank, a water tank and mixing tank. Once the user selects the desired CLF and water volumes, they are sent to the mixing tank and released to the plants. Moreover, in the automated mode, fertilizer mixing is done based on the soil nutrient levels sent by the PWSNM. The PWSNM was developed using a commercial NPK sensor and the sensor requires further calibration.

**Keywords:** *poly-tunnel, climate-control, fertigation*

## **Development of a Natural Umami Flavoured Soup Cube as a Substitute for Monosodium Glutamate-based Commercial Soup Cubes**

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Monosodium glutamate (MSG) is one of the most widely used food additives in the food flavor industry. In Sri Lanka, limited research has been focused on developing natural umami flavoured foods including soup cubes as a substitute for MSG-based soup cubes. This study focused on developing a natural umami flavoured soup cube to address the said problem. Soup cubes were developed using local ingredients namely dehydrated pumpkin, mushroom, tomato & curry leaves (CL) powder, corn starch, spices, vegetable oil, and salt. The said ingredients were formulated into three different formulations (F1, F2 & F3) with varying percentages of mushroom (M) and tomato (T) to provide natural umami flavor along with CL [F1: 20%M + 8%T + 13%CL; F2: 22%M + 10%T + 9%CL; F3: 20%M + 10%T + 11%CL]. Other ingredients in each formulation remained constant. Then, these formulations were taken to a paste form with adequate water and passed through a mold to make cubes followed by drying at 60°C. Then soup cubes were studied for moisture, crude protein, crude fat, crude ash, and crude fiber contents (n=3 each) according to standard AOAC methods and total carbohydrate content (n=3) using by difference method. Further, water activity and selected minerals were also studied (n=3 each). Furthermore, a sensory evaluation study was carried out using an in-house trained panel at the Industrial Technology Institute (n=12). Results showed that moisture, crude protein, crude fat, crude ash, crude fiber and total carbohydrate contents of three formulations ranged from 5.79 ± 0.04 - 6.26 ± 0.52%, 9.40 ± 0.05 - 9.41 ± 0.08%, 1.63 ± 0.40 - 1.65 ± 1.43%, 5.8372 ± 0.08 - 6.64 ± 0.05%, 7.13 ± 0.19 - 7.52 ± 2.00% and 68.23 ± 0.29 - 71.55 ± 0.11% respectively. Only crude ash and total carbohydrate contents showed significant differences (P<0.05) among the formulations. Water activity of all tested formulations was within the safe range (0.56 ± 0.05 - 0.57 ± 0.08). Interestingly, F3 showed the highest contents (mg/100g) of Zn (20.2 ± 0.22), Fe (25.1 ± 0.32), Na (11279 ± 0.43), K (5992 ± 0.67), Ca (1464 ± 0.76) and Mg (754 ± 0.11). Furthermore, F3 showed desirable sensory properties in terms of texture, solubility, taste, and overall acceptability. Considering all, it is concluded that formulation 3 is the best among those studied.

**Keywords:** *MSG, umami flavor, soup cubes, nutritional properties*

## Identification of Suitable Standard Analytical Methods for Determination of Significant Parameters of Surface Water Quality in Surrounding Water Bodies of *Kerawalapitiya* Waste Park Located in *Muthurajawela* Wetland

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*Muthurajawela* is one of the largest saline wetlands in Sri Lanka, located on the west coast (7003 'N, 79055 'E) between the *Negombo* lagoon and *Kelani* River and spreading inland in the *Gampaha* District (Bambaradeniya et al., 2002). *Kerawalapitiya* Waste Park; a large open dump site cum compost processing yard is operated by Sri Lanka Land Development Corporation even spread alone 20 acres from *Muthurajawela* development zone. Main objective of this paper is to reveal most suitable analytical methods for the significant parameters of surface waters of the study area to carry out Independent Site Contamination Audit for the *Kerawalapitiya* Waste Park and its Surroundings of *Muthurajawela* Wetland. The pH, Electrical Conductivity (EC), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), concentrations of Sulfate, Phosphate, Nitrate, total Manganese, Magnesium, Sodium and heavy metals (Cr, Pb, Cd, Ca, Ni, Zn, As, Hg) are identified as significant water quality parameters in the study area. Thus all the analytical procedures are carried out accordance with the 23<sup>rd</sup> edition of Standard Methods for the Examination of Water and Wastewater, Published by American Public Health Association, American Water Works Association and Water Environment Federation in 2017 (APHA Standard Methods). BOD varied to 31 – 53 mg/L in the study area and BOD 5-Day test (5210 – B) carry out and COD was varied from 100mg/L to 140 mg/L thus Open reflux method (5220 B) is selected to analyze the COD. Ammonia concentration in the surface water was tested with Titrimetric Method (4500-NH<sub>3</sub> C) by titrating with standard sulfuric acid. Nitrate of the study area was 0.52 mg/L to 5.47 mg/L hence, electrode method 4500-NO<sub>3</sub><sup>-</sup> D execute to determination and Phosphate concentration is less than 0.1 mg/L in selected water bodies hence 4500-P E Ascorbic Acid Method is being used. Sulfate determination is carried out with 4500 SO<sub>4</sub><sup>-2</sup> E Turbidimetric Method, Barium sulfate turbidity is measured by Spectrophotometer, for use at 420 nm... TDS 542 – 13290 mg/L and TSS was 5.0 – 181.0 mg/L, thus 2540 C for TDS and 2540 D for TSS standard methods were executed. Heavy metals (Cr, Pb, Cd, Ca, Ni, Zn), Sodium, Magnesium, total Manganese, total Iron was tested with the 3111 B Flame Atomic Absorption Spectroscopy method and Arsenic was determined with 3500-As B Silver Diethyldithiocarbamate Method. According to the analysis significant parameters of surface waters have given acceptable results.

**Key Words:** *standard methods, Muthurajawela wetland, surface water quality, open waste dump*

## Identification of Thermo-stable Amylase Enzyme Coding Genes from Maha Oya Hot Spring, Sri Lanka

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Microbial enzymes are ecofriendly and cost-effective alternative for chemical catalysts. However, mesophilic enzymes are prone to harsh conditions such as high temperature used in industrial processes. Therefore, it is important to identify enzymes that are stable under harsh industrial conditions. Amylase is a major enzyme used in industries and contributes 25% to 30% of the world enzyme market. Therefore, this study was aimed at identification of thermo-stable amylase enzyme coding genes from bacteria that inhabit the Maha Oya hot spring in Sri Lanka. Water samples were collected from the surface and bottom of Maha Oya hot springs. Then the water quality parameters were measured, and microbial genomic DNA was extracted using MoBio Power Water DNA extraction Kit. Shotgun metagenomic sequencing was performed on the Illumina HiSeq platform at Omega BioServices, USA. Bioinformatics analyses were conducted using MEGAHIT software for *de novo* metagenome assembly and FragGeneScan for the prediction of genes and proteins in Metagenome Assembled Genomes. Results indicated that temperature, Electrical Conductivity, pH, Dissolve Oxygen of the surface and bottom of the spring varied from 51.7 – 52.4°C, 1487 - 1507  $\mu\text{S}/\text{cm}$ , 8.05 – 8.07, and 2.01 – 2.05 mg/L respectively. The genes responsible for catalytic  $\alpha$  amylase, *treS*, *susA*, *treZ*, *treY* and *gtfA*, and *glgB* gene responsible for C-terminal all beta domain  $\alpha$  amylase enzyme production was detected from the metagenomic sample. Further, stress response genes including temperature response genes, metal response genes, and toxic substances response genes were detected from the hot spring. The dominant taxonomic levels responsible for producing  $\alpha$  amylase were identified as *Thermomicrobia*, *Alphaproteobacteria*, *Oscillatoriales*, *Chloroflexia*, *Sphingomonadales*, *Oscillatoriales*, *Aurantimonadaceae*, *Deinococcus-Thermus* and *Betaproteobacteria*. Thus, the microbiota that inhabit Maha Oya hot spring could provide an excellent source for industrially important thermos-stable  $\alpha$  amylase enzyme. Furthermore, these findings will provide a platform for future work on mass scale production of thermostable  $\alpha$  amylase enzyme using recombinant DNA technology.

**Keywords:** hot springs, thermo-stable enzymes, biotechnology, metagenome

## Removal of Dye in Batik Wastewater Using Eco-Friendly Biosorbents

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Adsorption technique is the most widely used wastewater treatment method due to its cost-effectiveness, easy usage, eco-friendliness, and high efficiency. This study aimed to investigate the best material or materials to be used in removing or reducing Naphthol and Reactive dyes in batik wastewater. Seven eco-friendly biosorbent materials namely coconut shell charcoal, gliricidia wood charcoal, rubber wood charcoal, coconut shell activated carbon, elephant dung activated carbon, Kaolinite clay, and eggshell were used in the adsorption process for 24 hours and 48 hours to investigate the removal percentage and the adsorption efficiency of dyes from used wastewater. Elephant dung activated carbon and coconut shell activated carbon were highly effective and efficient among all the biosorbents and their efficiency rate was high of in dye removal. The highest dye removal efficiency rate is shown in elephant dung activated carbon in naphthol mix wastewater sample at 24-hour adsorption process, which is 82.69% and Cr could be removed from the reactive mix wastewater sample at 46.74% by elephant dung activated carbon in 48 hours. The activated carbon is most widely used in dye removal studies and the elephant dung activated carbon also was identified as a similar adsorbent to the activated carbon. A combined material can be prepared from elephant dung activated carbon, coconut shell activated carbon, and with other adsorbents such as Kaolinite clay, and rubber wood charcoal prepared at 400°C, and 450°C which gave a promising result in adsorbing the dyes from Batik wastewater.

**Keywords:** *biosorbents, dye adsorption, batik wastewater, naphthol batik dye, reactive batik dye*

## **Assessment and Removal of Zinc and Aluminum from Balloon Manufacturing Industry**

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In recent years, many researchers have studied the removal of Zinc (Zn) and Aluminum (Al) in the wastewater from rubber and balloon manufacturing industries by using different low-cost adsorbents. In this study, biochar produced from *Gliricidia sepeium*, coconut shell and, rubber biochar were used as absorbent materials. Further, white (silica); red (garnet); black (magnetite) sand with eggshell composite in three different ratios (5:9, 10:8 and 15:7) were also used to evaluate the adsorption of Zn and Al from wastewater using the spectrophotometer. The highest removal of Zn, 74% from white sand/eggshell composite was achieved for 0.05 g, 50 ml of wastewater sample, at pH 6-7, ambient temperature, at the ratio of composite 5:9 and at a 6-hour time duration. When the contact time was increased, there were no significant improvement of the removal efficiency. The highest removal rate of Al, 91% from coconut shell biochar at 450 °C was achieved for 0.05 g, 50 ml of the wastewater sample, at pH 6 - 7, ambient temperature and at 6 hours contact time duration. Zn has shown different removal efficiencies (74 % highest) with different contact time. As a percentage, the Al removal was much higher than the Zn removal. However, the highest removal efficiency of the Zn and Al is greater than 70% due to development of higher absorption surfaces by the materials used. Thus, the results showed best adsorption using the silica sand and photocatalyst testing method for removal of Zn and Al from current balloon manufacturing industry wastewater treatment system.

**Keywords:** *adsorption, zinc, aluminum, removal efficiency, wastewater treatment*

**Sri Palee Campus  
University of Colombo**



***Annual International Research Symposium 2023***

***Excellence in Research in Media and Creative Arts***

**20<sup>th</sup> November 2023**

## MESSAGE FROM RECTOR

**Dr. Prathibha Mahanamahewa**



It gives me immense pleasure to extend a warm welcome to all of you for the Annual International Research Symposium 2023 (AIRS) hosted at the Sri Palee Campus, University of Colombo. This year's symposium revolves around the theme of “Excellence in Research in Media and Creative Arts”. Our esteemed Keynote Speaker for this event will be Professor Christop Schimdt, hailing from Deutsche Welle Academic, Germany.

I would like to express my deepest appreciation to the Chairperson, Secretary, and the entire symposium organizing committee for their unwavering support and encouragement. I also extend my gratitude to the dedicated members of the Organizing Committee, who have worked tirelessly, both within and outside the Sri Palee Campus, to ensure the success of this symposium. Their commitment to ensuring that our endeavors are not only exemplary but also conducive to the fulfilment of our ambitious goals has been truly commendable.

One of the primary objectives of this symposium is to facilitate the exchange of knowledge and experiences by inviting distinguished speakers, both from within and outside the Sri Palee Campus. I firmly believe that this conference will yield fruitful results and provide a solid foundation for the future development of public human resource management.

We eagerly anticipate your presence at the Sri Palee Campus on 20<sup>th</sup> November, 2023, and look forward to a memorable and enriching experience.



## MESSAGE FROM SYMPOSIUM CHAIR

### **Ms. Kalani Dharmasiri**

Senior Lecturer  
Department of Mass Media,  
Sri Palee Campus,  
University of Colombo



As the Chair of this remarkable conference, deeply humbled and inspired by the profound words expressed in our conference's opening passage: "Human society is either media with communication and liberal arts, or media with communication and liberal arts are human society." These words encapsulate the essence of our gathering and underscore the critical role that media, communication, and the creative arts play in shaping every facet of our lives. Our journey through this symposium is a testament to the unwavering commitment and dedication of each and every one of you in exploring the intricate intersections of media, communication, and the creative arts. It is through your active and creative engagement that we unlock the boundless potential of these disciplines, unleashing their transformative power on our society and personal experiences.

This year's symposium expectations are firmly rooted in our collective dedication to advancing the fields of media, communication, and the creative arts. It is my hope that, through our scholarly endeavors and collaborative efforts, we will contribute not only to academic excellence but also to the betterment of society as a whole.

I extend my heartfelt gratitude to each one of you for being part of this vibrant intellectual community. Your presence, insights, and unwavering commitment are the cornerstones of our shared pursuit of knowledge and innovation.

In closing, I would like to express my deepest appreciation to the organizers, the presenters, and all participants for making this conference a resounding success. Let us embrace the challenges and opportunities that lie ahead with enthusiasm and a sense of purpose, for it is through our collective endeavors that we shall continue to illuminate the path toward a brighter and more connected future.

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# Annual International Research Symposium 2023

## Sri Palee Campus

### University of Colombo

20<sup>th</sup> November 2023 from 9.00 a.m. to 3.00 p.m.

#### *Programme*

- 9.00 a.m. – 9.05 a.m. Inauguration of the Annual International Research Symposium 2023**
- 9.05 a.m. – 9.10 a.m. Lighting of the Oil Lamp and National Anthem**
- 9.10 a.m. – 9.20 a.m. Introduction to Annual International Research Symposium 2023**  
*Dr. Prathibha Mahanamahewa*  
*Rector, Sri Palee Campus, University of Colombo*
- 9.20 a.m. – 9.30 a.m. Address by the Chief Guest**  
*Senior Professor H. D. Karunaratne*  
*Vice Chancellor, University of Colombo*
- 9.30 a.m. – 9.35 a.m. Introduction of the Keynote Speaker**
- 9.35 a.m. – 9.55 a.m. Keynote Address**  
*Professor Christoph Schmidt*  
*Head, International Media Studies, Deutsche Welle Academic, Bonn, Germany*
- 9.55 a.m. – 10.00 a.m. Concluding Remarks of Inauguration Ceremony**  
*Ms. Kalani Dharmasiri*  
*Symposium Chair 2023*
- 10.00 a.m. – 10.25 a.m. Tea Break**
- 10.25 a.m. – 10.30 a.m. Introduction of the Plenary Speaker**
- 10.30 a.m. – 11.00 a.m. Plenary Speech**  
*Professor Zhang Yanqiu*  
*Deputy Dean, Institute for a Community with a shared Future ((ICSF), Communication University of China, Beijing, China*
- 11.00 a.m. – 12.00 p.m. Technical Sessions 01**
- 12.00 p.m. – 1.00 p.m. Lunch Break**
- 1.00 p.m. – 2.30 p.m. Technical Sessions 02**
- 2.30 p.m. – 3.00 p.m. Symposium Closing Remark and Vote of Thanks**

## INTRODUCTION TO KEYNOTE SPEAKER

### **Professor Christoph Schmidt**

*Head, International Media Studies, Deutsche Welle Academic,  
Bonn, Germany*



Accomplished academic with a rich background in Business and Economics, Professor Dr. Christoph Schmidt completed his studies at the University of Siegen and obtained his PhD from the University of Cologne. Prior to his academic career, he gained valuable industry experience as a Marketing Manager at Philips AG in Frankfurt. He later ventured into HR consulting and management, working with numerous companies.

In 1995, Prof. Dr. Schmidt joined Deutsche Welle (DW), a renowned international broadcaster, where he has held several leadership positions over the years. Since 2006, he has been entrusted with the responsibility of leading DW Akademie's Administration and Academic Department.

His contributions to the field have extended beyond the organization, as he has been a distinguished speaker at over 30 international conferences across the globe. Driven by his passion for education, he has developed study programs in countries like Turkey and Egypt, while also serving as an advisor to universities abroad.

Prof. Dr. Schmidt's expertise is shared through his teaching engagements, covering diverse topics such as Media Management, Comparative Media Systems, Media Globalization, Digital Transformation and Empirical Methods. His research is centered around international media systems, examining the impact of technology on media, and ensuring their sustainability. His work continues to shape the understanding of media dynamics and pave the way for future advancements in the industry.

# INTERSECTION BETWEEN TECHNOLOGY AND CREATIVITY; IMPULSES AND EMERGING TRENDS FOR JOURNALISM

**Professor Christoph Schmidt**

## **Summary**

Digital Revolution has triggered a transformation in the way technology and creativity interact. Each technological advancement pushes the boundaries of what's possible and opens up new - creative - expression and innovation paths that were once inconceivable. In particular, the rise and the rapid penetration of the so-called "new media" remodeled journalistic practices and ushered in new ways of communicating emotions, ideas, or experiences. The skill of creativity, valued as a core human competency and an essential product of human culture, is being besieged by complex machine learning models powered by artificial intelligence (AI). Looking further into the future, three broad scenarios on the impact of generative AI on creativity and content creation seem possible.

### **1. Understanding and impact of new media**

In today's rapidly evolving digital landscape, the media and creativity sectors are undergoing continuous transformation. Although the term "new media" has been used since the 1960s, it only gained renown in the mid-1990's - along with dotcom, cyberspace, and interactive television. The term was coined in order to distinguish this new fluid, individualized and connective medium from the mass media. New media emerged as an "epoch-making phenomenon" and was part of larger social, technological, and cultural changes. Since that time, it has been used as an "all-inclusive" word which enables to conceptualize "new media" in a larger sense than just technical or specialized terms.

Recent research has shown that new media refer to new textual experiences such as emojis, and computer games; new ways of representing the world through new experiences within virtual environments; new relationships between subjects (users and consumers) and media technologies, especially changes in uses and reception; new experiences of the relationship between embodiment, identity, and community for instance, in the ways people express, understand and represent themselves in online platforms, communities and social media groups; new conceptions of the biological body's relationship to technological media, in particular, distinctions between the human and artificial -today blurred within virtual worlds and social media platforms like Instagram; new patterns of organization and production, where wider realignments have been forming- media culture, industry, economy, ownership - leading to a greater degree of decentralization.

Each one of these new elements are represented through an array of rapidly developing fields of technologically mediated production (user-generated content), including computer-mediated communications, for example, email, chat rooms, avatar-based communication forums, voice image transmissions, the World Wide Web (WWW), blogs, social networking sites, and mobile telephony; new ways of distributing and consuming especially through interactive and hypertextual media content, for instance, WWW, podcasts, streaming and computer games platforms; virtual realities with simulated environments and immersive representational spaces; a whole range of transformations and dislocations of established media for example in photography, animation, TV, journalism, film and cinema.

According to Lister et al. (2009), "all media were once 'new media' [and] emergent media may be seen as instances of both risk and potential". The potential of new media arises from their distinctive nature, namely, digitality which extends and facilitates storage and development; interactivity referring to the new two-way communication that fosters participatory culture by enhancing consumers and users' involvement; hypertexts and other links which simplify navigation of different sources of information

allowing users to act more independently; networks enabling the creation of common pool of resources and information flows; virtuality with users being immersed or engaged in an environment constructed with computer graphics and digital video; simulation referring to synthetic and counterfeit creations, for example, driving and flight simulations.

## **2. Transformation of journalistic practices**

Instances of risk manifest themselves differently in specific contexts. Technology has been transforming both media consumption/usage and the media industry itself. In his article, “The Impact of Technology on Journalism,” John Pavlik (2010) argues that technological change has been exerting a profound influence on journalism in at least four main dimensions: a) the ways that journalists work, with increasing use of digital tools to gather and report news, check facts and find sources; b) the nature of news content both enabled and driven by the ascendancy of high-speed news and online publishing; c) the structure or organization of the newsroom with the digitalization of information collection, processing and distribution; and d) the relationships between or among news organizations, journalists and their many publics including audiences, competitors, news sources, sponsors and those who seek to regulate or control the press.

## **3. Creativity, journalism, and culture**

Journalism is a form of creative work since creativity contributes to all stages of news production, from story ideation via story narration up to story presentation. Today, especially, creativity is considered to be a competitive advantage as the journalistic profession adapts to technological innovations with creative approaches of researching, gathering, selecting, and verifying information; new storytelling modes and formats, innovative ways of publishing and distribution, up to inspired ideas to engage the audience.

What does creativity mean? With more than 50 definitions, the concept of creativity is complex, extending across all disciplines. It has been defined “as the ability to produce something novel and appropriate” (Hennessey and Amabile, 2010). In the Visual Guidelines of Creative Europe, creativity is viewed as a way of “thinking and expanding [one’s] ideas beyond the boundaries of what [is] know[n]” (EU, 2021). Creativity is culture-sensitive and viewed as “a key product of human culture and a tool for enriching culture”. (Shao Y. et al., 2019). According to current research on the impact of culture on creativity, individuals from different cultures have different conceptions of creativity, show differences in preferred creative processes and creative processing modes, and assess creativity using different culture-related measures.

As digital innovations are becoming widespread and digital devices are increasingly used for creative activities, creativity is assuming a new form; it becomes digital. Today, any form of creativity that is driven by digital technologies has come to be called digital creativity. Individuals, teams and organizations may tap from the immense digital world enabled by the Internet to spur their creative thinking. Social Networking is a typical example of how digital technologies influence creativity. No longer isolated, individuals and groups may work in a genuinely networked fashion - close to the ideal just as Manuel Castells envisioned in his model of network society - where they connect to others through digital networks and have access to a vast supply of relevant information and materials. The development of Web 2.0 has also enabled multiple communication and limitless circulation of images and narratives. In the Web 3.0 era -which enables a better data understanding, interoperability between different platforms, and decentralized data structures- Virtual Reality (VR) and Augmented Reality (AR) are blurring the boundaries between the physical and digital worlds. In VR, users are immersed in and interact with, an entire artificial three-dimensional (3-D) environment created with the use of computer modeling and simulation. Virtual Reality (VR) provides entirely new and enhanced possibilities ranging from virtual art galleries to immersive film experiences. News organizations are increasingly using VR and 3-D technology as journalism tools to enhance audience experience. AR, on



the other hand, displays computer-generated data over an existing reality (such as video or images) that is presented in a user's field of view. For example, AR applications developed for smartphones show information such as addresses, real estate offers, or restaurant reviews on specific sites that can be seen through the devices' viewfinder or electronic displays. Many opportunities arise from the complementary use of AR and VR technologies, but their application also requires careful consideration of potential risks, including privacy concerns, unethical usage, and addiction. A further illustration of the shift in the way people interact with technology is a "metaverse." A metaverse is a digital world closely mimicking physical life, blending VR and AR to offer more meaningful and interactive experiences. For example, the videogame Fortnite has virtual events like concerts, and the videogame World of Warcraft is a virtual world where players can buy and sell goods. In fact, the emergence of the metaverse may be viewed as a transformative shift in technology-driven human interaction, bridging the virtual and physical worlds for richer, more enhanced experiences.

#### **4. Digital creativity and generative artificial intelligence**

The latest intersection point of technology and creativity is art generated by artificial intelligence, the so-called AI-generated art or generative art. Generative AI uses complex machine learning algorithms to transform existing content into new visual and auditory compositions and artwork including music, visual art, software art, architecture, literature, and live coding (Lee et al.,2015). Some of the numerous Generative AI tools available are:

- GPT-4 - the most recent version of OpenAI's Large Language Model (LLM) – and ChatGPT which offers common users free access to basic AI content development;
- Bard - chatbot and content generation tool developed by Google;
- Rephrase.ai or Synthesia - AI video platform or tool for creating videos;
- StyleGAN or DALL-E 2 - is OpenAI's recent version for image and art generation.

These tools are being made available to anyone from computer game players to creators and journalists, allowing them to create their own "avatar", which is the graphical representation or incarnation of their "real" selves in virtual life. According to the 2023 Reuter's Institute Report on Journalism, Media, and Technology Trends and Predictions, media companies are integrating AI into their products to offer more personalized experiences to their audience. Generative AI tools such as MidJourney and DALL-E are already being used to create illustrative art for articles and blog posts. New applications such as ChatGPT and DALL-E 2 are also increasingly used to enhance production efficiency and to create new types of semi-automated content. Creativity in short-form video storytelling has also been expanding in youth-based social networks.

#### **5. Future perspectives**

With the rapid pace of technological change, creativity, which has been considered a quality belonging only to humans, seems to become vulnerable. Generative AI applications are affecting sectors and jobs which involve creative thinking and require an intensity of knowledge and information (for example, content creation and delivery, coding, and writing). In their article "How Generative AI Could Disrupt Creative Work", De Cremer et al. (2023) suggest three non-exclusive scenarios in relation to possible disruption of creative work: a) people use AI to augment their work, leading to greater productivity; b) generative AI creates a flood of cheap content that drives out human creatives, and c) human-made creative work demands a premium. The first scenario does not necessarily constitute a threat to creativity. Instead, Generative AI tools may assist creators to become more productive as they are used as an inspiration, reducing the time and effort required to come up with new ideas. In contrast, the second scenario foresees the "crowding out" of human creativity, with algorithmically generated content inundating the creative market. This extreme abundance of cheaply made content may curb human creativity as people will gradually stop creating new art and content. According to the third

scenario, the flooding with artificial creations will revive human interest in authentic creativity and people might be willing to pay for it. Generative AI tools might have impressive capabilities, but their products are full of factual errors and erroneous logic. Moreover, human creativity as a significant product of culture and society, has a dynamic quality that algorithms cannot emulate. In this scenario, carefully designed regulatory governance frameworks are deemed necessary to counter false or misleading content.

## **6. Conclusion**

In 1913, the German journalist Wolfgang Riepl formulated the hypothesis that “new, further developed types of media never replace the existing modes of media and their usage patterns. Instead, a convergence takes place in their field, leading to a different way and field of use for these older forms.” Until today, history has proved him right, with technological progress amplifying and broadening human faculties. Generative AI, however, is heralding a transformation that threatens creativity - the one skill that was considered an exclusive human characteristic. Will Riepl’s hypothesis still hold? Moreover, so far, there has always been a human behind AI to tell it what to create. In the future, will it be also the case? Indeed, with the continuous progress in the field of artificial intelligence, the question of whether AI will be able to create independently, without human intervention, becomes an intriguing and uncertain frontier of technological evolution.

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## Factors affecting the use of digital textbooks in Sri Lankan Secondary Education

N.W.W.G.K. Prabhashini

*PhD candidate, School of Information Management, Wuhan University, China*

Digital textbooks provide intellectual information in electronic form to encourage student participation in learning. In educational publishing, a digital textbook is more appealing as a learning method than a printed textbook because of its interactive features and ease of use, access, and information sharing. In Sri Lanka, the Educational Publication Department is the arm of the government responsible for publishing educational material for the school community. The present study aimed to research the factors affecting the use of digital textbooks in Sri Lankan secondary education. The main objective of the research was to determine which factors are affecting the use of digital textbooks in Sri Lankan secondary education. A mix of methodologies drove this study: questionnaire survey and interview methods were used as data collection techniques. An online questionnaire was distributed to 325 senior secondary students in Western Province, Sri Lanka, and the raw data from 323 respondents was accurate. The questionnaire was created using the "Google Docs" and circulated over WhatsApp social media. When design the questionnaire, questions 1 through 18 have a multiple-choice format, questions 19, 20, 21, and 23 are based on a linear scale, and questions 22 and 24 are based on a paragraph format. Semi-structured interview questions were used to collect data from resources. Interviews were conducted with two assistant commissioners from the Education Publication Department, five secondary school teachers from both public and private schools, and two university professors who were involved in the process of developing the school curriculum. SPSS and NVIVO software are used for analyzing quantitative and qualitative data. This study revealed that adopting digital textbooks positively affected students' academic progress, interest in learning, skill development, and knowledge transfer, with increased student-teacher collaboration in secondary education in Sri Lanka. Factors to be considered in affecting the use of digital textbooks include knowledge about new technology, the language barrier, traditional learning patterns, a lack of digital devices, and speedy internet facilities. Accepting new technology and behavioural learning processes were also identified as contributing factors.

**Keywords:** *Sri Lankan secondary education, digital textbook, educational publishing, learning aid, effects of adoption*

## **Stitch in time saves nine**

### **(Repairing the hearts and minds of the garment workers through applied theatre)**

Pujitha De Mel

*Department of Performing Arts, Sri Palee Campus, University of Colombo, Sri Lanka*

Garment industries comprised of skilled and unskilled labour were established in many parts of the country. Workers are under a lot of stress, and their lives are pretty routine. The majority of these employees are absent from and far from their families. Since they cannot take time off, they neglect their social commitments and grow socially isolated. Most of the time, Sexual harassment and other forms of gender-based violence occur in this surrounding. Regular Absenteeism, lethargy, negligence and labour conflicts continue to happen due to unsatisfying conditions in the work environment. This research aims to assess how workforce advancements in the apparel industry affect employees' psycho-physical behaviours, deepening our understanding of this relationship. Employing the Auto-Ethnography method, the study explores garment workers' experiences to elucidate their cultural contexts, beliefs, daily lives, and work practices. Utilising the 'Corporate theatre' genre, the research conducted eight months of weekend drama workshops to empower marginalised individuals, culminating in a forum theatre production. This production facilitated dialogue among workers, employers, and the audience, resulting in notable shifts in awareness, attitudes, and behaviours, contributing to a transformative process. The five distinguishing characteristics of the applied theatre techniques, such as Participation, Outreach, Service, Intention and Transformation of their lives, are explained through the method of this research is based on a qualitative study where the data were gathered from group discussions, individual feedback of participants, video recording of each workshop sessions, diary notes, feedbacks of trainers and observer's opinions during the six months workshop process. By bringing out their so-called 'frustrations, anxieties and worries, we could teach a positive attitude to the work, build self-confidence, improve interpersonal relations, and enhance synergy among the workers. We argue that solving their day-to-day problem is a must, and as the mandate says, a stitch in time saves nine.

***Keywords:*** *corporate theatre, auto-ethnography, participation, transformation*

## The role of social media in construction management

J.T.H. Chathurangani

*Sri Palee Campus, University of Colombo*

The construction industry has undergone a profound transformation in recent years, largely driven by technological advancements and the digital revolution. Among the many technological innovations that have reshaped construction management practices, social media platforms' emergence and widespread adoption have played a pivotal role. This review explores the multifaceted role of social media in construction management, focusing on its influence on project communication, collaboration, information sharing, and stakeholder engagement. Recently, research has explored the potential utility of social media platforms in project management. However, there remains a significant gap in understanding regarding the precise impact of social media on the management of construction projects. Consequently, this abstract seeks to fill this void by conducting a comprehensive systematic review of the role of social media as a tool for effectively managing construction projects. The findings of this study are presented through a rigorous analysis that combines both quantitative and qualitative content analysis of the collected research papers. This multifaceted approach allows for a comprehensive exploration of the subject matter, yielding valuable insights into the role of social media in construction project management. In conclusion, social media has evolved into a transformative force in construction management. Its capacity to enhance communication, foster collaboration, streamline information sharing and engage stakeholders positions it as an indispensable tool in the modern construction landscape. As technology advances, construction professionals must harness the power of social media to remain competitive and adapt to the industry's evolving demands. This review underscores the significance of social media in construction management. It serves as a call to action for continued exploration and utilization of these powerful digital tools.

**Keywords:** *social media, construction management, communication, stakeholders, project efficiency*

## The analysis of film language in dream sequences

D.C.V Fernando

*Department of Performing Arts, Sri Palee Campus, University of Colombo, Sri Lanka*

Cinema and Dreams share more common things as both are part of fantasies but originated in reality. From the silent era dream sequences had been frequently included in films (for example, First Scene of Life of an American Fireman -1903 by Edwin S Porter). Filmmakers employ captivating film language in cinema to create dream sequences that transport audiences into fantasy. These dream sequences are often influenced by dream interpretation through psychoanalysis. Sigmund Freud's theory of dreams suggests that dreams represent desires, thoughts, wish fulfilment, and motivations in the unconscious. These elements in the unconscious come through symbols and signs in Dreams. This study explores how filmmakers use Freudian psychoanalysis and Carl Jung's dream theory to craft dream sequences in film language. The filmmakers use dream-based psychological references to create dream sequences. The psychoanalysis approach towards dream psychology and the psychological background of the film language is used to understand the film language of dream sequences. 'How to Analyse the use of film language in dream sequences?' states the study's research problem. The research is qualitative research based on content analysis. Film sequences and film literature are used for data collection. Three dream sequences from *Amour* (2012), *Shutter Island* (2010), and *Hacksaw Ridge* (2016) are used in the research as the primary references. Dreams in art and literature-based resources, and film dream sequences-based research are the primary sources in the literature review. While ample literature is available on analysing film language in various contexts, a nuanced examination of film language within dream sequences represents an existing research gap. Analysing dream sequences, exploring film language, in-depth analysis of audience psychology, and developing more research in the field of cinema in Sri Lanka are considered the main objectives of the research. In conclusion, the research uncovered the use of film language within cinematic dream sequences, uncovering their complex role in storytelling. Examining cinematic visuals and sound, filmmakers adeptly employ signs and symbols drawn from psychoanalysis to construct intricate dreamscapes that blur the line between fantasy and reality within dream sequences.

**Keywords:** *Freudian psychoanalysis, film language, semiotics, fantasy, audience psychology*

## **The ‘Mirror’ Movement Improvisation Activity to Enhance Physical Performance of People with Physical Disabilities**

K. D. W. Ruchini

*Department of Performing Arts, Sri Palee Campus, University of Colombo, Sri Lanka*

This study investigates the impact of ‘*Mirror*’ improvisation movement activity on the physical performance of individuals with physical disabilities. Movement-based interventions have shown more significant results in enhancing physical functionality and promoting overall well-being in human segments of society, however, their specific impact on individuals with physical disabilities remains relatively underexplored in Sri Lankan communities. Therefore, this study tries to understand the strengths and limitations of improvisation movement activities to expand the physical function of people with disabilities. The research addresses how participation in improvisation movement activities impacts mobility and improved functional abilities in individuals with physical disabilities. Does engagement in improvisation movement activities interventions lead to improvements in balance, strength, and flexibility in them? The study adopts a qualitative approach, exploring participants' experiences and perceptions and the researchers' participation observations and insights. The research used a 4-day dance-based workshop in Wattala and Vavuniya Divisional Secretariat areas. Participants were individuals with physical disabilities from birth and victims of accidents living in aforesaid Divisional Secretariat areas. This study conducted four case studies involving participants from both workshops. The participants' experiences with the ‘*Mirror*’ movement activity and their physical engagement were collected through semi-structured interviews. The findings provide an understanding of the impact of improvisation movement activities that help to expand the physical performance and participants' subjective experiences. The findings will contribute to the rehabilitative and wellness approach for people with physical disabilities. Ultimately, this study seeks to promote holistic well-being and enhance the quality of life for people living with physical disabilities.

**Keywords:** *movement improvisation activities, people with disabilities, well-being*



# The Impact of Google's Algorithm Updates on SEO Strategies within the Context of Digital Humanities Research

S. I. Mahendra, Dharmakeerthi Sri Ranjan

*Department of Mass Media, Sri Palee Campus, University of Colombo, Sri Lanka*

Search engines are the primary method of finding relevant content in the digital world. Google's algorithm updates have consistently shaped the development of Search Engine Optimization (SEO) strategies. These updates significantly impact how websites are ranked and displayed on Search Engine Result Pages (SERP). The updates target low-quality content, keyword stuffing, and other manoeuvres manipulating search results. Therefore, SEO practitioners must adapt their techniques continuously to align with the latest Google algorithm updates to maintain and improve the visibility of respective websites in SERPs. SEO is recognized as a technical field, closely associated with the digital domain. Simultaneously, the efficiency of SEO practice relies on content development, which necessitates a strong command of language skills found within the humanities discipline. As a result, the comprehensive application of SEO incorporates a fusion of digital techniques and language proficiency, thus encompassing the essence of digital humanities. This integrated process is essential for meeting the criteria set forth by Google's algorithm updates. Examining the influence of Google's algorithm updates on SEO strategies in digital humanities research holds timely significance, as it empowers content creators to tailor their SEO approach, ensuring the visibility and accessibility of their work in the digital landscape. The data analysis employs a qualitative method. Qualitatively the study involves content analysis. In the context of SEO, content analysis can be used to examine the content of websites to understand how they are optimized for search engines. This qualitative research method analyses text, images, and other data types to identify patterns, meanings, and relationships in Sri Lankan context.

**Keywords:** *algorithm updates, SEO, visibility, digital humanities*

## **Impact of Format Changes in Online Advertising Models on Consumer Motivation (Specific to Facebook Social Media)**

W.M.M. Hansamali, Ranjan C.K. Hettiarachchi

*Department of Mass Media, Sri Palee Campus, University of Colombo, Sri Lanka*

This study aims to investigate the impact of changes in online advertising model forms on consumer motivation in the setting of Facebook social media. The research problem focuses on determining if changes in online advertising forms have a visible impact on consumer motivation, notably in the arena of Facebook media. It was hypothesized that the change in Facebook advertising models strongly impacts consumer motivation. The primary goal of this work is to provide a comprehensive conceptual and theoretical analysis of advertising and its evolutionary history, giving insight into its effect on consumer motivation. To achieve the objectives of this study, the research explores the theoretical and conceptual aspects of advertising, highlighting Furthermore, it identifies the unique features of online advertising and specifically Facebook advertising. The study examines the varying advertising models employed on Facebook's social media platform and investigates how changing advertising models affect customer incentives. The study also tries to combine conclusive data and make insightful recommendations. The study used a mixed quantitative and qualitative methodology with a sample of 180 people from the Colombo, Gampaha, and Kalutara districts. Data was gathered through the distribution of questionnaires and analyzed using SPSS software. To acquire a more in-depth understanding, three subject-matter experts were questioned. The key findings of this study emphasize the growing consumer awareness of items via online media channels, emphasizing the critical significance of changing Facebook advertising formats in generating customer motivation. As a result, the study shows that to increase consumer motivation, there must be a strategic alignment with the preferences of the target customer category, which necessitates the exploration and implementation of Facebook advertising models that resonate more closely with their choices. This research contributes to a nuanced understanding of the dynamics between online advertising format changes and consumer motivation, specifically within the Facebook social media landscape. It emphasizes the need for tailored strategies that align advertising models with consumer preferences for enhanced stimulation and engagement.

**Keywords:** *advertising, Facebook, online advertising, consumer, motivation*

## **Human Resource Management, Employee Efficiency, and Productivity (Specific to Derana Radio and Lakhada Radio)**

K. Pooja Piumali, Ranjan C.K. Hettiarachchi

*Department of Mass Media, Sri Palee Campus, University of Colombo, Sri Lanka*

This study investigates how human resource management practices in a media organization are employed to enhance employee efficiency and productivity. It also seeks to determine the effectiveness of these measures in achieving heightened performance. The central premise of this study is that human resource management within a media organization plays a significant role in elevating employee efficiency and productivity. The research objectives encompass several facets, including examining the role of human resource management within media organizations, evaluating the performance of human resource management practices in such contexts, and assessing the overall employee performance within media organizations. To study the role of human resource management in a media organization, and also To study the current human resource management practices of media organizations, To analyse the performance of employees in a media organization, To study the efficiency and effectiveness of employees of a media organization, To study the steps taken by human resource management to create efficiency and productivity of employees, Furthermore, the study aims to analyse the impact of enhanced employee efficiency and effectiveness on the growth and development of media organizations. The study focused on Derana Media Company as its research sample to accomplish these goals. Among the participants, 50 individuals were chosen, consisting of 25 from both Derana Radio and Lakhada Radio. The research methodology involved the distribution of questionnaires to the selected sample, with data subsequently analyzed using Statistical Package for Social Sciences (SPSS) software. Additionally, insights were gleaned from interviews conducted with four experts in the field. The research findings affirm the positive correlation between human resource management strategies in native media organizations and employees' heightened efficiency and productivity. As a recommendation, the study proposes implementing nomination programs for recruits in media institutes, enhancing their understanding of institutional disciplinary procedures, conditions, regulations, and rules. By investigating the interplay between human resource management and employee efficiency in media organizations, this research underscores pathways to improve HR practices, fostering an environment conducive to both individual and organizational growth. It provides valuable insights for optimizing workforce performance within the media sector, ultimately contributing to enhanced overall outcomes.

**Keywords:** *organizational management, media institution management, human resource management, efficiency, productivity*

# University of Colombo School of Computing



*ICT for Emerging Regions*

8<sup>th</sup> November 2023

## MESSAGE FROM DIRECTOR

**Dr. Ajantha Atukorale**

Director,

University of Colombo School of Computing



As the Director of the University of Colombo School of Computing (UCSC), it is my great pleasure to extend a warm welcome to all participants, researchers, and practitioners in the field of Computing at the ICTer International Conference 2023.

The ICTer International Conference is a legacy that stems from the renowned International Information Technology Conference (IITC), which has been a pivotal event in the landscape of Computing conferences in Sri Lanka since its inception in 1998. Building upon this rich history, ICTer now emerges as its successor, reaffirming our commitment to fostering innovation, sharing knowledge, and pushing the boundaries of technology.

In a world where the pace of technological advancement is relentless, it is vital that we create a platform for the exchange of ideas, insights, and research findings. ICTer aims to be precisely that platform. It is a unique opportunity for both seasoned researchers and emerging scholars to present their groundbreaking research results, innovative ideas, and practical deployments that are shaping the computing domains.

One of the distinguishing features of ICTer is the opportunity it offers for high-quality papers to be considered for publication in the esteemed Journals of the National Science Foundation (JNSF) and ICTer journal. This opens up a pathway for authors to share their work with a broader audience and contribute to the body of knowledge that is driving the technological landscape forward.

As we gather for the ICTer International Conference, I encourage all participants to take full advantage of this unique opportunity. Engage in the presentations, contribute to discussions, network with your peers, and foster new collaborations.

In conclusion, I look forward to witnessing the stimulating discussions, the knowledge sharing, and the collaborative spirit that will define the ICTer International Conference. Together, let us shape the future of technology and contribute to a world that is smarter, more connected, and better informed.

## MESSAGE FROM SYMPOSIUM CO-CHAIRS

**Dr. Chamath Keppitiyagama**

University of Colombo School of Computing



**Dr. Damith Sandaruwan**

University of Colombo School of Computing



ICTer conference, managed and hosted by the University of Colombo, has a history of 24 years. It is the successor of the International Information Technology Conference (IITC) started in 1998. In 2007, IITC was rebranded as the International Conference on Advances in ICT for emerging regions (ICTer).

This year's conference features seven keynotes, and four tech talks from the industry in addition to the presentations of research papers. Starting this year all papers selected to be presented at ICTer will be published in either a special issue of the Journal of the National Science Foundation or the ICTer Journal. Therefore, all submissions have been subjected to a rigorous review process by an international review panel.

ICTer 2023 is not just an academic conference. In the computing domain, industry is also in the forefront of innovation and research. ICTer recognizes industry innovations and provided space within the conference venue, Innovation Studio, for the industry partners to showcase their technology and innovations.

We hope that the blend of participants from the industry and academia at ICTer 2023 sparks innovations.

## **ORGANIZING COMMITTEE**

### **Conference Co-Chairs**

- Dr. Chamath Keppetiyagama, B.Sc. (Col), Ph.D. (British Columbia, Canada), MIEEEL, University of Colombo School of Computing
- Dr. Damith Sandaruwan, B.Sc. (Col), Ph.D. (Col) , University of Colombo School of Computing

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- Dr.Randil Pushpananda , BSc in Eng. Phys. (Col), BIT (Col), MCS (Col), Ph.D. (Col), University of Colombo School of Computing
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- Ms. Madara Jayarathna, Assistant Registrar, University of Colombo School of Computing



## Programme of Sessions

<b>AGENDA – 08<sup>th</sup> November 2023</b>	
07.30 AM	Registration
08.00 AM	Inauguration and Introduction of ICTer 2023
08.30 AM	Welcome address by the Conference Chair
08.35 AM	Address by the UCSC Director
08.40 AM	Address by the Vice Chancellor
08.50 AM	Address by the Chief Guest
09.00 AM	Keynote by Dr. Ruvan Weerasinghe
10.00 AM	Tea Break
10.30 AM	Tech Talk by Cambio Software Engineering
10.50 AM	Paper Presentations (Session 01)
11.50 AM	Tech Talk by Altria Consulting & WIA Systems Inc.
12.10 PM	Keynote by Prof. Timothy Baldwin
01.10 PM	Lunch Break
02.10 PM	Tech Talk by Softlogic Information Technologies (Pvt) Ltd & Dell Technologies
03.35 PM	Tea Break
04.00 PM	Keynote by Italo Vignoli
05.00 PM	Reception

## AGENDA – 09<sup>th</sup> November 2023

07.30 AM	Registration
08.00 AM	Commencement
08.10 AM	Paper Presentation (Session 03)
08.50 AM	Keynote by Prof. Peter Christen
09.50 AM	Tech Talk by London Stock Exchange Group
10.10 AM	Tea Break
10.40 AM	Key note by Mike Willburn
11.40 AM	Paper Presentations (Session 04)
12.20 PM	Keynote by Prof. Patrick Olivier
01.20 PM	Lunch
02.20 PM	Keynote by Prof. Thiemo Voigt
03.20 PM	Tea Break
04.00 PM	Paper Presentations (Session 05)
04.45 PM	Awards Ceremony & Closing

## INTRODUCTION TO KEYNOTE SPEAKERS

### **Prof. Patrick Olivier**

*Director of Action Lab*

*Faculty of Information Technology*

*Monash University*



Patrick Olivier is Professor of Human-Computer Interaction and Director of Action Lab: Australia at Monash University, Australia. He is a self-declared HCI generalist, who works in cross-disciplinary settings, and who has published widely on topics from ubiquitous computing & interaction techniques to participatory and experience-centred methods. Before moving to Monash in 2018 to establish Action Lab, Patrick founded and led Open Lab at Newcastle University (2009-2018), where he coined the term "digital civics" and led the world's largest research initiative into how digital technologies can be used to infrastructure new models of participatory citizenship. Patrick is the all-time most-published author at ACM CHI, the highest impact publication venue in Human-Computer Interaction.

## **Prof. Italo Vignoli**

*LibreOffice Marketing & PR*



Italo Vignoli is a founding member of The Document Foundation and the LibreOffice project, the Chairman Emeritus of Associazione LibreItalia, an Ambassador of Software Heritage, and a proud member of Free Software Foundation Europe (FSFE). Italo co-leads LibreOffice marketing, PR and media relations, co-chairs the LibreOffice Certification Program

Italo Vignoli is a founding member of The Document Foundation and the LibreOffice project, the Chairman Emeritus of Associazione LibreItalia, an Ambassador of Software Heritage, and a proud member of Free Software Foundation Europe (FSFE). He is a past board member of Open Source Initiative (OSI).

Italo co-leads LibreOffice marketing, PR and media relations, co-chairs the LibreOffice Certification Program, and is a spokesman for the project. He also handles advocacy and marketing activities for the Open Document Format ISO standard.

He has contributed to several large migration projects to LibreOffice, and is a LibreOffice certified migrator and trainer since 2014. From 2004 to 2010 he has been involved in the OOo project.

In his professional life, he is a marketing consultant with more than four decades of experience in high tech PR, and a visiting professor of marketing, public speaking and PR post-graduate courses.

Italo has a Degree in Humanities at the University of Milan, based on a typewritten thesis in human geography (well before the PC era) and MBAs in Marketing, Public Relations and Journalism.

Italo was born on August 12, 1954, at 6PM CET, 27 years before the announcement of the IBM PC in Boca Raton, Florida, on August 12, 1981, at noon EST. Shortly after, he was hired by the second largest computer company to manage high tech PR. Coincidence, or destiny?

## **Prof. Peter Christen**

*School of Computing  
Australian National University*



Peter Christen is a Professor in the School of Computing at the Australian National University (ANU) in Canberra. He graduated with a PhD in Computer Science from the University of Basel, Switzerland, in 1999. He is also the Research Lead on the Scottish Historic Population Platform (SHiPP) within the Scottish Centre for Administrative Data Research (SCADR) at the University of Edinburgh in the UK. Peter's main research interests are in record linkage and data mining, with a focus on privacy-preservation, data quality, and machine learning aspects of record linkage. He has published over 200 articles in these areas, including the two books "Data Matching" in 2012 and "Linking Sensitive Data" (co-authored with Thilina Ranbaduge and Rainer Schnell) in 2020. His work has attracted over 15,000 citations at Google Scholar.

## **Dr. Ruvan Weerasinghe**

*Senior Lecturer*

*University of Colombo School of Computing*



A former Director of the University Of Colombo School Of Computing, He has also served as a Visiting Professor at the Management & Science University of Malaysia (MSU) in 2010-2011, visiting Faculty at the Umea University of Sweden in the fall of 2013 and Dean of the Informatics Institute of Technology, Sri Lanka in 2015/2016. In 2001 He was an ERCIM Fellow at France's INRIA Labs and in 2002, a Fulbright Senior Visiting Scholar at Carnegie-Mellon University's Language Technology Institute in Pittsburgh, USA.

He has served on various committees and boards at the University Grants Commission (UGC), Ministries of Education and Higher Education (MoE and MoHE), the National Science Foundation (NSF) and the Information & Communication Technology Agency of Sri Lanka (ICTA) over the years. He was part of the Sri Lankan negotiating team with the World Bank on the e-Sri Lanka Project in 2003, and the Chairman of the Education Ministry Task Force for establishing a dedicated National College of Education for ICT in 2008/9. He was also part of the original group involved in introducing Internet and email connectivity to the universities and the country as a whole through the Lanka Education And Research Network (LEARN). From 1997 to 2001, He was an Instructor with the Internet Society's (ISOC) International Network Training (INET) Workshops around the world, and a Team Leader in 1997/2000 of the International Olympiad in Informatics (IOI) team of Sri Lanka. He serve as a member of the ICT Advisory Committee of the Export Development Board (EDB) and the Sectoral Committee on ICT of the Sri Lanka Standards Institute (SLSI). He is also a founder member of the Lanka Software Foundation (LSF), a prime mover of open source software in Sri Lanka and a subscriber of the Lanka Domain Registry (LKNIC). He serve as a member of the Board of Sri Lanka CERT and the Advisory Board of the Sri Lanka Association of Software and Services Companies (SLASSCOM).

His research interests are in Computational Linguistics including Machine Translation, and particularly in techniques employing statistical methods and machine learning using large data sets. He led a group of 6-8 researchers involved in Language Technology at the UCSC's Language Technology Research Lab (LTRL) from 2004 till 2018. His research interests expand naturally to Artificial Intelligence and more recently Bioinformatics.

## **ABSTRACTS OF KEYNOTE ADDRESSES**

### **Infrastructuring Participatory Citizenship**

**Prof. Patrick Olivier**

In this presentation, I will outline “what” it means to “infrastructure participatory citizenship”, that is, new relational models of digitally enabled public services, and "how" to realise these models. Will start by unpicking the notion of the “user”, and what it means for technologists and designers to think in terms of “citizens” and design digital technologies with and for citizens that move away from traditional “transactional models” of government and third sector services to create more “relation” citizen- and community-oriented services. Rather than getting too conceptual, I’ll develop my arguments by reference to a trajectory of my group’s digital service designs (all fully deployed) in the area of digital health and community technologies, from Feed-Finder (a community-led breastfeeding advocacy service) and App Movement (a community commissioning platform for Apps) to Paroli (a telephony-based collaboration service for low-resource settings) and Limitless (a video-based global youth innovation program). I will also present my views on how best to engage in this area of research as a university. Unsurprisingly, it means doing things “differently”, a view that I hope will resonate with the Monash University Malaysia business and management research community. By “different” I mean different ways we can design digital services; different ways of engaging communities, NGOs, government and businesses in the design of those services; and, different ways of doing research as a researcher and research group.

## **LibreOffice Technology, a FOSS platform for personal productivity**

**Prof. Italo Vignoli**

LibreOffice was announced in 2010 to relaunch innovation of the already stagnant OpenOffice project. Since 2011, LibreOffice has evolved from a single desktop product to a technology platform supporting applications for the desktop, the cloud and mobile. All products share the same engine, which provides superior consistency.

This has been achieved in stages, following the evolution of the office suite market. First, it has been necessary to pay the technical debt inherited from OpenOffice. Then, source code has been refactored, with the introduction of new technologies to replace legacy ones. Third, the user interface has been modernized and made more flexible, with options for users migrating from proprietary software.

Today, the LibreOffice Technology platform is based on the same software engine for all modules, based on a clean and refactored source code, with a focus on code quality and consistency, and supported by easy and extensive APIs.

LibreOffice consistency represents a strong advantage over the "siloed" approach of all other office suites, where there is a different software engine for each application and each platform. The result is a lack of consistency for files, which are also different by platform.

LibreOffice Technology is the best open source platform for personal productivity, and is tightly integrated on desktop, mobile and cloud.



## **Lessons from twenty years of working with (administrative) Big Data**

**Prof. Peter Christen**

The last twenty years have seen a massive increase in the collection of data about people by businesses and governments. Such databases are mostly collected for administrative purposes, for example to manage the patients in a hospital. The wealth of knowledge that can be gained from analysing such administrative databases and the resulting value to organisations has led to the widespread use of data science technologies across both the private and public sectors. However, administrative databases can also be used for research that is aimed at improving the social good, and to facilitate population studies across numerous domains. Known as Population Data Science, the use of administrative databases has various challenges that need to be considered. These include data quality and the human and social nature of how personal data are being collected, processed, and potentially integrated, as well as privacy aspects that need to be considered when working with databases that contain (possibly sensitive) personal information.

In this talk I will first provide an overview of what administrative data are, and give examples of how such data can be used for research to improve the social good. Then I will highlight some misconceptions that are commonly made when administrative data are used for analysis or research. I will also touch upon the challenges of accessing real administrative databases, and conclude with a set of lessons learnt and recommendations for anybody who is working with administrative Big Data.

## **When Machines Go Rogue: The Risks and Rewards of AI Hallucination**

**Dr. Ruvan Weerasinghe**

In an age where artificial intelligence is rapidly advancing, it's imperative to explore the intriguing yet complex phenomenon of AI hallucination. This talk will delve into the remarkable capabilities of Generative AI and their ability to generate creative content, be it in art, literature, or even scientific research. These AI hallucinations blur the line between human and machine creativity. The talk will navigate the uncharted territories of the risks associated with AI hallucination. We'll consider instances where AI-generated content challenges our perceptions of reality, from deepfake videos to the spread of misinformation. As technology pushes the boundaries of what AI can create, we are confronted with ethical dilemmas and the need for responsible AI use.

Yet, amidst these risks lie extraordinary opportunities. AI hallucination has the potential to revolutionize industries, elevate human creativity, and spark innovation. It promises to be a powerful tool in the hands of artists, scientists, and creators, unlocking novel possibilities that enhance our lives. The talk expects to inspire a thought-provoking dialogue on the delicate balance between the rewards and risks of AI hallucination. As IT professionals, academics, and researchers, we have a pivotal role in shaping the future of AI. It is a future where machines can go rogue, but it's our wisdom, ethics, and innovation that will determine whether this journey takes us to the heights of human potential or the depths of uncertainty.

## List of Abstracts

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*<sup>1</sup>University of Sri Jayewardenepura <sup>2</sup>University of Colombo School of Computing*
2. Multi-Hop Question Answering over Knowledge Graphs  
*Janadhi Uyanhewage, Viraj Welgama, Ruwan Weerasinghe, University of Colombo School of Computing*
3. Detecting the Severity of Depression in Online Forum Data by Leveraging Implicit Semantic Inferences  
*Shaveen Thilakaratne, Viraj Welgama, Ruwan Weerasignhe, University of Colombo School of Computing*
4. Exploring Low-resource Neural Machine Translation for Sinhala-Tamil Language Pair  
*Ashmari Pramodya, Randil Pushpananda, Ruwan Weerasinghe, K.T. Yasas Mahima University of Colombo School of Computing*
5. Comparing the Performance of Machine Learning Algorithms for Emotion Classification on Tweets  
*Sugeeshwa S P Galhena, Ajantha Athukorala University of Colombo School of Computing*
6. Enhance User Experience in Web Based AR with Dynamic Content  
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7. FEWSION: Fashion Editing With Stable Diffusion  
*V Vijayakumaran , Dr. P V K G Gunawardana, Dr. K.D Sandaruwan University of Colombo School of Computing*

8. Skeletal Point Analysis to Determine the Accuracy of Forehand Smash Shots Played by Badminton Players  
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*Michelle Fernando, Damitha Sandaruwan and Kavinda Athapaththu  
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*University of Colombo School of Computing*

16. Exploring the Efficacy of Gamification in Developing a Learning Platform for Students with Dyslexia in Sri Lanka.

*Yadeesha Weerasinghe, Sanka Gallage, Kavisha Perera, Prameeth Madhuwantha, Kasun Karunanayaka*

*University of Colombo School of Computing*

17. Comparative Analysis of Extensible Approaches for Document Layout Segmentation

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*University of Colombo School of Computing*

18. SeEar: Low-Cost Augmented Reality Glass for Deaf and Hard-of-Hearing Impaired

*Yasith Samaradivakara, Thavindu Ushan, Asela Pathirage, Chamath Keppitiyagama, Kasun Karunanayaka, Suranga Nanayakkara*

*University of Colombo School of Computing, Colombo, Sri Lanka*

19. Enhance User Experience in Web Based AR with Dynamic Content

*M S Dewanarayana , P S Mahagamage, H B M Faalil, K D Sandaruwan , Kenneth Thilakarathna*

*University of Colombo School of Computing*

20. Enhance User Experience in Web Based AR with Dynamic Content to mitigate the impact of content loading times.

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*University of Colombo School of Computing*

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*University of Colombo School of Computing, Colombo, Sri Lanka*

22. Optimizing Black Tea Fermentation through Climatic Variations: A Deep Learning Approach

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23. AgrOM: A Hybrid Model for Plant Disease Detection through Ontology and Machine Learning

*E.B.D.R. Sanjula<sup>1</sup>, G. Sribarathvajasarma<sup>1</sup>, J.P.M. Thushari<sup>1</sup>, L.N.C. De Silva<sup>1</sup>, M.D.J.S. Goonetilake<sup>1</sup>, S. Wilson<sup>2</sup>*

*<sup>1</sup>University of Colombo School of Computing, Colombo, Sri Lanka*

*<sup>2</sup>Sri Lanka Uva Wellassa University, Badulla, Sri Lanka*

## Abstracts

### **Applicability of End-to-End Deep Neural Architecture to Sinhala Speech Recognition**

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This research presents a study on the application of end-to-end deep learning models for Automatic Speech Recognition in the Sinhala language, which is characterized by its high inflection and limited resources. We explore two e2e architectures, namely the e2e Lattice-Free Maximum Mutual Information model and the Recurrent Neural Network model, using a restricted dataset. Statistical models with 40 hours of training data are established as baselines for evaluation. Our pretrained end-to-end Automatic Speech Recognition models achieved a Word Error Rate of 23.38% by far the best word-error-rate achieved for low resourced Sinhala Language. Our models demonstrate greater contextual independence and faster processing, making them more suitable for general-purpose speech-to-text translation in Sinhala.

**Keywords:** *Speech Recognition, Deep Learning, Transfer learning*

## **Multi-Hop Question Answering over Knowledge Graphs**

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Multi-Hop Question Answering over Knowledge Graphs (MHQA-KG) plays a pivotal role in various applications, including but not limited to Question Answering, Recommendation Systems, and Semantic Search. Nevertheless, current models for MHQA have limitations in their ability to grasp all the information included in the question, resulting a reduction in accuracy when producing answers. In order to mitigate this limitation, this paper proposes a novel Multi-Hop Question Answering over Knowledge Graphs approach. It mainly utilizes question and path embedding to answer multi-hop questions, significantly improving accuracy. This approach effectively captures auxiliary information that may be present in the question. The experimental findings provide evidence that the suggested methodology outperforms the current state-of-the-art models, achieving highly accurate outcomes with improvements.

**Keywords:** *Question Answering, Knowledge Graphs, Multi-Hop, Path Embedding, Sentence Embedding*



# Detecting the Severity of Depression in Online Forum Data by Leveraging Implicit Semantic Inferences

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Depression, a prevalent mental health disorder with global implications, exerts a profound negative influence on individuals' lives. While the prediction of depression (as a binary classification task) is a well-established research area, depression severity detection is a new research direction with limited studies. In the context of detecting the severity of depression through online forum data, this research endeavors to offer two distinct solutions by employing Ada embeddings, GPT 3.5 Turbo, and LIWC as feature engineering techniques, while AutoSklearn serves as the ensemble learning algorithm. Notably, the outcomes of this study significantly outperform existing state-of-the-art models on both depression severity annotated datasets used in this research. The results also showcase the potential reuse nature of the proposed models in diverse data sources due to their high performance in both datasets. Furthermore, as a valuable practical outcome, a software prototype has been developed, capable of providing the depression severity level, along with associated symptoms and keywords, upon inputting an online forum post.

**Keywords:** *Neural Machine Translation, Low Resourced Languages, Back translation, Hyper-parameters, Sinhala, Tamil*

## Enhancing Neural Machine Translation for the Sinhala-Tamil language pair with limited resources

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Neural Machine Translation has emerged as a promising approach for language translation. Transformer-based deep learning architectures have also significantly enhanced translation performance across various language pairs. However, several language pairs with limited resources face challenges in adopting Neural Machine Translation because of their data requirements. This study investigates methods for expanding the parallel corpus to enhance translation quality.

We establish a series of effective guidelines for enhancing Tamil-to-Sinhala machine translation based on cutting-edge Neural Machine Translation techniques like fine-tuning hyper-parameters and data augmentation through both forward and backward translation. We validate our methods empirically using standard evaluation metrics. Based on our conducted experiments, we observed that Neural Machine Translation models trained on larger sets of back-translated data outperform other methods of synthetic data generation in Transformer-based training settings.

We investigated if we could effectively use the Transformer architecture in the limited-resource context of translating Tamil to Sinhala. Our research demonstrated that Transformer models can surpass the top Statistical Machine Translation models, even in language pairs with limited resources. We achieved an improvement of 3.43 BLEU points in translation quality compared to the statistical translation models.

**Keywords:** *Depression, Language Models, Natural Language Processing, Machine Learning, Deep Learning*

## Comparing the Performance of Machine Learning Algorithms for Emotion Classification on Tweets

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The rapid increase in the availability of textual content due to Industry Revolution 4.0 has made sentiment analysis an important area of machine learning research. This study aims to develop a mechanism to identify the hidden emotions in textual content, beyond the three basic sentiments of positive, neutral, and negative. Several machine learning approaches to emotion classification, including Naive Bayes classifiers, Support Vector Machines, Regression, Decision Trees, and Random Forests have been explored. The experiments show that simple linear models can achieve high accuracy (up to 90.5%), suggesting that complex algorithms are not always necessary for effective emotion classification. The performance of the models was evaluated using a variety of metrics, including accuracy, weighted F1-score, and efficiency. The findings suggest that machine learning approaches can be used to effectively identify emotions in textual content, even with simple models. This has potential applications in a variety of domains, such as social media analysis, customer service, and healthcare.

**Keywords:** *emotion detection, sentiment analysis, machine learning, supervised learning, text classification*

## Enhance User Experience in Web Based AR with Dynamic Content

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Augmented Reality (AR) applications have revolutionized the way we interact with the physical world by using digital content. A number of factors influence the interaction to be a near realistic experience to the human user such as elapsed loading time. However, with the enhanced features of AR technologies, increased number of applications and heterogeneous end users have forced AR applications to work on end user devices with minimal modification to their devices or environment, for example deploying AR by using only the web browser. Making the AR experience more realistic while having less control over the rendering endpoint is a challenging task. Content loading delays have been identified as a prominent factor affecting the realistic experience to the end user and keeping the user device focused on the physical space targeted to augment the digital content. In addressing the problem, we aim to elevate user experience of web-based Augmented Reality (AR) contexts focusing on reducing the content loading time when loading dynamic content on dynamic targets. A comprehensive review has been carried out to identify the different factors influencing the user experience in web-based AR applications on dynamic content and targets. Furthermore, we propose predictive models that can evaluate user experiences within web-based AR contexts. The models are drawn from a predefined set of factors, including content complexity, interactivity, and contextual relevance, empowering AR content developers to provide a more immersive user experience. Additionally, effective UI/UX strategies will be explored during the content-loading phase to maximize user engagement while minimizing distractions. Interactive UI/UX strategies are employed to ensure users remain engaged within the application while focusing the device on the target to enjoy a seamless and captivating AR experience.

**Keywords:** *Augmented Reality, User Experience, Dynamic Content, Content Loading*

## **FEWSION: Fashion Editing with Stable Diffusion**

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Fashion editing involves curating and selecting garments, accessories, and styling elements to create cohesive and visually appealing looks for editorial shoots, runway shows, or commercial campaigns. To increase the efficiency of this field, the fashion industry combined with AI can now effortlessly manipulate and enhance garments digitally, altering their color, texture, patterns, and even their overall silhouette. Here, efficiency refers to the ability to improve the quality of generated images and reduce the training time and computational cost. This fashion editing with AI can be divided into two approaches. The initial approach involves performing image-to-image editing, whereby the dress image is modified in accordance with a provided input dress image. Conversely, the alternative approach involves editing the attire in the given input images by relying on textual descriptions provided by the user. In this research we focused on the second method of editing the image by giving a text description of the garment. There are several solutions implemented with AI. Those solutions are variations of Generative Adversarial Networks (GAN). But, there are some limitations with these GAN based models. First one is, for the training of GANs, we need a minimum NVIDIA A100 GPU which means we need additional resources for the training. The second problem is that we can only generate approximate results for complex descriptions (eg:- generating objects & logos in the garment). It means we cannot generate high quality images in fashion editing for complex text description. And the last one is that we need additional inputs & data preprocessing to improve the quality of the edited image (eg:- garment sketches). In our study, we examine the balance between computational efficiency and image quality in the context of fashion editing. Our objective is to approach fashion editing as a secondary method relying solely on the user's body image and text descriptions, while conserving computational resources, particularly on personal computers. We aim to achieve this without compromising image quality, by employing an alternative pretrained model called Stable Diffusion instead of GANs. For the evaluation of the model with existing models, we will use a quantitative metric called F1-Score and qualitative metric such as user studies. So, this research will have a significant impact on the fashion design industry by providing customers with immediate garment experiences.

## **Skeletal Point Analysis to Determine the Accuracy of Forehand Smash Shots Played by Badminton Players**

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This research paper addresses the lack of scientific research on badminton, specifically focusing on the accuracy of smash shots in the sport. The authors propose using a skeletal coordinates-based technology to analyze the biomechanics of smash shots and compare them to an ideal biomechanical model. Three approaches were considered: a dynamic mathematical model, a player-to-player comparison model, and a machine learning model. Video footages were collected from university level badminton players and processed using Mediapipe software. Preliminary results suggest that using 3D skeletal landmarks instead of 2D landmarks provides more accurate results in calculating the angle between the dominant arm from any camera perspective. The proposed simple dynamic model compares a player's biomechanics with predefined biomechanics derived from literature to determine accuracy. Additionally, the machine learning model predicts shot accuracy using training data, while the player-to-player comparison model facilitates comparisons between different players. In conclusion, the study identified three distinct methods for describing the ideal biomechanics of a smash shot. The research also identified MediaPipe as a suitable technology for detecting and analyzing biomechanics. Additionally, the study explored various approaches to evaluating these biomechanics and generating meaningful output.

**Keywords:** *Biomechanics, Badminton, Forehand Smash, Shot Analysis, Mathematical Model, Machine Learning, Player to player comparison, MediaPipe, Python*

## **Taekwondo Poomsae Movements Evaluation Using Skeleton Points**

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The evaluation of Poomsae movements in Taekwondo has been a subjective process, relying heavily on human judgement. This study addresses the above issue by developing a systematic approach to evaluating Poomsae movements using computer vision. Two different models, a Dynamic model that compares biomechanical aspects, and an LSTM-based ML model, were developed and evaluated for their effectiveness in Poomsae movement evaluation. The study also aimed to develop these models as self-evaluation methods, for Taekwondo players to enhance their skills at their own pace. For this study, a dataset was created specially by recording the movements of University of Colombo (UOC) Taekwondo players. The technical infrastructure used to capture Skeleton joints data was cost-effective and easily replicable in other settings. Small video clips containing taekwondo movements were recorded using a Mobile Camera and extracted the skeleton joint data using MediaPipe python library. The results showed promising accuracy levels, with the Dynamic model achieving an accuracy of 80% and the LSTM-based ML model achieving an accuracy of 61% when compared with the domain expert's results. Overall, the study successfully achieved its objectives of defining a self-paced approach to evaluating Poomsae and developing models to remove human subjectivity in the evaluation process.

**Keywords:** *human action recognition, taekwondo, performance evaluation, computer vision, mediapipe, lstm, deep learning*

## **Utilizing Multi-sensory Cues to Enhance Art Gallery Experience: Focus on Entertainment for the Visually Impaired**

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Assistive technologies play a major role in bridging the accessibility gap in art and culture. Despite the constant advancements in these areas, a notable research gap can be seen in engaging visually impaired individuals to independently experience and interpret paintings through other sensory means, which prompted the authors to address this critical shortcoming. The research is aimed at conveying a painting to visually impaired individuals using multi-sensory stimuli (tactile, auditory, and somatosensory) to compensate for the loss of input from the sense of sight. An apparatus (named SEMA - Specially Enhanced Multisensory Art) is prepared with a painting on the inner walls that incorporates descriptive outputs of the aforementioned stimuli. Primarily, temperature control systems and directional speakers are used to achieve this end. Currently, the structure of the apparatus along with the temperature control system are completed and the technical evaluations of the apparatus are being conducted. To measure the usability and user experience of the system, two subject groups are taken into account; the treatment group consists of visually impaired individuals who experience SEMA at their own pace individually, and the control group consists of people with a sense of sight who observe the same painting without the additional sensory stimuli. The feedback collected from the questionnaire given to each individual is then subjected to a word vectorization process. The aim is to reduce the distance between the two groups' vector points in an iterative process of changing the inputs of SEMA. The research goal here is to enable visually impaired individuals to provide a description of the painting that closely mirrors the description provided by those with sight.

**Keywords:** *Multisensory, HCI, Visually Impaired, Assistive Technology, Tactile, Auditory, Art, Painting*



## Telltale Twin: MPTCP Subflow as a Passive Probe on Other Subflows

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Transmission Control Protocol (TCP) is the de facto standard connection-oriented transport layer protocol used on the Internet. TCP was designed in 1970's and it has evolved since then without any drastic changes. TCP connection is uniquely identified by a 4-tuple, <source IP, source port, destination IP, destination port>. This implicitly assumes a single network interface at the source and the destination. However, modern devices are also equipped with more than one network interface. However, due to the limitation in TCP, these multiple interfaces cannot be utilized at the same time. This is known as the multihomed problem of TCP.

There are a number of solutions proposed for the multihomed problem of TCP. Multipath Transmission Control Protocol (MPTCP) is one of the solutions proposed by the Internet Engineering Task Force (IETF). MPTCP is backward compatible with traditional TCP. With the help of MPTCP applications can create a single TCP connection that is multiplexed over the available network interfaces. MPTCP scheduler multiplexes data over the available interfaces and these subflows are goin through different Internet Service Providers (ISPs).

MPTCP schedules subflows based on the end-to-end path characteristics of the paths through different network interfaces. Therefore, the characteristics of one subflow depend on its own path metrics as well as the metrics of the other paths. Each subflow is a telltale twin of the other subflows. When one subflow of the MPTCP connection goes through an ISP that ISP can potentially get information about the paths available through the other ISPs.

The research was conducted to validate the hypothesis that an ISP, or the man in the middle (MiM), can extract network-related information from unseen subflows by analyzing the visible subflow. To test this hypothesis, a number of experiments were conducted in a virtual network deployed in the Mininet network emulator under different network conditions. Packet traces were extracted from a point in between the endpoints of a subflow to simulate a MiM. Preliminary results show that the sequence numbers of the MPTCP data acknowledgments and the TCP acknowledgments of an observed subflow can be used to infer the link conditions of the unseen subflow.

**Keywords:** *MPTCP, Man in the Middle, Network conditions.*

## Scheduling MPTCP Subflows on Highly Asymmetric Links

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Multipath TCP (MPTCP) is an extension of the Transmission Control Protocol (TCP) that allows the simultaneous use of multiple available network interfaces to transmit and receive data. MPTCP can improve the throughput, lower the latency, and provide higher resilience to network failures. MPTCP creates a number of network connections (subflows) between the destination and presents a single endpoint to the application. MPTCP schedulers multiplex data over subflows based on their end-to-end path metrics. In this study, we found that the presence of asymmetric links within an MPTCP connection can lead to suboptimal performance.

We explored the architecture of the Linux implementation of MPTCP and identified the design choices that lead MPTCP to underperform in the presence of highly asymmetric links. To test the behaviour of MPTCP an emulation testbed was built using the Mininet emulator. We conducted comprehensive experiments in this controlled environment to analyze MPTCP behavior under asymmetric subflows in terms of bandwidth and latency.

We designed a novel scheduling algorithm tailored to mitigate the impact of asymmetric subflows and implemented it in the Linux kernel. Building a scheduling algorithm for MPTCP in the Linux kernel is not a straightforward task. Several iterations of the algorithm had to be investigated in order to develop a practically deployable algorithm. The proposed algorithms were implemented in the Linux Kernel and were tested in the testbed. These algorithms were tested for their suitability to be used over highly asymmetric links under several test scenarios. Finally, we proposed the “Extended Dynamic Scheduler Algorithm” which observes the MPTCP connection and adjusts its subflows to limit the effect of asymmetric subflows in the MPTCP connection. The algorithm also has its own *kickback* policy where the throughput of the connection starts to improve when the asymmetry of the subflows decreases.

**Keywords:** *Multipath TCP, Computer Networks, Operating Systems.*

## Performance analysis of Multipath TCP in user space using DPDK

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Most network communication today relies on the Transmission Control Protocol (TCP) due to its reliability and connection-oriented nature. While TCP provides essential communication characteristics, it has certain limitations. One such limitation is its inability to effectively utilize multiple network interfaces within a device, a challenge known as the multi-homing problem. In the past, when devices had only one network interface, this limitation was not significant. However, in today's technological landscape, devices as small as smartphones support multiple network interfaces, such as Wi-Fi and LTE connectivity. To address this limitation, the Internet Engineering Task Force (IETF) has proposed the Multipath Transmission Control Protocol (MPTCP) as an extension of TCP. MPTCP's modified design is crucial for ensuring compatibility with the widely-used TCP, given the challenges of introducing a new protocol in the face of TCP's popularity.

The most commonly used implementation of MPTCP involves a forked version of the Linux kernel, which integrates MPTCP with the existing TCP stack. However, technologies like the Data Plane Development Kit (DPDK) enable user space packet processing, bypassing the kernel's processing. User space packet processing avoids per-packet interrupts that require frequent user mode to kernel mode switching, reducing performance overhead. DPDK offers raw packet processing capabilities but poses a barrier to developing a user space MPTCP implementation since MPTCP relies on services provided by TCP. Several open-source projects have developed user-space TCP/IP stacks that operate on top of kernel bypass technologies like DPDK. This study aims to leverage such a stack and adapt it to support MPTCP. We anticipate that this modification will lead to performance improvements in MPTCP, akin to those observed in TCP.

**Keywords:** *MPTCP, DPDK, Userspace, Linux Kernel*

## Improving Low-Level Isolation of Containers: Leveraging Microkernel Design

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The container is a concept in virtualization that groups code and dependencies into a single isolated unit. It leverages the operating system's kernel features to manage and run processes within its isolated environment. While current implementations offer seamless integration and enhanced performance, they do come with inherent limitations. The design and architecture of the kernel serve as a critical factor in enhancing key container characteristics, such as isolation, owing to its dependency on kernel functionality. While it affects the level of isolation provided within a container, it also affects the isolation provided among containers. A deeper understanding of container implementations underscores the importance of shifting the primary focus from containers themselves to the underlying kernel and its inherent strengths. The majority of contemporary container engines are optimized for monolithic kernels, which, by definition, prioritize performance over isolation. In contrast, microkernels are designed to provide higher levels of isolation at the cost of performance. It is important to explore how the capabilities of microkernels and the requirements of containers could interact to collectively find a stronger position in terms of isolation. While the exploration for a highly isolated container solution on microkernels is captivating, it's a task that demands collaboration from a diverse and large group of individuals. This study primarily focuses on exploring improvements in file system isolation achieved through microkernel design. In monolithic implementations, a single host file system is perceived as distinct file systems by individual containers. Conversely, the microkernel approach, facilitated by the use of servers, enables each container to have its independent file system, distinct from the file systems of other containers and the host file system. Our chosen methodology currently employs GNU Hurd, a distribution based on the GNU Mach microkernel, as the underlying environment. Within this framework, ongoing efforts involve exploring technologies like Subhurd to establish a container environment and ongoing experimentation with various approaches, including the use of translators, to potentially enhance file system isolation when compared to Linux-based container implementations. A comprehensive evaluation of performance and isolation is also underway to identify the strengths and weaknesses of the proposed method.

**Keywords:** *Microkernel, Containers, Isolation, GNU Hurd, Operating systems, File systems*

## Real-Time Driving Assistance at Night for Sri Lankan Context

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Nighttime driving poses significant challenges for drivers, including the detection of pedestrians and cyclists, identification of potholes in low-visibility situations. These factors have contributed to a series of road accidents. Currently, there is no automated system capable of handling these challenging situations in Sri Lanka. The proposed system utilizes AI and real-time video processing, combined with voice commands, to enhance driver safety. The enhancements include improving pedestrian and cyclist visibility, developing a reliable pothole detection system. Achieving these objectives relies on the extensive collection of data for training models. We gather datasets to train these models and develop specialized computer vision and machine learning models tailored for real-time, low-light scenarios. The application facilitates intuitive voice commands, providing real-time alerts and visual cues to reduce nighttime driving accidents. Through rigorous data collection, testing, and the development of the aforementioned solutions, nighttime driving safety in Sri Lanka is significantly enhanced by addressing current challenges.

**Keywords:** *Nighttime driving, pedestrian detection, cyclist detection, pothole detection, real-time video processing, machine learning, driver safety, low-visibility scenarios.*

## **Exploring the Efficacy of Gamification in Developing a Learning Platform for Students with Dyslexia in Sri Lanka.**

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Inclusive educational practices play a crucial role in creating an environment where students with dyslexia can thrive. This involves adopting inclusive teaching strategies and providing accommodations and assistive technologies. There's a significant need to create a public platform for Sri Lankan dyslexic students that combines reading support with motivating gamification elements. This research addresses a gap in accessible learning platforms for this specific group and aims to develop a prototype of a gamified reading platform tailored to their needs. The research methodology involves developing a working prototype of a gamified learning tool and evaluating its usability with dyslexic students who have elementary-level Sinhala reading skills. These participants engage in a realistic sample scenario that emulates actual system usage, encompassing tasks tailored for dyslexic students. The evaluation combines qualitative methods, including conducting interviews and collecting open-ended responses to explore their thoughts, challenges, and suggestions related to the usability of the system, and quantitative measures including task completion rates and error rates. The research has involved conducting a comprehensive literature review, engaging in consultations with specialist educators and medical professionals, identifying specific requirements, generating wireframes, and designing high-fidelity prototypes in accordance with dyslexic style guidelines, Human-Computer Interaction (HCI) principles, and gamification strategies. These prototypes undergo heuristic and usability evaluations as part of the ongoing research into accessible design and educational innovation. The use of gamification principles has potential to significantly enhance the learning process for dyslexic students. By applying these principles, we can create an interactive and immersive environment that encourages active participation, self-directed learning, and skill development.

**Keywords:** *Dyslexia, Gamification, Human-Computer Interaction (HCI)*

## **Comparative Analysis of Extensible Approaches for Document Layout Segmentation**

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In document analysis and understanding, document layout segmentation is an important task to extract the text from document images. As the demand increases for efficient methods to process and analyse complex document layouts, this study was conducted by comparing and analysing several object detection models which can be used for the segmentation task and extensible approaches for document layout segmentation. Currently, document layout segmentation models perform well for specific document types used to train the model; however, when the models are further extended to the new document types, they perform poorly. Hence, it needs an extensible generalised approach. The study mainly focused on evaluating the performance of object detection models MaskRCNN, FastRCNN, and FasterRCNN, in addition to evaluating extensible approaches: Transfer learning, Ensemble learning, and Continual learning such that it could incorporate new document types with minimal retraining and process unseen document types.

Using a quasi-experimental research design, this study examines the efficiency of various document layout segmentation approaches. Experiments were conducted on four selected document types: newspapers, research papers, forms and invoices comparing the mean average precision as the base metric where Mask RCNN outperformed Faster RCNN and Fast RCNN with mAP at 57.6% while other models having a mAP at 51.9% and 50.8% respectively. Hence, Mask RCNN was considered the object detection model for evaluating the extensibility.

Comparing extensible approaches, it was noticed that ensemble learning has outperformed the other approaches by a remarkable margin. In contrast, continual learning, a promising but challenging approach, encounters difficulties with limited or unbalanced datasets. On the other hand, transfer learning requires more improvements for the extensibility of document layout segmentation. The study highlights the need for extensible approaches in document layout segmentation and investigates an unexplored research area in continual learning in document segmentation. The findings contribute to further research to improve various disciplines, including document analysis, text extraction, reading order detection and similar tasks.

*Keywords - Document Layout Segmentation, Object Detection, Extensible Approaches, Ensemble Learning, Transfer Learning, Continual Learning*

## **SeEar: Low-Cost Augmented Reality Glass for Deaf and Hard-of-Hearing Impaired**

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Hearing loss is a global challenge, especially pronounced in developing countries, posing challenges in daily life, from learning, social interactions to safety. Augmented Reality (AR) holds great promise for bridging the gap in access to spoken words and environmental sounds. However, designing effective, affordable, and localized speech recognition and visual interfaces remains a significant research challenge. This research-in-progress explores the design of optimized interfaces tailored to the needs of deaf and hard of hearing individuals. A key focus is affordability, realized through a low-cost AR glass prototype utilizing common smartphones and transparent headsets. While use of real-time caption systems have been studied in conversations, addressing the unique challenges faced by this community during the learning and social interactions remains unaddressed. Our study adopts the use of real-time captions and in-depth examination of novel text presentation methods, interactive text visualizations, keyword highlighting techniques and words per line optimizations specifically for the Sinhala language to enhance comprehension, readability, reading speed, and mitigate information overload. Furthermore, we extend the scope by leveraging AR to address challenges in accessing surrounding sound information. We designed a visual interface incorporating icons and text to convey sound characteristics, considering factors such as sound type classification, loudness, direction, and importance based on user feedback. The research adopts a participatory design approach, collaborating with Dr. Reijntjes School for the Deaf, Sri Lanka with over 100 deaf children. We gained valuable insights into user needs and usage scenarios through interviews, focus groups, and iterative design, resulting in an empirical understanding of their requirements. We used interactive prototyping to develop high-fidelity prototypes, which we test in the field to assess the impact on usability, reading comprehension, reading speed, and cognitive load. This research not only contributes to the field of accessibility and AR but also offers practical solutions to improve the lives of individuals with hearing impairments, particularly in regions where these challenges are more pronounced.

**Keywords:** *Augmented reality, accessibility, novel text presentations, keyword highlighting, interactive prototyping, sound characteristics*



## Enhance User Experience in Web Based AR with Dynamic Content

Authors: M S Dewanarayana , P S Mahagamaage, H B M Faalil, K D Sandaruwan , Kenneth Thilakarathna

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Augmented Reality (AR) applications have revolutionized the way we interact with the physical world by using digital content. A number of factors influence the interaction to be a near realistic experience to the human user such as elapsed loading time. However, with the enhanced features of AR technologies, increased number of applications and heterogeneous end users have forced AR applications to work on end user devices with minimal modification to their devices or environment, for example deploying AR by using only the web browser. Making the AR experience more realistic while having less control over the rendering endpoint is a challenging task. Content loading delays have been identified as a prominent factor affecting the realistic experience to the end user and keeping the user device focused on the physical space targeted to augment the digital content. In addressing the problem, we aim to elevate user experience of web-based Augmented Reality (AR) contexts focusing on reducing the content loading time when loading dynamic content on dynamic targets. A comprehensive review has been carried out to identify the different factors influencing the user experience in web-based AR applications on dynamic content and targets. Furthermore, we propose predictive models that can evaluate user experiences within web-based AR contexts. The models are drawn from a predefined set of factors, including content complexity, interactivity, and contextual relevance, empowering AR content developers to provide a more immersive user experience. Additionally, effective UI/UX strategies will be explored during the content-loading phase to maximize user engagement while minimizing distractions. Interactive UI/UX strategies are employed to ensure users remain engaged within the application while focusing the device on the target to enjoy a seamless and captivating AR experience.

**Keywords:** *Augmented Reality, User Experience, Dynamic Content, Content Loading*

## **Enhance User Experience in Web Based AR with Dynamic Content to mitigate the impact of content loading times**

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Augmented Reality (AR) applications have revolutionized the way we interact with digital content, bridging the gap between the virtual and physical worlds. However, as AR technology continues to advance the endeavor to achieve a smooth and immersive user experience faces a central challenge, particularly in addressing the issue of content loading time delays. We aim to elevate user experiences within web-based Augmented Reality (AR) contexts, with a primary focus on addressing the impact of content loading time when dealing with dynamic content and targets. Firstly, we aim to explore and identify the different factors influencing the user experience in web-based AR applications when dealing with dynamic content and targets. Furthermore, we work on developing predictive models that can evaluate user experiences within web-based AR contexts. These models will draw from a predefined set of factors, including content complexity, interactivity, and contextual relevance, empowering AR content developers to provide more immersive user experiences. Concurrently, we explore effective strategies during the content-loading phase, aiming to maximize user engagement while minimizing distractions. Through an exploration of interactive strategies employed, our objective is to ensure users remain engaged within the application, enjoying a seamless and captivating AR experience. Our ultimate goal is to contribute to a future where AR applications offer users immersive experiences, effectively managing the challenges posed by dynamically changing content and targets while mitigating the impact of content loading time.

**Keywords:** *Augmented Reality, User Experience, Dynamic Content, Content Loading*

## **A Context-Aware Clothing Design & Recommendation System Using a Deep Generative Model for Young Females**

Azma Imtiaz, Nethmi Pathirana, Shakir Saheel, Chamodi Jayathilaka, Ilthizam Imtiyas,  
Kasun Karunanayake

*University of Colombo School of Computing, Colombo, Sri Lanka*

The fashion industry is currently experiencing a significant transformation, driven by rapid advancements in technology, particularly in the fields of artificial intelligence (AI) and machine learning (ML). This evolution is fueled by a growing population segment, namely young females, who are deeply engaged in fashion trends and seek personalized clothing recommendations that not only reflect their age but also their unique personal preferences, local climate conditions, and individual styles. However, traditional recommendation systems often fall short in catering to the distinct needs of the mentioned demographic. In order to address this problem, authors propose an innovative context-aware clothing recommendation system designed for young females. Central to this system is the utilization of a Conditional Generative Adversarial Network (GAN) model, a neural network that enables the generation of custom clothing designs tailored to the preferences and requirements of each user. By considering the skin tone, weather condition, type of occasion, and body type, the proposed model is capable of generating a unique clothing design customized to the user. The system consists of a skin tone segmentation model that captures the skin tone group of the specific user from an image uploaded by the user. In addition to skin tone, our system requires users to provide the date and geographical location of the event for which they desire an outfit recommendation. Using this information, the system interfaces with a weather data API to determine the relevant weather category, ensuring that the recommended outfit is suitable for the prevailing climate. With the generated final outfit, the system also browses selected clothing e-commerce sites to recommend outfits similar to the one generated. The proposed model supports consumers of the fashion industry to make informed fashion choices and supports clothing designers to produce unique designs. Our study presents a proof-of-concept prototype that is being developed and evaluated using clothing data meticulously labeled by fashion designers. The research aims to bridge the gap between the fashion industry and the distinctive fashion requirements of the selected demographic, ultimately providing them with a more personalized clothing recommendation system.

**Keywords:** *Context-aware, Conditional Generative Adversarial Network, Skin Tone Segmentation, API*

# Optimizing Black Tea Fermentation through Climatic Variations: A Deep Learning Approach

M.Saranka<sup>1</sup>, Lasanthi N.C De Silva<sup>1</sup>  
<sup>1</sup> *University of Colombo School of Computing*

Ceylon Tea is renowned worldwide for its high quality, aroma, and taste and serves a significant role in the Sri Lankan economy as a primary agricultural export crop. It comes in different unique flavors due to various weather conditions and processing. Among these varieties, black tea is the only tea that goes through oxidization during processing, which is a crucial step contributing to the tea's flavor, color, aroma, and overall quality. It is the critical process that sets black tea apart from other types of tea and makes it a beloved beverage worldwide. The manufacturing process of black tea always deals with four primary stages: plucking and withering, rolling, fermentation, firing, and packing. Among these, the process and the time taken to fermentation play a significant role in deciding the quality of the Tea. The optimum time for fermentation depends on several factors, including the factory's unique climatic and processing conditions. In Sri Lanka, three kinds of Black tea are produced from each set of batches, named "Dhool 1, Dhool 2, Dhool 3," according to their particle size, mapped to their quality: First, Second, and Third, respectively. Furthermore, the duration of fermentation is varied by the Dhool number of a given batch due to various sizes of tea particles with climatic changes and overall time spent on steps before fermentation. However, at present, the fermentation level is determined entirely through color observation using the naked eye, which is error-prone. Hence, the proposed study aims to investigate the potential of employing digital images of tea particles to track the fermentation process of black tea production under varying climatic conditions. The green copper color is used to measure the degree of fermentation over each climatic change; additionally, the humidity and temperature measures are added as main parameters along with RGB values with corresponding time intervals. The research includes three main phases: image pre-processing, Dhool classification, and predicting the optimum fermentation level over climatic changes. Image pre-processing techniques are applied to enhance the quality of the images, remove noise, and extract features. Different machine learning techniques, along with the green copper color metric, humidity, temperature data, and RGB values obtained at specific time intervals, have been employed to classify the Dhool and optimize the fermentation time. Through the proposed study, we aim to contribute valuable insights to the field of tea production and enhance the overall quality.

**Keywords:** *Black Tea, Optimum Fermentation Time, Image processing, Dhool, Deep Learning*

## **AgrOM: A Hybrid Model for Plant Disease Detection through Ontology and Machine Learning**

E.B.D.R. Sanjula<sup>1</sup>, G. Sribarathvajasarma<sup>1</sup>, J.P.M. Thushari, L.N.C. De Silva, M.D.J.S. Goonetilake<sup>1</sup>, S. Wilson<sup>2</sup>

<sup>1</sup>*University of Colombo School of Computing, Colombo, Sri Lanka*

<sup>2</sup>*Sri Lanka Uva Wellassa University, Badulla, Sri Lanka*

The effective and accurate prediction of plant diseases plays a crucial role in assisting farmers in the agriculture domain to make informed decisions to optimize their cultivation practices. Monitoring the plant diseases during the production life cycle is essential as it significantly affects the crop yield, leading to food security in a country. Distinguishing plant diseases accurately on time is required to provide correct control measures and improve plant health for effective disease management. The existing research heavily relies on visible leaf symptoms. However, diseases also show various ‘extra symptoms’ such as non-leaf symptoms (on other parts of the plant) and non-capturable symptoms such as odor symptoms. Hence, the main objective of the research is ‘How to effectively detect plant diseases integrating Machine Learning and Ontology through incorporating the extra symptoms.’ The study is conducted by following the constructive research methodology. It includes systematically identifying all possible parameters that impact plant disease detection, modeling the ontology, and building a system of multiple machine-learning models to address the relevant problem. Ontology, a knowledge framework, is being designed and developed to integrate domain-specific plant disease knowledge to enhance the accuracy of disease prediction. Currently, a suitable representative structure is being constructed. Machine Learning techniques are being explored to develop an appropriate predictive model that can be systematically integrated with the modeled ontology for efficient plant disease prediction. The tomato plant is selected for the proposed research, and a combined dataset from PlantVillage, PlantDoc, and Taiwan Tomato datasets is used to train the predictive model. YOLO NAS model is used for live disease detection, while YOLOv8 is used to create a segmentation mask as a background filtering technique. Deep learning models are trained with different architectures and transfer learning for accurate disease prediction on other base models such as ImageNet, MobileNet, and VGG16. A mixed approach that uses qualitative and quantitative measures, with domain experts evaluating and validating the accuracy of Ontology, will be used to evaluate the proposed model. The outcome of the proposed research is to contribute to the agricultural domain by advancing plant disease detection methods, improving the ability for early disease diagnosis, and improving disease management practices for better decision-making.

**Keywords:** *Plant Disease Detection, Deep Learning, Ontology, Non-Leaf symptoms*

# **University of Colombo Institute for Agro- Technology and Rural Sciences**



## ***Exploring Path for Food Security through Innovative Agriculture***

28<sup>th</sup> June 2023

## MESSAGE FROM DIRECTOR

**Professor Asanga D. Ampitiyawatta**



I am delighted to issue a congratulatory message to the proceedings of the 3rd National Symposium on Agro- Technology and Rural Sciences (NSATRS 2022) as the Director of the University of Colombo Institute for Agro-Technology (UCIARS).

The conference is organized under the theme of “Exploring Path for Sustainable agriculture through

Integrative Research”. Today, the agriculture environment is changing rapidly due to excessive use of inputs and environmentally unfriendly practices so the whole sector may face a huge threat in the near future. In this sense, sustainable agriculture becomes more important to protect the precious natural environment, maintaining agricultural productivity and profitability in the long run. The incorporation of rural and traditional knowledge into modern agricultural technologies through integrative research may play a vital role in this trajectory.

To make a common platform for researchers from various agricultural disciplines for eye-opening integrative research is the aim of this conference. Organizing such an event in the present situation of the country is challenging and it discloses our commitment towards the development of the agriculture sector.

I take this opportunity to extend my sincere appreciation and congratulation to the organizing committee, keynote speakers, paper presenters and the participants of the conference and wish them all success.

## MESSAGE FROM SYMPOSIUM COORDINATOR

### **Dr. N.P. Vidanapathirana**

Senior Lecturer,  
University of Colombo  
Institute for Agro-Technology and Rural Sciences



It is with great honor and privilege for me to convey this message on the occasion of Forth National Symposium on Agro Technology and Rural Sciences 2023 (NSATRS 2023) on “Exploring Path for food security and safety through innovative agriculture”. The symposium will provide a comprehensive overview of the research conducted in the field of Agro-Technology over the past years. Main purpose of organizing this symposium is to present research findings, dissemination of technology and formulation of future research program for increasing the agriculture productivity in perspective of national and global needs ensuring food security. The diversity of specializations and related themes will enable us to achieve our targeted mandate and vision.

This research conference will undoubtedly offer a forum for the exchange of knowledge, insights, and research discoveries. And will provide a forum specifically for young researchers to talk about the problems and potential directions in many agricultural research sectors to uplift agricultural productivity.

The hard work and dedication of all the members of organizing, scientific, technical and financial committees during the preparation for this symposium is highly appreciated. Without them the event would not have been possible. A note of appreciation is offered to the academia for their thorough and timely reviewing of the papers and support to maintain the quality of the research papers.

Further, I would like to pleasantly request you to put the knowledge gained from this symposium into practical action for the betterment of Agriculture in Sri Lanka. I congratulate to the organizing committee of the NSATRS 2023 and wish today’s symposium, a grand success.



## ORGANISING COMMITTEE

Prof. A.D. Ampitiyawattha

Dr. (Mrs.) N.P. Vidanapathirana

Dr. D.M.C.C. Gunathilake

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Mr. P.B. Darshana

Mr. J.A.U. Srinath

## Programme of Sessions

<b>Agenda</b>		
08:00 AM	Welcome Address – Dr. N. P. Vidanapathirana	
08:05 AM	Inauguration Address – Prof. Asanga D. Ampitiyawatta	
08:10 AM	Address by Chief Guest – Senior Prof. H. D. Karunaratne	
08:15 AM	Keynote Address I – Prof. Buddhi Marambe	
08:45 AM	Keynote Address II – Prof. Rajeev Bhat	
09:15 AM	Address by the Guest of Honour – Mr. Ariyaseela Wickramanayaka	
09:25 AM	Vote of Thanks – Mr. H. K. R. S. Kumara	
09:30 AM	Refreshments	
10:00 AM	Technical sessions	
10:00 AM	Session 1-A	Session 1-B
	Crop Production and Protection Practices	Agriculture economics, extension and entrepreneurship
11:45 AM	Session 2 - Livestock, Fisheries and Aquaculture	
01:05 PM	Lunch Break	
01:30 PM	Session 3 - Food Processing & Post Harvesting Technology	
02:45 PM	Session 4 - Innovations for Sustainable Agriculture	
03:35 PM	Closing session	

## INTRODUCTION TO KEYNOTE SPEAKER - I

Professor Buddhi Marambe

*Department of Crop Science of Faculty of Agriculture,  
University of Peradeniya, Sri Lanka.*



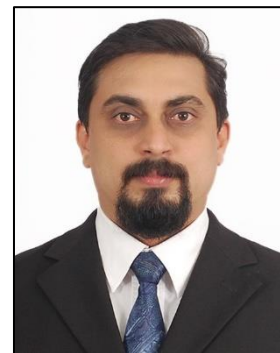
Professor Buddhi Marambe has more than 36 years of experience as an academic attached to the Department of Crop Science of Faculty of Agriculture, University of Peradeniya, Sri Lanka. His research interests include weed science, climate change adaptation, and food security. He has won the prestigious “Lifetime Achievement Award” from the International Weed Science Society (IWSS) in 2022 for the contribution made to field of Weed Science. He has also won the “Presidential Award” and “National Research Council (NRC) Merit Award” in Sri Lanka, for scientific research.

He is the President of the Weed Science Society of Sri Lanka (WSSSL), Chairman of the National Invasive Species Specialist Group (NISSG) and the former Chairman and a member of the National Experts Committee on Climate Change Adaptation (NECCCA) of the Ministry of Environment. He is a member of the Government Delegation on climate negotiations at the United Nations Framework Convention on Climate Change (UNFCCC), and has served in this position since 2013. He is also a member of the Public Enterprise Expenditure Review Committee (PERC) of the Government of Sri Lanka focusing on the Ministry of Agriculture. He was also the Assistant Secretary of Lanka Organic Agriculture Movement for the period 2001-2003. While being an academic, Prof. Marambe has also served as a non-executive member of the Boards of several private sector organizations providing technical guidance to agriculture-related operations, and Council Member/Executive Committee member of many professional entities, including Universities of Sri Lanka. He has provided his services to the government of Sri Lanka in terms policy development and also as a consultant to the World Bank (WB), Asian Development Bank (ADB), European Union (EU), United Nations Development Programme (UNDP), Food and Agriculture Organization (FAO), World Food Programme (WFP), United Nations Environment Programme (UNEP), World Agroforestry Center (ICRAF), International Water Management Institute (IWMI) and International Center for Tropical Agriculture (CIAT) in nationally and internationally important issues related to climate change adaptation, food security, and agriculture.

## INTRODUCTION TO KEYNOTE SPEAKER - II

Professor Rajeev Bhat

*Professor and European Research Area Chair,  
VALORTECH (Food By-Products Valorisation Technologies),  
Estonian University of Life Sciences*



Prof. Rajeev Bhat is presently working as a Professor and ERA-Chair-holder (European Research Area Chair) in VALORTECH (Food By-Products Valorisation Technologies) at the Estonian University of Life Sciences. He has extensive 'Research & Teaching' experience of more than two decades (24 years) in the field of agri-food technology, with expertise focusing mainly on issues pertaining to 'Sustainable Food Production' and 'Food Security.' He holds international experience of working in India, South Korea, Malaysia, Germany, Fiji Islands, and now in Estonia. To date, he has authored more than 250 research articles published in ISI-WOS-based journals (Google-Scholar H-index 58; Scopus-H-index 49) and as refereed book chapters; has edited 13 books and authored one book; is on the editorial board of leading international journals; has been on the scientific committee/advisory board member & an invited keynote speaker in various international conferences and symposiums. His name now figures in the World's top 2% of scientists in the field of Food Science & Technology as per recent survey done by Stanford University-based researchers. Recently, he was elected by the European Academies Science Advisory Council (EASASC) as an expert in 'Meat Alternatives' under the EASAC Biosciences Programme. He is also an appointed expert panel member of the World Health Organization's (WHO) Guideline Development Group (GDG) working on 'Traditional Food Markets.' Prof. Bhat has been a visiting professor in many of the recognized universities and is also a recipient of several prestigious international awards and recognitions conferred by various institutions of higher learning and research establishment.

## **ABSTRACT OF THE KEYNOTE ADDRESS**

### **Technology adoption in Agriculture – Sri Lanka**

**Prof. Buddhi Marambe**

In the contemporary landscape of global agriculture, the incorporation of technology has become an essential driver of growth, efficiency, and sustainability. Sri Lanka, with its rich agricultural history and diverse agro-climatic zones, has embraced technology adoption in agriculture as a means to revolutionize its farming practices and overcome the challenges facing the sector. The keynote speaker shed light on the significance and implications of this transformation in the presentation titled "Technology Adoption in Agriculture - Sri Lanka." Agriculture has historically been a pivotal component of the country's economy, contributing to food security and employment. However, it also faces numerous challenges, including small-scale farming, land constraints, climate change, and market access issues.

The presentation emphasized how technology adoption is pivotal in addressing these challenges. Various technological innovations, such as precision agriculture, remote sensing, IoT (Internet of Things), and advanced machinery, are being integrated into Sri Lanka's farming practices. These technologies enable farmers to optimize resource usage, increase crop yields, and mitigate the impact of climate change. The speaker delved into the digital transformation of agriculture in Sri Lanka. The adoption of mobile apps, blockchain technology for supply chain management, and AI-powered decision support systems has streamlined processes, reduced inefficiencies, and enhanced transparency within the agricultural ecosystem. Sustainability was a key focal point of the presentation. The speaker highlighted how technology adoption promotes sustainable agriculture in Sri Lanka by reducing the reliance on harmful chemicals, optimizing water usage through smart irrigation systems, and encouraging organic farming practices. The keynote speaker also acknowledged the challenges and barriers associated with technology adoption in Sri Lankan agriculture. These include access to technology, digital literacy among farmers, affordability, and the need for supportive government policies.

The presentation underscored the importance of government support in driving technology adoption. Sri Lanka's government has initiated programs to provide subsidies, training, and incentives to encourage farmers to embrace technology. The speaker concluded by discussing the future outlook for technology adoption in Sri Lankan agriculture.

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## **Knowledge and adoption levels of entrepreneurs in relation to the Palmyrah non-food based production; a case study in Trincomalee district, Sri Lanka**

B.P. Siriwardena, D. Sanjayan, K.G. Ketiparachchi

*Department of Agro-Technology, University of Colombo Institute for Agro-Technology and Rural Sciences, Hambantota, Sri Lanka*

Palmyrah (*Borassus flabellifer* L.) is a tropical palm tree and perfectly useful tree for many purposes. The objective of the research is to explore the awareness levels and adoption levels of entrepreneurs on Palmyrah non-food based production in Trincomalee District, Sri Lanka. A survey was conducted with the 55 entrepreneurs in Trincomalee district, Sri Lanka. Stratified random sampling technique was practiced for selecting samples from the total population of the district. Pretested questionnaire was prepared with a Likert scale and distributed, and data were collected. Data were analyzed using SPSS statistical software package. The selected sample contains higher female respondents and most of them are belongs to the age category of 41-50. Further, most of the respondents are married and not highly educated. With regard to the knowledge levels and adoption levels, basic knowledge, training, encourage to production, marketing support, government support is having significant ( $p$  value  $< 0.05$ ) somewhat awareness level and adoption level. The factors of Selection of quality raw materials, availability of creative and innovative skills, future perception of the trade, latest technologies are not significant ( $p$  value  $> 0.05$ ) on awareness levels and adoption levels. Understanding of entrepreneur's knowledge levels and adoption levels are important to the further development of Palmyrah nonfood production in the region.

**Keywords:** *Adoption, Awareness, Entrepreneurs, Nonfood production, Palmyrah*

This abstract has been already published in 4<sup>th</sup> NSATRS 2023 – 28<sup>th</sup> June 2023

## Effects of different root inducing agents on cutting propagation of tea (*Camellia sinensis*)

H.H.N. Sumanasekara, L.M. Rifnas, N.P. Vidanapathirana

*Department of Agro-Technology, University of Colombo Institute for Agro-Technology and Rural Sciences, Hambantota, Sri Lanka*

In commercial cultivations, vegetative propagation through rooting of cuttings is common, and IBA based rooting hormone is often used. However, due to the need for non-chemical alternatives in organic cultivations, organic rooting substances have become increasingly important. Hence considering this, an experiment was conducted to investigate the effectiveness of different root inducing agents on the propagation of tea cuttings. The nodal cuttings were pre-treated with six different root inducing agents including water (control), aloe vera gel, coconut water, honey charcoal mixture, potato juice and rooting hormone (0.3% IBA). Each treatment was replicated four times with 20 cuttings in each. The experimental units were arranged in a completely randomized design. Cuttings' survival percentage, rooting percentage, number of roots, root length, fresh and dry weight of the root were evaluated during three phases as 2<sup>nd</sup>, 4<sup>th</sup> and 6<sup>th</sup> week. The data were statistically analyzed using SAS statistical package and treatment means were compared using DMRT at a 5% significance level. The results revealed that there were significant differences between the treatments on cutting performances. The cuttings treated with rooting hormone showed the highest values in rooting percentage (55.8%), sprouting percentage (72.3%), during the 4<sup>th</sup> week and root length (2.1cm) and root dry weight (0.254g) during the 6<sup>th</sup> week. Moreover, coconut water and aloe vera gel showed not significantly higher values in most of the measured variables compared to the rooting hormone. Therefore, it can be concluded that coconut water and aloe vera gel can be considered as alternative rooting substances to the chemical-based rooting hormone for organic tea cultivations.

**Keywords:** *Aloe vera gel, Camellia sinensis, IBA, Propagation*

This abstract has been already published in 4<sup>th</sup> NSATRS 2023 – 28<sup>th</sup> June 2023



## Morphological characterization of turmeric (*Curcuma longa*) in Gampaha and Kalutara districts, Sri Lanka

I.S. Hettiarachchi<sup>1</sup>, K.G. Ketipearachchi<sup>1</sup>, N.P. Vidanapathirana<sup>1</sup>, S. Subasinghe<sup>2</sup>,  
B.P. Siriwardena<sup>1</sup>

<sup>1</sup>*Department of Agro-Technology, University of Colombo Institute for Agro-Technology and Rural Sciences, Weligatta New Town, Hambantota*

<sup>2</sup>*Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya*

*Curcuma longa* is a valuable spice crop grown in Sri Lanka. It is cultivated as monocrop or intercrop mainly in wet and intermediate zones in Sri Lanka. Morphological characterization is important to describe plant phenotypic variability. There was a lack of studies conducted on morphological characteristics of *Curcuma longa* in Sri Lanka. The present study is mainly focused to identify the morphological characteristics of *Curcuma longa* available in Kalutara and Gampaha Districts, Sri Lanka. Three DS (Divisional Secretariat) divisions were randomly selected from each district and four GN (Grama Niladhari) divisions were randomly selected from each DS division. Snowball sampling technique was used to select the sample for data collection. The study found that the *Curcuma longa* plants varied in height from 80.0 – 120.6 cm in Gampaha district and 71.0 – 115.0 cm in Kalutara district. The leaf shape varied from obtuse to lanceolate. The leaf length varied from 26.0cm – 49.8 cm and leaf width varied from 8 cm – 15 cm in Gampaha district. In Kalutara district, leaf length varied from 35.0 cm – 54.0 cm and leaf width varied from 10cm – 18 cm. The inflorescence length varied from 9.00 - 22 cm and inflorescences were whitish light green to light green colour. Rhizomes were straight to curve in shape and Rhizome colour variations are light yellow to orange yellow. The fresh weight of rhizomes per plant varied from 2.23 kg – 6.56 kg in Gampaha district and from 2.5 kg - 5.25 kg in Kalutara district. According to the cluster analysis, accession from near locations was grouped into the same cluster. Thus, there were morphological variations of *Curcuma longa* plants grown in Gampaha and Kalutara district which can be used by breeders for improvement of the plants.

**Keywords:** *Curcuma longa*, Morphology, Sri Lanka, Turmeric

This abstract has been already published in 4<sup>th</sup> NSATRS 2023 – 28<sup>th</sup> June 2023

## **Effect of plucking methods on efficiency of plucking, yield and quality of tea (*Camellia sinensis* L.)**

J.L. Edirisooriya<sup>1</sup>, S.L. Nawarathna<sup>1</sup> and G.G. Bandula<sup>2</sup>

<sup>1</sup>*Institute for Agro-Technology and Rural Sciences, University of Colombo, Hambantota, Sri Lanka.*

<sup>2</sup>*Hector Kobbekaduwa Agrarian Research and Training Institute, Sri Lanka.*

Plucking is the first step in the manufacturing process of tea (*Camellia sinensis* L) and tea plucking is considered to be the most labour-intensive field operation in tea cultivation. Under average field conditions in Sri Lanka, the labour requirement for manual harvesting is about 10-12 workers per ha, which can be considerably reduced by mechanical harvesting. Introduction of new plucking methods to overcome above issue is a current need. Therefore, this study has been conducted to test different plucking methods to find out the effect of plucking methods on efficiency of plucking, yield and quality of tea (*Camellia sinensis* L.). The experiment was design according to RCBD and three replications were used. Treatments applied were T1; manual plucking, T2; shear plucking and T3; machine plucking. Data were collected for plucking round, time required for plucking, yield, number of poor-quality leaves and number of best quality leaves. The collected data were statistically analyzed using SAS statistical software version 9.1. The mean differences were compared using Duncan's Multiple Range Test at 5% significance level. Based on the results, machine plucking was significantly decreased the time taken for plucking and total cost of harvesting of 100kg of leaves. Meantime, yield was significantly increased by machine plucking during the study period. However, manual plucking was significantly recorded the highest amount of best quality leaves and lowest number of poor-quality leaves. Further, manual plucking was significantly recorded the shorted plucking round. Hence considering the findings, it can be concluded that, machine plucking can be recommended to the tea land more than one acre to reduce the cost of plucking while manual plucking is recommended to small scale land less than one acre and it will induce the best quality tea harvest.

**Keywords:** *Camellia sinensis* L., Cost of plucking, Plucking method, Quality harvest

This abstract has been already published in 4<sup>th</sup> NSATRS 2023 – 28<sup>th</sup> June 2023

## Effect of different sources of nitrogen fertilizer and soil amendments for growth and yield performances of *Zea mays* under dry zone condition

S.A.P. Nelka<sup>1</sup>, S. Subasinghe<sup>2</sup>, N.P. Vidanapathirana<sup>1</sup>, R. Hewawasam<sup>1</sup>

<sup>1</sup>Department of Agro-technology, University of Colombo Institute for Agro-technology and Rural Sciences, Hambantota, Sri Lanka

<sup>2</sup>Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Mapalana, Sri Lanka

*Zea mays* is a commercially cultivated crop in the dry zone of Sri Lanka and exhibit a strong dependency on fertilizer application, particularly nitrogen to enhance its yield performance. However, excessive use of fertilizers beyond recommended levels has been observed to yield diminishing and increasing environmental losses. The study aimed to investigate the most appropriate nitrogen source combination for better performances of *Z. mays* under zone conditions by implementing various soil amendments. The experimental investigation took place at the agricultural land of the University of Colombo Institute for Agro-technology and Rural Sciences, Hambantota, dry zone of Sri Lanka. The study employed a factorial Complete Randomized Design with three distinct nitrogen fertilizer sources as Urea, Ammonium Sulphate  $(\text{NH}_4)_2\text{SO}_4$ , and Ammonium biphosphate  $(\text{NH}_4)_2\text{HPO}_4$  alongside a control group. Additionally, three different soil amendments, namely cow dung, paddy husk charcoal and coconut shell charcoal were tested, each with five replications. Inorganic fertilizers followed the recommendations of the Department of Agriculture, Sri Lanka, and standard cultural practices were employed. The study involved collecting data on various parameters, including growth (plant height, number of leaves, plant biomass), and yield (fresh and dry weight). The statistical analysis was performed using Minitab 17 software, employing Turkey and Dunnet tests. The results indicated a significant difference ( $p < 0.05$ ) between the treatments and the control group for all tested parameters. Specifically, the combination of Ammonium bi-phosphate  $((\text{NH}_4)_2\text{HPO}_4)$  and cow dung (T9) exhibited a significant increase ( $p < 0.05$ ) in both plant fresh and dry weights, suggesting its efficacy in promoting a robust root system for *Z. mays*. Moreover, the combination of Ammonium Sulphate  $((\text{NH}_4)_2\text{SO}_4)$  and coconut shell charcoal (T7) was found to significantly enhance above-ground biomass and yield ( $p < 0.05$ ) of *Z. mays* under the dry zone.

**Keywords:** Ammonium biphosphate  $((\text{NH}_4)_2\text{HPO}_4)$ , Fertilizer, Dry zone, Yield, *Zea mays*

This abstract has been already published in 4<sup>th</sup> NSATRS 2023 – 28<sup>th</sup> June 2023

## **Prevalence of gastrointestinal parasites in free- range goats (*Capra hircus*): a study in Mihintale veterinary division of Anuradhapura district**

R.M.H.S. Rathnayake, H.K.R.S. Kumara

*Department of Food-Technology, University of Colombo, Institute for Agro-Technology & Rural Sciences, Hambanthota, Sri Lanka.*

The purpose of this study was to investigate the prevalence of gastrointestinal parasites in goats under the free-range farming system in the Mihinthale veterinary division. To achieve this objective, 50 goat farms were randomly selected, and fecal samples were collected directly from the rectum of each selected animal using disposable medical gloves. The samples were placed in sterilized containers and immediately transferred to a 4°C iced container until dispatched to the Parasitology Section of the District Veterinary Research Investigation Centre in Kurundhankulama, Anuradhapura for carpopological examination. The study found that 76% of the goats were infected with gastrointestinal parasites, while 24% tested negative. The most common gastrointestinal parasite found was *Haemamonchus contortus*, with an incidence of 65.78%, followed by *Oesophogostomum* spp. at 18.42%, and *Trichostrongylus* spp. at 15.78%. The study also found that recently dewormed goats (< 3.08 mean weeks) had the highest incidence of nematodes. Most farmers used Levamisole and Oxyclozanide as a dewormer (85%), but the highest success rate was seen with Levamisole and oxyclozanide combined with Ivermectin (before or after one week), which had an 80% efficacy rate. There was a significant difference ( $P < 0.05$ ) between the type of dewormer used and the parasite egg count. Poor farm management practices, such as poor feeding, unhygienic watering, and inadequate housing facilities, would be contributing factors to the high prevalence of nematodes among the goats. The study concludes that *Haemamonchus contortus* is the major parasite in the goats of the study area, and improved farm management practices and regular deworming are necessary to control gastrointestinal parasites in goats.

**Keywords:** *Deworming, Farm management, Gastrointestinal parasites, Goats*

This abstract has been already published in 4<sup>th</sup> NSATRS 2023 – 28<sup>th</sup> June 2023

## **Influence of grass and maize silage on milk yield and milk composition of dairy cows**

H.M.A.K.M. Herath<sup>1</sup>, H.K.R.S. Kumara<sup>1</sup>, G.G.P.D. Kumara<sup>2</sup>

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Forage availability during the rainy season can be conserved as hay or silage to provide feed for animals in the dry season. This study aimed to investigate the impact of grass and maize silage on milk yield and milk composition in dairy cows. Sixteen lactating dairy cows of the Jersey Sahiwal crossbreed weighing approximately 400±10 kg, were selected for the experiment. The study employed a randomized complete block design (RCBD) with four treatments: T1: Maize silage + Total Mixed Ration (TMR); T2: Pakchone silage (Supper Napier) + TMR; T3: Pakchone + Maize silage (50:50) + TMR; T4: TMR only (Control). Each treatment had four replicates, which were randomly assigned. The experiment was conducted over a period of 30 days, during which daily measurements of feed intake, milk composition, and milk yield were recorded. The results indicated that average feed intake did not significantly differ among the treatments, despite the supplementation with different types of silage. The treatments did not have a notable effect on milk yield and composition, except for milk fat content. Cows fed with maize silage exhibited a significant improvement ( $p < 0.05$ ) in milk fat content compared to the control group. Based on these findings, it can be concluded that incorporating super Napier silage in cow feed can yield favorable results in dairy farming.

**Keywords:** *Dairy cows, Forage quality, Milk composition, Milk yield, Silage*

This abstract has been already published in 4<sup>th</sup> NSATRS 2023 – 28<sup>th</sup> June 2023

# Institute of Biochemistry, Molecular Biology and Biotechnology

University of Colombo



*Proceedings of the 12<sup>th</sup> Annual Scientific Sessions of the IBMBB*

31<sup>st</sup> May 2023

## MESSAGE FROM THE DIRECTOR OF IBMBB

### **Professor Prasanna Galhena**

Professor in Biochemistry and Clinical Chemistry



On behalf of the academics and students at the Institute of Biochemistry, Molecular Biology and Biotechnology (IBMBB), University of Colombo, I would like to extend my warmest welcome to all the delegates and participants for the 12<sup>th</sup> Annual Scientific Session at IBMBB, University of Colombo.

This is one of the key events at IBMBB, that facilitates an interactive dialog among all the stakeholders in the field of Life Sciences. Annual Scientific Session 2023 primarily focuses on the key issues pertaining to multidisciplinary applied research. Validation of novel molecular diagnostics, exploring novel drug leads, and execution of fundamental applied research are some of the highlights of the Conference.

Annual Scientific Session 2023 will be graced by Prof. Stanley Wijesundara memorial lecture delivered by Prof. Rohan Siriwardana, Consultant Surgeon sharing his experiences in Liver transplantation.

I would like to express my sincere gratitude to the distinguished invited speakers for their presence and contribution to the conference. I also thank all the resource people who have contributed in numerous ways to making the event a success.

Finally, I would like to keep a note of the dedicated team at IBMBB who worked tirelessly in bringing you a productive conference despite all the challenges during this difficult time.

Prof. Prasanna Galhena

## **The Organizing Committee of the 12<sup>th</sup> Annual Scientific Sessions**

### **Chairperson**

Prof. Nimal Punyasiri

### **Co-Secretaries**

Dr. Ruwandi Ranasinghe and Ms. Anjana Welikala

### **Co-Editors**

Ms. Joanne T. Kotelawala and Ms. Thulangi Siriwardana

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Prof. Sisira Pathirana

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Mr. Shashika Niranjana Ms.

Anoma Jayasoma

Mr. Yapa Bandara

Ms. Tharini Somarathna

Ms. Kushlani Thivanka

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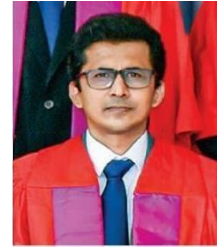
## PROGRAMME

9.00 h	Inauguration
9.05 h	Lighting of the traditional oil lamp
9.10 h	Welcome Address by Director IBMBB
9.20 h Colombo	Address by Vice Chancellor – University of
9.30 - 10.20 h	Professor Stanley Wijesundera Memorial lecture by Professor Rohan Siriwardana – “Liver Transplantation;a dream to a reality”
10.20 - 10.30 h	Address by Professor Wijesundera family member
10.30 - 10.35 h	Vote of Thanks
10.35 - 11.00 h	Tea
11.00 - 12.45 h	Free papers – Parallel Sessions: Oral presentation Sessions I & II
12.45 - 13.15 h	Lunch
13.15 - 14.45 h	Free papers – Parallel Sessions: Oral presentation Sessions III & IV
14.45 - 15.45 h	Poster Presentations – (Parallel Sessions I & II)
15.45 - 16.00 h	Award Ceremony
16.00 - 16.15 h	Tea

## PROFESSOR STANLEY WIJESUNDERA MEMORIAL LECTURE

### **Prof. Rohan Siriwardana**

*Professor in Gastroenterology and Hepatobiliary Surgery,  
Faculty of Medicine - University of Kelaniya.*



### **Liver Transplantation; a dream to a reality**

The liver, the largest solid organ in the body, performs a diverse range of functions essential for life. Liver failure leads to suffering and loss of life, and the only method for saving a life once the liver fails is through liver transplantation. This procedure is the ultimate gift of life, but it comes with significant challenges. The first liver transplantation was performed in the United States in 1969, and it took almost half a century for the first liver transplant to be performed in Sri Lanka. The complexity of the surgery, the need for specialized training, and the availability of infrastructure are the primary challenges. However, the sustainability of the surgery relies on the support of many other specialties. The real challenge of liver transplantation is to sustain what has been started and flourish as a team. This talk will explore the journey of liver transplantation over the last 10 years

## Oral Presentations

Isolation, purification and activity study of laccase enzyme from *Rigidoporus microporus* isolates

Geethma KS, Weerasena OVDSJ, Gunaratna LNR, Fernando THPS

Development of a molecular method to detect adulteration of *Saraca asoca* (Roxb.) Willd. (Ashoka) with *Polyalthia longifolia* in herbal drug industry

Ravindrakumar S, Gunaratna LNR, Weerasena OVDSJ, Tennakoon TMSG

Effect of *Exobasidium vexans* masee on flavonoid production and expression of selected flavonoid biosynthetic enzymes during the early stage of blister blight disease development on tea (*Camellia sinensis* [L.] O. Kuntze)

Anuforo C, Punyasiri PAN, Weerasena OVDSJ, Gunaratna LNR, Siriwardana RSGTN, Sinniah GD

Morphological and molecular characterization of *Leucinodes orbonalis* Guenee (Brinjal Shoot and fruit borer) from selected locations in Sri Lanka

Gunachandra KSR, Suvanthini T, Gajapathy K

A Study on Allelic and Expression Differences of Selected Salt Responsive Genes in At354 and Bg352 Rice Varieties

Peiris DPRP, Weerasena OVDSJ, Gunaratna LNR, Kottearachchi NS

RNAi-mediated yEGFP gene knockdown in *Pichia pastoris*

Dharmarathna CS, Gunawardena YINS, Dassanayake RS, Shashi Kumar, Hettiarachchi C

Characterization of mealybug species associated with different host plants using morphological and molecular methods

Sathsarani KWI, Suvanthini T, Gajapathy K

Association of PNPLA3 gene variants with non-alcoholic steatohepatitis (NASH) related hepatocellular carcinoma (HCC) patient cohort in Sri Lanka.

Samarasinghe SASM, Hewage AS, Siriwardana RC, Tennekoon KH, Niriella MA, Silva SD

Alpha-hederin modulates  $\beta$ -catenin pathway target genes and induces caspase dependent programmed cell death in breast cancer stem cells

Sailu PT, Seneviratne NN, Fizal M, Rajagopalan U, Adhikari A, Senathilake KS, Galhena PB, Tennekoon KH, Samarakoon SR

Cytotoxicity of endophytic fungi strains of *Rhizophora mucronata* using human hepatocellular carcinoma (HepG2) cell line

Thusyanthan J, Wickramaratne NS, Rajagopalan U, Senathilake KS, Samarakoon SR, Tennekoon KH and Thabrew MI

Initial validation of analyte-specific Fluorescence In-Situ Hybridization probes targeting MYC, BCL2, and BCL6 gene rearrangements

*Karunathilaka ST, Kaluarachchi NP, Williams HAS, Abeygunasekara PH, Senathilake NHKS, Galhena BP*

Comparison of uniparental inheritance in a cohort of Adivasi inhabiting in the Ratugala area

*Fernando AS, Bandyopadhyay E, de la Fuente Castro C, Witonsky D, Karunanayake E, Somadeva R, Rai N, Tennekoon KH, Raghavan M, Ranasinghe R*

Length heteroplasmy analysis in the C-stretch of Mitochondrial DNA hypervariable region I in Sinhalese, Sri Lankan Tamil and Vedda populations in Sri Lanka

*Welikala AHJ, Fernando A, Kotelawala JT, Tennekoon KH, Ranasinghe R*

Species delimitation of blind snakes by molecular phylogenetic analysis of mitochondrial DNA sequences

*Wickramasinghe N, Wickramasinghe LJM, Tennekoon KH, Samarakoon SR, Vidanapathirana DR, Gower DJ*

In silico prediction and in vitro validation of new anti-aging natural compounds

*Hennadige ND, Senathilake NHKS, Samarakoon SR, Galhena BP*

Virtual Screening and Molecular Dynamics Based Identification of Bismahanine as a Potential Anti-Aging Compound

*Mishal MFM, Senathilake KS, Samarakoon SR*

The in vitro effect of *Mikania cordata* aqueous leaf extract on wound healing

*Vijithsingh NN, Anuradha K, Shiroma Handunnetti S, Fernando N, Senarath K*

Cancer stem cell targeted in vitro anti-cancer activity and acute in vivo toxicity studies of a diterpene isolated from *Caesalpinia pulcherrima*

*Wijerathne PKSK, Saliu TP, Rathnayake RK, Rajagopalan U, Senathilake NHKS, Samarakoon SR*

Isolation of a potential anti-cancer compound from *Mangifera zeylanica* leaves and investigation of its effects

*Perera AADN, Samarakoon SR, Ediriweera MK, Tennekoon KH*

Lactone ring enhances anti-breast cancer activity of three structurally related compounds isolated from *Gardenia crameri*

*Wickramaratne NS, Thusyanthan J, Adhikari A, Rajagopalan U, Tennekoon KH, Karunaratne DN, Samarakoon SR*

Investigation of a Termite Nest-Derived Fungus for the Presence of Biologically Active Secondary Metabolites

Rexon SS, Punyasiri N, Lewke Bandara N, Rajagopalan U and deSilva ED

Prevalence of Iron Deficiency Anaemia among Type 2 Diabetic patients attending the Diabetic Centre, Teaching Hospital Jaffna

Thivya K, Risla MRF, Samiya HM, Arasaratnam V, Thayananthan

Association of Socio-Demographic and Clinical Factors with the Prevalence of Hypertension in Type 2 Diabetic Patients, attending the Diabetic Centre, Teaching Hospital, Jaffna

Thivya K, Risla MRF, Samiya HM, Arasaratnam V, Aranraj T

Detection of Anti-SARS-CoV-2 Spike Protein Antibodies in COVID-19 Patients and Naïve Recipients of Different COVID-19 Vaccines in Sri Lanka

Pathirana SL, Deepachandi B, Gunasekara P, Premawansa G, Namalie D, Fernando N, Perera IC, Nanayakkara S, Kumarasinghe D, Gangani PD, Thambyarajah J, Perera T, Siriwardana S, Manilgama S, Sumathipala S, Muthugala R, Rajapakse S, Dassanayake D, De Silva R, Premawansa S, Nitsche A, Handunnetti S

Expression, isolation, and purification of dengue NS1 protein from bacterial cells

Perera RD, Wickramasinghe NI, Wijesinghe KJ

Genetic analysis of *Leptospira* from clinically characterized leptospirosis patients from Western Province, Sri Lanka

de Silva Y, Weerasena J, Fernando N, Sathkumara H, Chandrapadma N, Rajapakse S, Premawansa S, Handunnetti S

Aqueous leaf extract of *Vitex negundo* exerts immunomodulatory effects in an in vitro model of hypertension

Nyamweya B, Rukshala D, Fernando N, de Silva R, Premawansa S, Handunnetti S

Comparative study of novel human monkeypox virus isolates of the 2022 outbreak

Batagoda BNNT, Senanayake KS

Assessing the resistance of selected brinjal varieties in Sri Lanka against *Leucinodes orbonalis* Guenee

Jayasooriya JANC, Suvanthini T, Gajapathy K

Comparison of the presence of FLT3 receptor on peripheral blood mononuclear cells between newly diagnosed non-Hodgkin lymphoma patients and healthy individuals

Nandasena C, Jayathilake PWDC, Dharmarathne G, Suresh S, De Silva AD, Perera IC, Kottahachchi DU

Bio-efficacy and persistence of inert dust formulations as stored-grain protectants against *Rhizopertha dominica* (F.)

Ganhewa HT, Perera AGWU

Molecular phylogenetic analysis on genera *Thrixspermum* (Orchidaceae)

Wijayabandara AMWA, Lewke Bandara N, Papini A, Atthanagoda AG

In silico investigation of anticancer properties of *Withania somnifera* on cancer stem cells  
*Perera KDC, Faizan M, Senathilake NHKS, Samarakoon SR*

Germline variants in the exon 3 of the POLG1 gene: optimization of the polymerase chain reaction and preliminary analysis in a few selected Sinhalese individuals and breast cancer patients  
*Kariyawasam CM, Kotelawala JT, Tennekoon KH, Ranasinghe R*

Analysis of DUOX2 mutations in a cohort of Sri Lankan patients with permanent congenital hypothyroidism  
*Thayaparan P, Hewage S, De Silva S, Athapattu N*

Analysis of NKX2-5 mutations in a cohort of Sri Lankan patients with ectopic thyroid  
*Fonseka WNT, Hewage S, De Silva S, Athapattu N*

Detection of selected SNPs of HOX transcript antisense RNA (HOTAIR) gene in a cohort of patients with breast cancer in Sri Lanka  
*Shafeeu FA, De Silva S, Hewage S, De Silva K*

Detection of disease-associated variant (n.662G>T) in Colon Cancer Associated Transcript 2 RNA gene in a cohort of patients with colorectal cancer in Sri Lanka  
*Kehelgamuwa RP, De Silva S, Hewage S, De Silva K*

Neanderthal inherited COVID-19 genetic variations: Assessing the Polymerase Chain Reaction conditions and database-based allele frequency analysis  
*Galagamaarachchi SH, Fernando AS, Tennekoon KH, Ranasinghe R*

PCR optimization and amplification of selected exons of mitochondrial transcription factor A (TFAM) in sporadic breast cancer patients  
*Fasha MA, Kotelawala JT, Ranasinghe R*

## Isolation, purification and activity study of laccase enzyme from *Rigidoporus microporus* isolates

KS Geethma<sup>1</sup>, OVDSJ Weerasena<sup>1</sup>, LNR Gunaratna<sup>1</sup>, THPS Fernando<sup>2</sup>

<sup>1</sup>Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo

<sup>2</sup>Department of Plant Pathology and Microbiology, Rubber Research Institute of Sri Lanka

Laccase (EC 1.10.3.2 benzendiol: oxygen oxidoreductase) is multicopper oxidase that can catalyze multiple phenolic and non-phenolic compounds by reduction of molecular oxygen to water. Although laccases are widespread among different organisms, from bacterial strains to higher plants, the characteristic properties of fungal laccases have reached more attention in the past decade. Fungal laccases are mainly involved in delignification and plant pathogenesis. The white-rot basidiomycete *Rigidoporus microporus* (RM) is considered a significant laccase producer. A total of nine pre-identified RM isolates from different locations in Sri Lanka were screened for laccase production in PDA media with 0.04% guaiacol. Laccase enzyme was expressed in a synthetic liquid media supplemented with guaiacol (a laccase activity inducer). Culture filtrates were harvested, and proteins were precipitated by ammonium sulphate at an 80% saturation level. Laccase production was quantified in different RM isolates using Fast Protein Liquid Chromatography (FPLC). Laccase activity of the isolates were compared using ABTS assay and the decolorization abilities of textile dye (Acid Blue 113). The decolorization percentage of each sample has been evaluated and RM4 showed the highest decolorization percentage (82.16%) at 72 hours. The isolate RM4 that recorded with overall highest laccase activity was purified to homogeneity with size exclusion chromatography on Superose 12HR 10/30 column and the enzyme was further purified using a strong anion exchange chromatography column (HiTrap Q FF). The molecular weight of the purified laccase was approximately 60 kDa as estimated by SDS-PAGE and a native PAGE. Enzyme activity was measured as 857.3 U/L by ABTS assay. Laccase enzyme of RM4 was 66.7-fold purified with a 10.3% yield.

Keywords: Laccase; *Rigidoporus microporus*

*This work was supported by IBMBB and constitutes part of the MSc studies of GKS.*

**Development of a molecular method to detect adulteration of *Saraca asoca* (Roxb.) Willd. (Ashoka) with *Polyalthia longifolia* in herbal drug industry**

S Ravindrakumar <sup>1</sup>, LNR Gunaratna <sup>1</sup>, OVDSJ Weerasena <sup>1</sup>, TMSG Tennakoon <sup>2</sup>

<sup>1</sup> Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo. <sup>2</sup>Research and Development Center, Link Natural Products (Pvt) Ltd, Malinda, Kapugoda, Sri Lanka

*Saraca asoca* (Roxb.) Willd is a medicinal plant used to treat many gynecological disorders. However, due to the scarcity of this plant, raw materials of the plant are commonly adulterated with many species and the most commonly used adulterant is *Polyalthia longifolia* (Sonn.) Thwaites. known as False Ashoka. This research focused on developing a cost effective and fast molecular method to detect adulteration of *S. asoca* plant materials with *P.longifolia*. Specific primers were designed from 2 chloroplast genome barcoding regions (matK and rbcL) of *P. longifolia* sequences obtained from the GenBank database and analyzed by using bioinformatics tools. The forward primer for rbcL derived primer was PL-RBCL- 5' ATGGGGCGGGCCCTGGAAAGTC 3' and the reverse primer was PL-RBCL -5' ATACTCCTGAATATGAAACCAAAGATAC 3'. The forward primer for matK derived primer was PL-MATK- 5' GGGTCTCAAATTTCTTTATAGAAGTC 3' and the reverse primer was PL-MATK 5' CTATCAGAATTCGAAAAGTCTCCA 3'. Genomic DNA was extracted from the leaves of both plants using the Phytospin d™ plant genomic DNA extraction kit (Ceygen Biotech). PCR was optimized for specific amplification of each genomic region from *P. longifolia*. PCR was carried out with 0.2 mM dNTPs, 2.5 mM MgCl<sub>2</sub>, 0.3 μM forward and reverse primers, 1U of ThermoRead™ Taq Polymerase (CeyGen biotech) and 1x buffer. The PCR program was, the initial denaturation at 94°C for 4 minutes followed by 35 cycles of denaturation at 94°C for 30 seconds, annealing at 63°C for 1 minute, extension at 72°C for 1 minute and a final extension at 72°C for 4 minutes. Both primers sets were combined to develop a duplex PCR assay which resulted in 386 bp amplicons for rbcL and 545 bp amplicons for matK respectively. The developed duplex PCR assay could detect *P. longifolia* in DNA extracted from mixed samples of 0.01% adulteration, demonstrating the high specificity and sensitivity of the PCR assay.

Keywords: *Saraca asoca*; adulterant

*This work was supported by IBMBB and constitutes a part of the MSc studies of SR.*



**Effect of *Exobasidium vexans* Masee on flavonoid production and expression of selected flavonoid biosynthetic enzymes during the early stage of blister blight disease development on tea (*Camellia sinensis* [L.] O. Kuntze)**

C Anuforo<sup>1</sup>, PAN Punyasiri<sup>1</sup>, OVDSJ Weerasena<sup>1</sup>, LNR Gunaratna<sup>1</sup>, RSGTN

Siriwardana<sup>1</sup>, GD Sinniah<sup>2</sup>

<sup>1</sup>Institute of Biochemistry, Molecular Biology and Biotechnology, University of

Colombo. <sup>2</sup>Plant Pathology Division, Tea Research Institute of Sri Lanka

The effect of *Exobasidium vexans* infection on flavonoid production and expression of genes of selected flavonoid biosynthetic enzyme dihydroflavonol 4-reductase (DFR), anthocyanidin reductase (ANR) and leucoanthocyanidin reductase (LAR) during the early stage of blister blight development on tea leaves *using* selected cultivars TRI 2043, CY9, TRI2024 and TRI2025 was studied with HPLC for catechin quantification and relative gene expression ( $2^{-\Delta\Delta Ct}$ ) method) with qPCR. Healthy samples were compared with early stages of disease development for each cultivar and the results revealed that the tested cultivars had lower expression of LAR in the early stage of the infection. Early stage of disease on TRI 2043 recorded high expression of DFR and ANR with relative fold change of 210.05, and 4.38 respectively when compared to that recorded in the healthy leaf sample and later stage of blister blight. CY9 had a higher expression of DFR and ANR in the later stage of blister blight compared to the early stage. High expression of DFR leads to accumulation of leucoanthocyanidins. The general low expression of LAR indicates an overall low content of (-)-Flavan-3-ols, while high expression of ANR lead to an accumulation of (+)-Flavan-3-ols, when the HPLC and gene expression data are compared for ANR, the susceptible cultivar TRI 2024 and TRI 2025 despite having high expression of ANR, had a preferential accumulation of Epigallocatechin gallate (EGCG) (antimicrobial property mainly against *Colletotrichum fructicola* infection and not *Exobasidium vexans* infection). In contrast, there was a significantly higher accumulation of Epicatechins (EC) and Epicatechin gallate (ECG) in the TRI 2043 cultivar (resistant) during the early stage of blister blight than other tested cultivars (using One way ANOVA and Tukey's multiple comparisons post hoc test with significant difference at  $p < 0.05$ ). Probably the increased levels of Epicatechins and Epicatechin gallate during early stages of blister disease may have a role in resistance of *Camellia sinensis* to *Exobasidium vexans*.

Keywords: Flavonoid; blister blight; *Camellia sinensis*

*This work was supported by the Association of Commonwealth University Research Grant FE-2020-239 and constitutes a part of the MSc studies of CA*

**Morphological and molecular characterization of *Leucinodes orbonalis* Guenee  
(Brinjal Shoot and fruit borer) from selected locations in Sri Lanka**

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<sup>2</sup>Department of Agricultural Biology, Faculty of Agriculture, Kilinochchi.

Brinjal shoot and fruit borer (*Leucinodes orbonalis*) is one of the most detrimental pests affecting brinjal cultivation. Understanding existing morphological and genetic variations based on geography and the host variety are important in developing efficient pest management strategies. The present study was designed to assess the morphological and genetic variations of *L.orbanalis* infesting brinjal varieties; namely, HORDI Lena iri, Thinnaweli purple, Plastic cultivar and Eerku vellai from randomly selected locations in Anuradhapura, Badulla, Jaffna, Kandy, Kilinochchi, Monaragala, Polonnaruwa and Puttalam districts. The morphological variations of all life stages emerging from infested brinjals collected from all locations were studied independently in lab-rearing colonies. The genetic variations of *L.orbanalis* were investigated using DNA sequences obtained for D3 region of 28S rDNA and cytochrome c oxidase subunit I (COX I) genes. There were no morphological variations observed among life stages that emerged from the colonies. In terms of developmental period, the only difference was observed during the transformation of larval to pupal stage, which exhibited 11.98 days at 26-28<sup>0</sup>C and 6.04 days at 34-36<sup>0</sup>C. The pest spent significantly lower time in HORDI Lena Iri (1.98±0.35 days) and higher time in Eerku vellai (2.00±0.00 days). This could be because of variations in seed arrangement and flesh texture. The phylogenetic tree constructed using the COX I sequence (681 bp) revealed five unique groups, whereas no variation was observed in the D3 sequences. Jaffna, Chavakacheri, Kilinochchi, and Monaragala populations were identified as four distinct clades. The populations of Bandarawela, Anuradhapura, and Kaithady were grouped together. Among them, Kaithady population from the Plastic cultivar was separated distinctly from the Bandarawela and Anuradhapura populations infesting HORDI Lena iri. Monaragala population showed higher sequence divergence and more distantly related to all other populations. According to the study, molecular variations were noticed among different populations of *L. orbanalis*, which can be helpful to design a breeding programme to develop a resistant brinjal variety.

Keywords: brinjal; *Leucinodes orbonalis*; breeding programme

## **A Study on Allelic and Expression Differences of Selected Salt Responsive Genes in At 354 and Bg 352 Rice Varieties**

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Rice is a world famous staple food. In Sri Lanka most of the crop loss is due to biotic and abiotic stress. Salinity is a major cause of abiotic stress . A previous study has identified two salinity responsive candidate genes in *Oryza sativa* known as Os11g0655900 and Os12g0624200. At 354 is salinity resistant and Bg 352 is salinity susceptible rice variety. According to a previous study based on Next Generation Sequencing (NGS), there are 6 bp and 3 bp insertions in Os11g0655900 and Os12g0624200 genes respectively whereas those are absent in Bg 352. Therefore, this study was conducted to observe the expression differences in Os11g0655900 and Os12g0624200 genes under different saline conditions and to confirm the above mutations as detected by NGS, using Sanger sequencing. Expression of those two genes in At 354 and Bg 352 were observed using quantitative Real Time PCR (qPCR) under different salinity levels. Results indicates, the expression of Os11g0655900 gene in At 354 increased after salinity exposure and the highest expression was observed after 5 days. The expression of Os12g0624200 gene in At 354 increased after salinity exposure and the highest expression was observed after two days of exposure. Both genes in Bg 352 showed a reduction in expression than in the control. According to the Sanger sequencing of Os11g0655900 gene it has been shown that At 354 consists of the 6 bp insertion which is absent in Bg 352. Also, 3 bp insertion in At 354 was observed only in the Os120624200 gene as observed by NGS. Therefore, it can be suggested that the mutations observed in At 354 may contribute to salinity responsive increase in expression of above genes and thereby salinity resistance of At 354. However, further research is needed to confirm the findings of this study.

Keywords: rice; Bg352; At 354; salinity response

*This work was supported by IBMBB and constitutes part of the MSc studies of PDPRP*

## RNAi-mediated yEGFP gene knockdown in *Pichia pastoris*

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Gene knock-down in living organisms for therapeutic purposes is becoming a widely studied area with the uprising advancements in current technologies. RNA interference (RNAi) is being used to suppress genes related to infectious diseases as well as genetic diseases in humans such as HIV and HPV-related cancers. The present study was conducted as a model study focused on monitoring the knock-down of yEGFP gene in *Pichia pastoris* which has an artificially reconstituted human RNAi pathway. The objective of this study was to test whether the reconstituted human RNAi pathway is functional in *P. pastoris*, using yEGFP as a reporter gene. For this purpose, two genetically modified *P. pastoris*; yEGFP expressing reporter strain, and both yEGFP and RNAi expressing ADT strain were developed. The fluorescence expression of each strain was visualized using the FITC filter in Nikon ECLIPSE Ni-U upright microscope. Photographed fluorescent intensities exhibited by yEGFP in *P. pastoris* cells were analyzed using Image J software. The wild-type *P. pastoris* was used as the control. The average mean fluorescent intensity of the yEGFP reporter strain was  $40.148 \pm 13.824$ . RNAi expressing ADT strain reported  $5.969 \pm 1.700$  mean fluorescent intensity. The control wild-type strain showed  $0.031 \pm 0.002$  average mean fluorescent measurement. Taken together, these results showed low mean fluorescent in ADT strain compared to the yEGFP expressing reporter strain due to the RNAi-mediated knocked down yEGFP gene in ADT strain. In conclusion, a successful knockdown of yEGFP gene expression can be observed in RNAi reconstituted *P. pastoris*. In future aspects, RNAi reconstituted *P. pastoris* has the potential to be used to study the gene knockdown by replacing the yEGFP gene with any gene of interest related to human diseases.

Keywords: *Pichia pastoris*; yEGFP gene; gene knockdown

†This article is dedicated to the memory of Prof. Ranil Samantha Dassanayake who passed away tragically while this research was being conducted. This is one of his last works.

## Characterization of mealybug species associated with different host plants using morphological and molecular methods

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Mealybugs are significant pests with a wider host range, such as okra, tomato, turkey berry, coffee, brinjal, guava, papaya, pineapple, soursop, cassava, croton, and shoe flower. The aim of the research was to study the variation in mealybug species associated with different host plants. Mealybug samples (n = 180) were collected from selected fields in Kilinochchi, Jaffna, and Monaragala districts. They were morphologically identified based on published taxonomic keys. PCR was performed to confirm the species by amplifying the D3 region of the 28s rDNA. The sequences were analyzed for variation, and the phylogenetic tree was constructed using maximum-likelihood method. The field study revealed that mealybugs exist as a complex associated with ant species such as *Oecophylla smaragdina* and *Technomyrmex albipes*, mealybug destroyers, and sooty mold, which itself caused enormous damage to plants in terms of quantity and quality. Ten mealybug species belonging to seven genera were identified. Those were; *Phenacoccus solenopsis*, *Phenacoccus solani*, *Phenacoccus manihoti*, *Planococcus minor*, *Planococcus lilacinus*, *Ferrisia virgate*, *Coccidohystrix insolita*, *Paracoccus marginatus*, *Pseudococcus vibruni*, and *Rastrococcus mangiferae*. Among them, *P. solenopsis* was the most abundant species recorded in okra, tomato, turkey berry, and hibiscus crops, while *F. virgate* was the second most abundant mealybug species recorded in guava, brinjal, and croton crops. *P. solenopsis*, *F. virgate*, *P. minor*, and *P. lilacinus* were found in more than one host plant, confirming their preference for multiple host plant species. DNA sequence data were consistent with morphological identification. Phylogenetic tree analysis revealed that one *P. solenopsis* (Accession no. ON787841) was clustered separately from the rest of the same species identified (ON787838, ON787840, and ON787844), which were clustered with sequences from China and the USA. This might be a unique genetic variant belonging to Sri Lanka. This study contributes to understanding the species variation, host preference and other insects associated with mealybug species, which might be important in designing management strategies.

Keywords: Mealybug; species variation; host preference

**Association of *PNPLA3* gene variants with non-alcoholic steatohepatitis (NASH) related hepatocellular carcinoma (HCC) patient cohort in Sri Lanka**

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NASH is the hepatic manifestation of metabolic syndrome. Worldwide, NASH is one of the major causes of HCC. Apart from the environmental factors (unhealthy diet, lack of exercise, and weight gain), genetic variants in the key genes of lipid metabolism can predispose to the development of NASH-related HCC. Three single nucleotide polymorphisms (SNPs) (rs738409, rs2281135, and rs2294918) in the *PNPLA3* gene have been linked with the progression of NASH. The aim of the current study was to analyze the genetic association of NASH-related HCC with respect to three common SNPs in the *PNPLA3* gene in a cohort of Sri Lankan patients. A group of 48 patients with NASH-related HCC and 25 age and gender-matched healthy controls were genotyped. Primer extension-based SNP analysis was used to genotype all three polymorphisms. In the *PNPLA3* gene, the most common genotype and allele were CG (79%) and C (60.4%) for the rs738409 polymorphism, GA (73%) and G allele (59.4%) for the rs2281135 polymorphism and GG (65%) and G (77%) for the rs2294918 polymorphism. Collectively, 77.1% of our study cohort were carriers of all three *PNPLA3* variants. Two out of three tested SNPs, *PNPLA3* rs738409 (Relative risk=1.80, 95% CI: 1.13-2.866; P=0.002) and *PNPLA3* rs2281135 (Relative risk=1.52, 95% CI: 0.988-2.343; P=0.027) showed significant associations with NASH related-HCC. The present study shows *PNPLA3* (rs738409, rs2281135) variants were significant genetic determinants of NASH-related HCC in the Sri Lankan population.

Keywords; NASH; HCC; *PNPLA3*

*This work is supported by National Research Council (NRC-19-030) and constitutes a part of the PhD studies of SASMS*

## Alpha-hederin modulates $\beta$ -catenin pathway target genes and induces caspase dependent programmed cell death in breast cancer stem cells

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Intriguing evidence demonstrates that breast cancer stem cells (bCSCs) play a vital role in tumor cell proliferation, metastasis, recurrence and chemoresistance in breast cancer.  $\beta$ -catenin, one of the frequently over activated proteins in breast cancer cells help maintaining the bCSCs population in the cancer cell mass by constitutive activation of Wnt/  $\beta$ -catenin pathway. Interaction of T-cell factor (Tcf) DNA binding proteins and  $\beta$ -catenin protein play a critical role in the activation of proliferative genes in bCSCs in response to upstream Wnt/ $\beta$ -catenin signaling. For the identification of novel and effective Wnt/  $\beta$ -catenin pathway inhibitors, a library of 100 natural compounds was docked *in silico* against Tcf binding site of  $\beta$ -catenin. Protein ligand complexes with binding energy less than -7 kcal/mol were investigated for protein-ligand binding interactions. Stability of the protein-ligand complexes was studied by performing 100 ns molecular dynamics (MD) simulations. Alpha-hederin (AH) with binding affinity of -8.2 kcal.mol<sup>-1</sup> having a stable MD profile was studied *in vitro* for anti-proliferative and apoptotic effects using bCSCs isolated from a triple-negative breast cancer cell line (MDA-MB-231). Further, oral bioavailability and possible toxic effects of AH were predicted using *in silico* tools. AH significantly decreased the viability of bCSCs which was evaluated by WST-1 assay. Apoptosis in bCSCs was induced with treatment of AH which resulted in a potent increase in caspase3/7 activity and nuclear DNA fragmentation. AH downregulated the transcription of Wnt/ $\beta$ -catenin downstream target genes, *CD44* and *Cyclin D1* while inducing the transcription of the tumor suppressor gene *p53*. Results of the drug-likeness study indicated that AH possesses acceptable overall drug-likeness. AH is widely known as an inhibitor of the proliferation of various cancer cells, current *in vitro* study demonstrates the potential anti-cancer activities; anti-proliferative, apoptotic effects and regulation of Wnt/  $\beta$ -catenin pathway in bCSCs by AH inhibitors.

**Keywords:** T-cell factor; breast cancer stem cells; Wnt/  $\beta$ -catenin pathway; AH inhibitors  
*This work was funded by National Science Foundation Sri Lanka grant number 2016-C-07 and IBMBB*

**Cytotoxicity of endophytic fungi strains of *Rhizophora mucronata* using human hepatocellular carcinoma (HepG2) cell line**

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Endophytic fungi have been considered as a potential source of novel anticancer therapeutics since most of the endophytic fungi have not been explored for their chemical constituents. The present study was carried out to screen cytotoxicity of extracts of selected endophytic fungal strains isolated from *Rhizophora mucronata* (a mangrove plant) against human hepatocellular carcinoma cells (HepG2). Five endophytic fungal strains (Rhm/1/A4/1, Rhm/R/A3/0, Rhm/R/A4/0, Rhm/R/A2/0 and Rhm/R/A4/1) were isolated from the leaves of *R. mucronata* and extracted into dichloromethane and methanol to assess cytotoxicity against HepG2 cells by using Sulforhodamine B (SRB) assay. Thymoquinone was used as the positive control ( $IC_{50} = 6.15 \mu\text{g/mL}$ ). Extract with potent cytotoxicity on HepG2 was used to test on normal liver epithelial cell line (THLE-3) for toxicity and further investigated for its apoptotic effects by (a) analyzing morphological changes of HepG2 and (b) determining caspase 3/7 and lactate dehydrogenase (LDH) activities. Active cytotoxic extract was further investigated for radical scavenging activity [by using 2, 2-diphenyl-1-dipicrylhydrazyl (DPPH) assay] and total phenolic content (TPC). Dichloromethane extract of Rhm/R/A3/0 (DRA3) exhibited a lower cytotoxicity ( $IC_{50} = 110.4 \mu\text{g/mL}$ ) against HepG2 cells after 24 hours of incubation but potent cytotoxicity after 48 and 72 hours of incubation ( $IC_{50} = 13.3$  and  $10.5 \mu\text{g/mL}$  respectively). Further DRA3 showed a lower toxicity ( $IC_{50} = 180.2 \mu\text{g/mL}$ ) against THLE-3 cells compared to HepG2 cells after 48 h exposure. DRA3 showed comparatively less radical scavenging activity ( $EC_{50} > 100 \mu\text{g/mL}$ ) and increased LDH activity in cell lysate compared to the standard nicotinamide adenine dinucleotide (NADH). Total phenolic content was less than 50 mg/g of gallic acid equivalents. Morphological changes of apoptosis were evident in DRA3 treated HepG2 cells with a significant ( $p < 0.0001$ ) time and dose dependent increase in caspase 3/7 activities. Current study provides comprehensive evidence that DRA3 is a potent source of anti-cancer drug leads against hepatocellular carcinoma with less toxic to normal liver cells.

**Keywords:** *Rhizophora mucronate*; hepatocellular carcinoma; anti-cancer drug

*This work was supported by the National Science Foundation, Sri Lankan (RPHS/2016/C-07) and constitute a part of the PhD studies of JT*



## **Initial validation of analyte-specific fluorescence in-situ hybridization probes targeting MYC, BCL2, and BCL6 gene rearrangements**

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B-cell lymphomas (BCL) are malignant, heterogeneous group of lymphoproliferative disorders considered as a sub-type of non-Hodgkin lymphomas (NHL). BCLs arise from different stages of the differentiation process of B-cells with a high diversity of malignancy, thus making their diagnosis and management extremely challenging. MYC, BCL2, and BCL6 gene rearrangements are closely associated with BCLs and usually appear as composite rearrangements. Molecular cytogenetic techniques such as karyotype, immunohistochemistry (IHC), and fluorescence in-situ hybridization (FISH) have been employed in detecting vital molecular rearrangements of BCLs. However, the detection of these molecular anomalies depends on the sensitivities of each technique. Interphase FISH has emerged as an effective, highly sensitive, and reproducible molecular cytogenetic technique. FISH assays usually employ non-FDA-approved, analyte-specific reagents (ASR) that should be validated prior to their use in clinical practice. In the present study, an extensive probe colocalization was carried out as part of the validation process. Sequential G to FISH banding was performed using dual fusion probes targeting t(8;14) [MYC/IGH], t(14;18) [IGH/BCL2], and a break-apart probe targeting 3q27 [BCL6 rearrangement] separately on twenty metaphases of peripheral blood samples obtained from healthy individuals. Since a single metaphase consists of two alleles for each chromosome, a total of forty hybridization signals for a single chromosome was accommodated in the analysis. Hybridization signals were captured coordinated with previously karyotyped metaphases. The outcome of the present study, clearly indicated that all three sets of probes accurately hybridized with the intended locations in all forty loci tested for each chromosome, thus reporting 100% probe specificity. The fulfillment of 100% probe specificity is one of the prime prerequisites prior to their use in clinical diagnostics. Therefore, the present study justifies the use of the above analyte-specific FISH probes for the remaining validation process for their clinical diagnostic use.

**Keywords:** B-cell lymphomas; FISH probes

*This work was supported by IBMBB, Lanka Hospital Diagnostics and the Department of Pathology, National Cancer Institute, Maharagama*

## Comparison of uniparental inheritance in a cohort of Adivasi inhabiting in the Ratugala area

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Sri Lanka holds the evidence for the oldest skeleton of the anatomically modern human who lived in the South Asian region; known as the ‘Balangoda Man’. The ancestors of Sri Lankan Adivasi share morphology with the Balangoda Man, and hence the Adivasis are believed to be the earliest inhabitants of Sri Lanka. In the current study, we compared the maternal and paternal ancestry of Ratugala Adivasi to obtain a better understanding of the uniparental inheritance of the present-day descendants of the early inhabitants of Sri Lanka. DNA was extracted from five Ratugala Adivasi individuals [males (N=4) and females (N=1)] using the Qiagen investigator kit. The whole genome was sequenced through Illumina Novaseq 6000 platform. The mitochondrial genome was extracted using samtools and bcftools upon quality checking. The mitochondrial haplogroup (mt hg) was determined via Haplogrep2 and Y haplogroup (Y hg) through yHaplo software. Out of the study individuals, four were assigned to R30b2a mt hg and one individual to the U7a2 mt haplogroup. The high prevalence of R30b2a mt hg was consistent with the previously published data. When analyzed for Y hg, two individuals reported R2a (M124), one each with R1a1a1b2a2a (Z2125) and H1b1. The individual reported with U7a2 mt hg was assigned to R1a1ab2a2a (Z2125) Y hg and those lineages are associated with near east (pre-Steppe) lineages while the rest of the maternal and paternal lineages are associated with autochthonous early Indian lineages. The geographical derivations of the reported maternal and paternal haplogroups suggest a possible influence by the early Near East and Indian lineages on the genetic constitution of Adivasis ancestors of the studied individuals.

Keywords: Adivasi; Sri Lanka; mitochondrial genome

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**Length heteroplasmy analysis in the C-stretch of Mitochondrial DNA  
hypervariable region I in Sinhalese, Sri Lankan Tamil and Vedda populations in  
Sri Lanka**

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Numerous migrations from neighboring countries have significantly affected the genetic diversity of Sri Lankan populations since prehistoric times. However, inadequate genetic information on these populations makes it challenging to understand their genetic relatedness and gene flow patterns. Some studies have considered the length heteroplasmy in the C-stretch of mitochondrial DNA (mtDNA) hypervariable region I (HVS-I) (base pairs 16180-16193) as a reliable genetic marker to explore genetic differences among distinct populations. Hence, the present study has focused on analyzing C-stretch variations in three major contemporary populations in Sri Lanka; Sinhalese, Sri Lankan Tamil, and Adivasi (Vedda) populations. Thirteen different South Asian populations were also included in the study together with the Aboriginal populations in Australia and Papua New Guinea to understand possible genetic links of Sri Lankan populations to neighboring nations. Sequences of mtDNA HVS-I were analyzed for C-stretch variations in all study individuals (N= 1352). Nineteen different haplotypes were identified. However, (C<sub>5</sub>TC<sub>4</sub>) haplotype was the most significant in all populations. In addition, approximately 13% of the study population exhibited C-stretch length heteroplasmy. Out of them, C<sub>10</sub> and C<sub>11</sub> variations displayed high frequencies. All study populations displayed relatively low genetic diversities ranging from 0.00 (Adivasis) to 0.64 (Australian and Papua New Guinea aborigines). No significant differences between Sinhalese and Sri Lankan Tamils were observed regarding diversity measures. According to the pair-wise distance matrix (Fst) and Multi-Dimensional scaling (MDS) plot, the Adivasi (Vedda) population clustered separately from other study populations. Sinhalese clustered together with Bangladesh Bengalis and Telegu populations in India while Sri Lankan Tamils with the Jammu-Kashmir populations. The results indicate that C-stretch variations in mtDNA HVS-I region are useful genetic markers to understand the genetic relationships of distinct populations.

**Keywords:** mitochondrial DNA; hypervariable region I; populations  
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## Species delimitation of blindsnakes by molecular phylogenetic analysis of mitochondrial DNA sequences

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Blindsnakes belong to the infraorder Scolecophidia, comprising 4 families: Leptotyphlopidae, Typhlopidae, Gerrhopilidae and Xenotyphlopidae. Sri Lanka has a known fauna of 10 species of Scolecophidians, all but two are endemic; eight are *Indotyphlops*, and two *Gerrhopilus*, representing two families; Typhlopidae and Gerrhopilidae. No dedicated surveys have been carried out in Sri Lanka on blindsnakes for over 72 years. The current study evaluated the species diversity of Sri Lankan blindsnakes using a single-locus species delimitation method, proposing species limits for the two families: Typhlopidae and Gerrhopilidae. The entire island of Sri Lanka has been considered as the study area in the current study. Field sampling was opportunistic. Whole-genomic DNA was extracted from tissues of 79 specimens; we present here the results obtained for 56 samples (49 Typhlopidae + 7 Gerrhopilidae) of a selected part of a single mitochondrial, Cytochrome b gene (*cyt b* ~ 738 bp amplified), through single-locus species delimitation. Preliminary phylogenetic analyses were run, treating the two families separately, using Maximum Likelihood and Bayesian Inference methods; utilizing IQ tree and MrBayes software respectively. Based on preliminary analyses, five major monophyletic groups were recognized for the entire 56 sequences of *cyt b*. For each of these assembled groups pairwise distances were calculated using MEGA X. Two different tree-based species delimitation methods; Poisson tree processes (PTP: Zang et al., 2013) and Multi-rate poisson tree processes (mPTP: Kapli et al., 2017), were used for each of the major clades. Results obtained via tree-based species delimitation methods and conventional methods were integrated to obtain final conclusions, that indicated three distinct species for Gerrhopilidae, at least 9 distinct species for Typhlopidae, and the probable re-discovery of all but one (*Indotyphlops vaddae*) of the currently known species diversity of the island. These findings will facilitate site-based conservation actions; and updates to the IUCN Red List.

Keywords: blind snakes; species delimitation; mitochondrial DNA

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## **In silico prediction and in vitro validation of new anti-aging natural compounds**

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Aging is an inevitable process where the bodily functions necessary for survival deteriorates. The characteristics of aging are affected by all living organisms. Aging is a complex process influenced by genetic and environmental factors that affect the physiological pathways and is associated with increasing susceptibility to conditions such as neurodegenerative diseases, cancer and heart diseases. In this study, a compound library of 22 natural compounds were screened in silico by molecular docking and molecular dynamics against anti-aging protein drug targets that are SIRT1, SIRT6, MMP9, MMP2, hyaluronidase, collagenase and elastase. High binding affinity was observed in; alpha-hederin (-6.7 kcal/mol) for SIRT1 protein target, epigallocatechin (-9.0 kcal/mol), K-3 (-10.3 kcal/mol) and mangiferin (-8.7 kcal/mol) for SIRT6 protein target, epigallocatechin (-9.3 kcal/mol) and K-3 (-10.3 kcal/mol) for MMP9 protein target, epigallocatechin (-9.3 kcal/mol), K-3 (-10.3 kcal/mol) and DC-3B (-8.6 kcal/mol) for MMP2 protein target, K-3 (-8.2 kcal/mol) and DC-3B (-8.1 kcal/mol) for hyaluronidase protein target, K-3 (-8.2 kcal/mol) and DC-3B (-7.8 kcal/mol) for collagenase protein target, K-3 (-6.8 kcal/mol) and DC-3B (-6.4 kcal/mol) for elastase drug target. The following compounds were analyzed in vitro since there were no findings based on all the protein anti-aging targets selected in this study. In vitro cytotoxic effects on the selected compounds based on the high binding affinity in molecular docking were evaluated by Sulforhodamine B (SRB) assay (Alpha Hederin IC<sub>50</sub> 13.29 μM, epigallocatechin IC<sub>50</sub> 19.71 μM, K-3 IC<sub>50</sub> 28.46 μM, DC-3B IC<sub>50</sub> 29.35 μM, mangiferin IC<sub>50</sub> 135.9 μM). The anti-oxidant potential of these compounds were investigated by, α-diphenyl-β-picrylhydrazyl (DPPH) assay and glutathione-s-transferase (GST) activity assay. Epigallocatechin (EC<sub>50</sub> of 36.27 ± 2.62 μg/mL) and mangiferin (EC<sub>50</sub> of 43.95 ± 3.23 μg/mL) showed relatively high DPPH scavenging activity. Elevated GST activity was observed in epigallocatechin at 1.25 μg/mL (0.1436 ± 0.0054 U/mL), mangiferin at 20 μg/mL (0.1442 ± 0.0031 U/mL) and DC-3B at 5 μg/mL (0.1381 ± 0.0082 U/mL).

**Keywords:** anti-aging; natural compounds; epigallocatechin; mangiferin

*This work was supported by IBMBB and constitutes part of the MSc studies of HND.*

## Virtual Screening and Molecular Dynamics Based Identification of Bismahanine as a Potential Anti-Aging Compound

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Since the middle of the 19th century, human life expectancy has been steadily increasing in many parts of the world, including Sri Lanka. At the age of 60 or older, individuals become more susceptible to chronic illnesses with a rising burden of multimorbidity. Hence, the identification of new anti-aging compounds that might be present in common herbs and edible plants will open up avenues for formulating effective and readily available anti-aging formulations. To identify new anti-aging phytochemicals, a library of 1426 plant secondary metabolites was constructed in-silico based on the previous research work of the Institute of Biochemistry, Molecular Biology and Biotechnology (IBMBB) and by carrying out database and literature searches. The phytochemical library thus constructed was screened using AutoDock Vina (Lamarckian algorithm) in PyRx software. It was screened against validated anti-aging drug targets, mTOR1 and sirtuin-1. Absorption, distribution, metabolism, excretion, and toxicity (ADMETox) parameters were predicted using the FAFdrug4 online server to determine the drug likeliness of identified potential anti-aging compounds. To verify the findings, molecular dynamic simulations were carried out for potential hits in Desmond. Possible other targets of the identified potential anti-aging compounds were predicted by target fishing and a network pharmacology approach using the String database. Based on the binding affinity values, 35 hits were selected for interaction analysis and ADMETox predictions. Out of the 35 compounds, bismahanine from *Murraya koenigii* was predicted to have very high anti-aging potential by eliciting the required binding stability. Molecular dynamics simulations confirmed that the complexes formed by bismahanine with mTOR1 and Sirtuin-1 were stable up to 100 ns in an aqueous environment. Target fishing and network pharmacology analysis provided limited evidence for potential off-target effects of bismahanine. Overall results indicate that bismahanine may be a natural compound with potent anti-aging properties. However, results should be experimentally validated through in-vitro and in-vivo experiments.

Keywords: Bismahanine; anti-aging; mTOR1; in-silico

## **The *in vitro* effect of *Mikania cordata* aqueous leaf extract on wound healing**

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Traditional and modern wound-healing methods come in a variety of forms, each with its own level of clinical acceptance, efficacy, and limits. Traditional medicines that are used most frequently to treat skin lesions are those which are derived from herbs. The current *in vitro* study focuses to assess the wound healing ability of aqueous extract (AE) of *Mikania cordata*. *M. cordata* is an Asteraceae plant with a vine that grows on trees or on the surface of the soil. *M. cordata* has been used for its antibacterial, anti-inflammatory, and wound-healing properties. In this study, an AE was produced using fresh leaves and EA. hy926 cell line was used to examine the capacity to heal wounds compared to the positive control Allantoin. Cells were treated with a series of concentrations of AE of *M. cordata* ranging from 1000 – 3.905 µg/ml to determine the non-toxic concentrations using SRB and MTT assays. Results showed more than 80% of viability and overall cell functionality in concentrations 1000 – 3.905 µg/ml. Therefore, the scratch assay was performed using 500, 250, and 125 µg/ml concentrations to examine the wound healing ability of the AE. The cells treated with 125 µg/ml of AE for 48 hours displayed the highest percentage of wound closure (70%) compared to the untreated cells ( $P \leq 0.001$ ). Further, the Griess assay was performed to investigate the effect of AE of *M. cordata* on nitrite levels produced by the scratched cells and results demonstrated that the cells exposed to 125 µg/ml of AE of *M. cordata* for 48 hours displayed 41% reduction compared to positive control ( $P \leq 0.001$ ). Hence, the result of this study suggests that the AE of *Mikania cordata* may have wound-healing properties, indicating the need of further studies to prove its observed activity.

Keywords: MTT assay; *Mikania cordata*; wound-healing

**Cancer stem cell targeted *in vitro* anti-cancer activity and acute *in vivo* toxicity studies of a diterpene isolated from *Caesalpinia pulcherrima***

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Cancer stem cell (CSC) subpopulation present in different cancer types plays a key role in recurrence, metastasis, and chemo-resistance. Current anti-cancer drugs do not effectively eliminate CSCs. As an effort to identify CSC targeted drug leads, a diterpene compound of traditionally used anticancer medicinal plant *Caesalpinia pulcherrima* has been computationally predicted as an anti-CSC drug lead that can down regulate Wnt/ $\beta$  catenin pathway that is essential for the maintenance of CSCs. In the current study, the abundance of the said diterpene was investigated in different parts of *C. pulcherrima* using thin layer chromatography (TLC) and the diterpene was isolated from the root bark of the plant. The structure of the compound was confirmed by analyzing proton and carbon nuclear magnetic resonance (NMR) spectra. Wnt/ $\beta$  catenin pathway modulatory activity and anti-proliferative activity of pure diterpene were separately investigated by exposing the diterpene to *in vitro* cultured breast CSCs at different concentrations followed by RT qPCR gene expression assays and Sulforhodamine B (SRB) assay respectively. SRB assay was then conducted for 19 other cancer cell lines after exposing each cell line to pure diterpene. Acute *in vivo* toxicity of the pure diterpene was investigated in Wistar rats according to the Organization for Economic Cooperation and Development (OECD) guideline 420. Strong anti-proliferative activity of the diterpene was observed for breast CSCs ( $IC_{50} = 49.18 \mu M$ ), triple negative breast cancer ( $IC_{50} = 4.905 \mu M$ ), gastric adenocarcinoma ( $IC_{50} = 0.99 \mu M$ ), hepatocellular carcinoma ( $IC_{50} = 3.101 \mu M$ ) and ovarian adenocarcinoma ( $IC_{50} = 3.987 \mu M$ ). Diterpene modulated Wnt/ $\beta$  catenin pathway target gene expression indicating its ability to effectively down regulate the Wnt/ $\beta$  catenin pathway. *In vivo* toxicity signs were not observed up to the highest dose tested (300 mg/kg) and the diterpene was stable under tested conditions indicating the potential of the diterpene as a good drug lead.

Keywords: cancer stem cell; *Caesalpinia pulcherrima*; in-vivo; anti-cancer

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## Isolation of a potential anti-cancer compound from *Mangifera zeylanica* leaves and investigation of its effects

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Lung cancer has been estimated to cause the highest number of cancer deaths in 2023. Of two subtypes of lung cancer, Non-Small Cell Lung Cancer (NSCLC) is the most frequently reported. Currently used treatment options for NSCLC are chemotherapy, radiotherapy and surgery. However, chemo- and radio-therapies result in severe side effects. Therefore, invention of new treatment strategies for NSCLC is timely needed. Investigations on plant derived compounds is becoming a promising approach for discovering potential anti-cancer drug leads. *Mangifera zeylanica* (family: Anacardiaceae) is a plant endemic to Sri Lanka and used for cancer treatment in traditional medicine. We have previously reported that the chloroform extract of *M. zeylanica* leaves is cytotoxic to non-small cell lung cancer cells (NCI-H292) with less cytotoxicity to normal lung fibroblasts. In the present study we isolated an active compound (B-II-c-a) from the chloroform extract using silica-gel column chromatography, size exclusion chromatography and reversed phase preparative high performance liquid chromatography. Cytotoxicity of B-II-c-a on NCI-H292 cells was evaluated using Sulforhodamin B (SRB) assay. The effects of B-II-c-a on cell migration and colony formation was investigated using wound healing assay and colony formation assay respectively. Assessment of potential apoptotic effects of B-II-c-a was carried out using Ethidium Bromide/Acridine Orange (AO/EB) staining. The compound B-II-c-a showed cytotoxic effects on NCI-H292 NSCLC cells and MRC-5 normal lung fibroblast cells following 24h exposure (IC<sub>50</sub> of 3.22 µg/mL and 7.83 µg/mL respectively). Moreover B-II-c-a resulted in inhibition of colony formation and cell migration. AO/EB staining revealed that B-II-c-a induces apoptosis in NCI-2H92 cells. Structure determination of B-II-c-a is currently in progress.

Keywords: SRB assay; Non-Small Cell Lung Cancer; anti-cancer

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**Lactone ring enhances anti-breast cancer activity of three structurally related compounds isolated from *Gardenia crameri***

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*Gardenia crameri* is an endemic plant used in medical applications to treat various diseases in Sri Lankan traditional medicine. The *Gardenia* genus has also been reported to have anti-cancer properties. Therefore, this study aims to identify compounds from *G. crameri* with anti-breast cancer properties. The isolation was performed on exudate from the buds using chromatographic techniques, mainly normal and reverse-phase wet loading gravity silica columns and preparative thin-layer chromatography according to the polarity of the compounds and the solvent system used for the isolation. Three isolated compounds were identified by using the nuclear magnetic resonance (NMR) spectral data, <sup>1</sup>H NMR, <sup>13</sup>C NMR and <sup>1</sup>H-<sup>1</sup>H COSY, HSQC, HMBC, NOESY spectral analysis. Anti-cancer activity was tested using the sulforhodamine B assay against highest abundant breast cancer subtypes Luminal A (MCF-7) and triple-negative breast cancer (MDA-MB-231) and normal mammary epithelial cells MCF-10A. The apoptotic effects were tested using fluorescence microscopy and the caspase Glo 3/7 assay. The effects on colony formation and migration ability of cancer cells were tested using colony formation and wound healing assay. Compound 1 showed highly potent cytotoxic activity (<10 µg/ mL) on both MDA-MB-231 and MCF-7 cell lines resulting due to lactone ring. Compounds 2 and 3 with similar structures that do not have a lactone ring exerted less but selective activity (< 70 µg/ mL) on MDA-MB-231. Compound 1 exerted high toxicity whereas compound 2 and 3 have exerted low toxicity on MCF-10A. The all three compounds led to apoptosis of cancer cells. Furthermore, they reduced the colony formation and migration ability of the cancer cells, which would help to prevent the cancer from growing into an invasive stage. The isolated compounds have the potential to be used as tailor-made drugs by modifying their structure to treat different molecular sub types of breast cancer.

Keywords: *Gardenia crameri*; breast cancer; anti-cancer

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## Investigation of a Termite Nest-Derived Fungus for the Presence of Biologically Active Secondary Metabolites

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Termites consume decaying plant material. Termites of the family *Termitidae* do not produce wood-digesting enzymes and depend on symbiotic fungi for such enzymes. This study was designed to investigate the capacity of termite-nest-derived fungi to produce biologically active metabolites under laboratory culture conditions. A fungal species isolated from fungal nodules from a termite mound in Ingiriya, Sri Lanka was cultured on potato dextrose agar for 14 days at room temperature. Fungal identification was carried out morphologically and by Sanger sequencing. The cultured fungus was extracted with ethyl acetate and the extract was concentrated under reduced pressure to yield 270 mg of extract which was extensively analysed by normal-, reversed-phase- (RP), and high-performance liquid chromatography. Additionally, it was analysed by <sup>13</sup>C- and <sup>1</sup>H-NMR spectroscopy and was assayed against the human breast cancer cell line (MCF-7). The crude extract was subjected to solvent/solvent partitioning and the resulting chloroform fraction was separated by RP – column chromatography to yield a pure compound. Morphological and molecular analysis established the fungus as a *Pestalotiopsis* or *Pseudopestalotiopsis* species while the termite was identified as *Hypotermes obscuriceps* belonging to *Termitidae*. The crude extract exerted considerable cytotoxic effects on MCF – 7 cells (IC<sub>50</sub> = 181 µg/mL) at 24 hours post-treatment. Chromatographic analyses showed the presence of several prominent ultraviolet (UV) active spots indicating that the fungus is producing many UV-active metabolites. Several signals in the low-field regions of the <sup>1</sup>H and <sup>13</sup>C-NMR spectra and the bioassay results indicated that the fungal metabolites are likely to be secondary metabolites with interesting structural features. The NMR spectra of the pure compound isolated showed that it is a single compound. Further studies to elucidate the molecular structures and bioactivities of the fungal metabolites are in progress.

Keywords: Termitidae; metabolites; bioactivities; wood-digesting enzymes

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**Prevalence of Iron Deficiency Anaemia and its associated risk factors  
Among Type 2 Diabetic Patients Attending the Diabetic Centre, Teaching Hospital  
Jaffna**

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Both iron deficiency and iron deficiency anaemia (IDA) can impair glucose homeostasis by affecting the glycaemic control in diabetic patients. Objective of this study was to evaluate the prevalence of iron deficiency anaemia and its associated risk factors among type 2 diabetic patients, attending the Diabetic Centre, Teaching Hospital Jaffna. This is a descriptive cross-sectional study conducted by systematic random sampling of 300 type 2 Diabetic patients with interviewer-administered questionnaire. Serum albumin, Haemoglobin, Serum ferritin & Total Iron Binding Capacity levels were measured, and peripheral blood smear was prepared. IDA was defined as Hb and serum ferritin levels <130g/dl and < 20ng/ml respectively for males while for females were <120g/dl and < 10ng/ml respectively. Statistical analysis was carried out by multivariable logistic regression analysis. Prevalence of IDA was 10.7% and, 31.3% were males and 68.8% were females. Mean Hb and serum albumin levels of IDA patients were 9.74 ( $\pm 1.54$ ) and 3.67 ( $\pm 0.64$ ) g/dl respectively. Medians of serum ferritin and TIBC of IDA patients were 7.35 (4.65-8.30) ng/ml and 564.59 (459.33-746.41)  $\mu$ g/dl respectively. All the patients with IDA exhibited microcytic hypochromic blood pictures. Those from rural areas (AOR= 5.020, 95% CI: 1.449– 6.23), consumed leafy vegetables  $\leq 2$  times a week (AOR= 12.052, 95% CI: 2.93 – 9.67), have DM for > 10 years (AOR= 4.032, 95% CI: 1.983 – 5.842) and with past family history of IDA (AOR= 7.32, 95% CI: 1.98– 7.45) were significantly associated with the development of IDA. The findings suggested that a high incidence of IDA is likely to occur in patients from rural areas, consumed leafy vegetables  $\leq 2$  times a week, with DM for > 10 years and with the family history of IDA. Thus, it is essential to evaluate Hb and serum ferritin levels in diabetic patients for a better quality of life.

Keywords: Iron Deficiency Anaemia; type 2 diabetes; Jaffna

*This work was supported by the Department of Biochemistry, Faculty of Medicine, University of Jaffna.*

**Association of Socio-Demographic and Clinical Factors with the Prevalence of Hypertension in Type 2 Diabetic Patients, attending the Diabetic Centre, Teaching Hospital, Jaffna**

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Hypertension is one of the major threats to type 2 Diabetes Mellitus (DM) patients, which may contribute to morbidity, mortality and aggregated diabetic complications. The objective of this study was to evaluate the association of socio-demographic and clinical factors with the prevalence of hypertension among type 2 DM patients, attending the Diabetic Centre, Teaching Hospital, Jaffna. It was a descriptive cross-sectional study involving a systematic random sampling method to select 300 type 2 DM patients using an interviewer-administered questionnaire. Statistical analysis was carried out by multivariable logistic regression analysis. Majority (64.3%) of the patients were females. The males [60.17 ( $\pm$  12.07) years] were older than females [57.69 ( $\pm$  10.86) years]. The BMI of the Females and males were very closer [males 25.39 ( $\pm$ 4.68) & females 25.9 ( $\pm$ 4.36) kg/m<sup>2</sup>]. The prevalence of hypertension among diabetic patients was 57.3%. Among them, 59.2% and 40.8% were females and males respectively. Among those with hypertension, 57.3% were > 60 years, 75.2% had secondary education and 57.3% had the monthly income  $\leq$  LKR24,999. Prevalence of hypertension in males from rural areas (64.1%) was more than in females (53.8%) and the opposite tendency was observed from urban areas. More female patients (45.2%) with DM for > 10 years had hypertension than the males (32.4%) ( $p=0.063$ ). Among the total hypertensive patients, more females (24.2%) had diabetic complications than males (14.6%) ( $p=0.076$ ). Further, retinopathy was more prevalent among males (27.8%) than in females (14.7%). According to the multivariable logistic regression analysis, age > 60 years (AOR= 2.211, 95% CI: 1.35–3.62), having diabetic complications (AOR= 2.917, 95% CI: 1.08 – 7.81) among hypertensive DM patients were the independent predictors. Age > 60 years and having diabetic complications remarkably associated with the development of hypertension. Thus, appropriate intervention should be made to prevent and control hypertension among type 2 DM patients.

Keywords: hypertension; type 2 diabetes; Jaffna

*This work was supported by the Department of Biochemistry, Faculty of Medicine, University of Jaffna.*

## Detection of Anti-SARS-CoV-2 Spike Protein Antibodies in COVID-19 Patients and Naive Recipients of Different COVID-19 Vaccines in Sri Lanka

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Antibodies against SARS-CoV-2 spike protein have shown a strong correlation to virus neutralization. It will be interesting to understand trends of immune status in natural infections and vaccinees. This study evaluated serum anti-spike immunoglobulin G antibodies in natural infections and vaccinees using an in-house ELISA. Six groups of patients and a control group were enrolled. Group one (G1) was fifty non-vaccinated individuals recruited within one month from the onset of symptoms of natural infections. G2 was seventeen follow-up individuals of G1 after 6 months from the onset of symptoms (16/17 had 1-2 doses of Sinopharm, 4/17 had a third dose of Pfizer). G3 was eighteen individuals who received two doses of Sinopharm recruited 3 months after the first vaccination. G4 comprised of twenty individuals who had two doses of Sinopharm (13/20 had Pfizer as the third dose, and 4/20 were diagnosed with natural infection at least two weeks before) and whose sera were obtained six months after first dose. G5 and G6 were AstraZeneca vaccinees (n=30 in each) recruited three and six months respectively after the first dose. G6 have had 2 doses of AstraZeneca. The control group (G7) included fifty pre-pandemic healthy individuals. One-way analysis of variance and post hoc multiple comparisons based on Tamhane's T2 tests were applied. G1-G6 had significantly higher antibody levels compared to G7 ( $p < 0.001$ ). There was a significant increase of antibodies in G2 compared to G1 ( $p = 0.003$ ). G6 showed a significantly high antibody level compared to G3 ( $p < 0.001$ ). No significant difference was observed between G2 and G4 ( $p = 0.052$ ) or G2 and G6 ( $p = 0.989$ ). However, G4 had a significantly higher antibody level compared to G6 ( $p < 0.001$ ). These findings were suggestive that AstraZeneca was more effective than Sinopharm. The potency of hybrid immunity would be important to maximise the benefits of vaccines. Monitoring of neutralizing antibodies will be of advantage when formulating vaccination policies.

Keywords: SARS-COV2; antibodies; vaccines; Sri Lanka

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## Expression, isolation, and purification of dengue NS1 protein from bacterial cells

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Dengue is a widely prevalent mosquito-borne viral disease that causes explosive outbreaks in tropical and subtropical regions in the world. Early and accurate detection of the disease is important to prevent fatalities as dengue infection can lead to life-threatening severe conditions. This study aims to investigate the suitability of a bacterial expression system to produce recombinant DENV-2 NS1 protein in *E. coli* BL21(DE3) cells and to isolate and purify the recombinant protein. It can be later used to produce monoclonal anti-NS1 antibodies through mice immunization to develop diagnostic rapid assays to detect dengue infections. First, the DENV-2 NS1 sequence was PCR amplified using custom designed primers from a synthetic NS1 construct, and the amplicon was cloned in a modified pET-21a (+) bacterial expression vector. The recombinant expression plasmid was validated by colony PCR and restriction digestion fragment mapping of the isolated recombinant plasmid. Expression of recombinant DENV-2 NS1 (rNS1) protein was carried out in *E. coli* BL21(DE3) cells by inducing the pET expression system with IPTG. The rNS1 protein appeared in the insoluble fraction as inclusion bodies following cell lysis and solubilization of the inclusion bodies was performed in 8 M urea. Expressed rNS1 carrying a C-terminal 6× Histidine tag was purified further using metal-chelating affinity chromatography (IMAC) under denaturing conditions. Through SDS-PAGE, purity and size of the isolated protein were determined and the size was found to be approximately 46 kDa as expected. Final yield of the purified rNS1 protein was estimated using Bradford protein assay which was found to be 1.32 mg per 1 g of cell pellet. Isolated rNS1 which was in the unfolded state was subjected to refolding by dialysis. Subsequently, rNS1 antigens can be utilized to immunize mice.

Keywords: dengue; NS1 protein; antigens

**Genetic analysis of *Leptospira* from clinically characterized leptospirosis patients from Western Province, Sri Lanka**

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Leptospirosis remains the most widespread zoonotic disease in the world. It is caused by pathogenic spirochetes of *Leptospira* spp for which there are numerous animal reservoirs. The *Leptospira* genus constitutes different species, classified as pathogenic, intermediate and saprophytic. According to phenotypic classification, there are about 200 pathogenic serovars divided into 25 serogroups. Clinical presentation in patients show a wide variation from asymptomatic, mild and severe/fatal disease. The objective of this study was to determine the genotypes of *Leptospira* that cause mild and severe infections. DNA was extracted from whole blood samples from 53 (21 mild and 32 severe) patients using CEYGEN BactoSpin D™ genomic DNA kit. Leptospirosis was confirmed by Lip132 based quantitative PCR (Genesis Real-Time PCR detection kit -Primer Design Ltd). Nested PCR was performed using primers for *flaB* gene. Out of 53 samples, 11 were positive with expected amplicon size of 732 bp. The amplicons were purified and subjected to Sanger dideoxy sequencing (Genelabs Medical Ltd). The first sequence obtained from a mild case (NHSL13ML713) was analyzed using MEGA 11. The partial *flaB* gene sequence showed alignment with 100% percentage identity with *L. interrogans* serovar Bataviae. The *flaB* gene sequence was deposited in GenBank and accession number (OQ553816) was obtained. Phylogenetic analysis of the partial *flaB* gene sequence was carried out with 25 *Leptospira* sequences in GenBank using MEGA 11. Sequences were aligned by ClustalW, and phylogenetic inference was carried out using UPGMA method. The sequence analysis of other amplicons is currently in progress. *L. interrogans* serogroup/serovar Bataviae has been previously recorded from a recent study in one isolate from Sri Lanka. The genotype analysis of *Leptospira* from clinically characterized leptospirosis patients would provide data to determine most prevalent genotypes in patients with different disease severity and also target species/serovars for the development vaccine(s) and diagnostics.

Keywords: Leptospirosis; *flaB* gene; diagnostics

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## Aqueous leaf extract of *Vitex negundo* exerts immunomodulatory effects in an *in vitro* model of hypertension

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Although hypertension is a major risk factor for cardiovascular diseases, its control and treatment continue to be ineffective as many patients respond poorly to conventional treatment with a certain proportion developing resistant hypertension. The central drivers of the immunopathogenesis of hypertension are inflammation and oxidative stress. *Vitex negundo* L. is a medicinal plant used in Ayurveda and traditional medicine. However, investigations on its ethnopharmacological potential to effectively curtail the progression of hypertension is limited. This study was aimed at assessing the immunomodulatory effects of aqueous mature leaf extract (ALE) of *V. negundo* in an *in vitro* model of hypertension developed using PMA-induced, THP-1 derived human macrophages stimulated with angiotensin II (Ang II). Non-toxic concentrations of ALE were selected as 15.6 - 500 µg/ml using Sulforhodamine B and MTT assays. Quantitative nitro blue tetrazolium and Griess assays were done to assess the effect of the ALE on Ang II-induced production of reactive oxygen species (ROS) and reactive nitrogen species (RNS) respectively. ALE of *V. negundo* inhibited ROS and RNS production in a dose-dependent manner comparable with Telmisartan which was used as the drug control ( $r=0.910$ ;  $p<0.0001$ ). The effect of the ALE on the expression of TNF- $\alpha$ , IL-6, IL-1 $\beta$  and NF- $\kappa$ B assessed using RT-qPCR showed that both ALE and Telmisartan attenuated the expression of the pro-inflammatory cytokines in Angiotensin II-stimulated macrophages like cells derived from THP-1 cells ( $p<0.001$ ). Our results demonstrate the potential of ALE of *V. negundo* in exerting immunomodulatory effects in this *in vitro* model of angiotensin II-mediated hypertension mainly by limiting production of pro-oxidants leading to inflammation. As inflammation and oxidative stress are known as central drivers of pathogenesis of hypertension, these findings therefore emphasize further studies on validating the antihypertensive potential of *V. negundo* and to develop more effective antihypertensive therapies.

Keywords: *Vitex negundo*; hypertension; therapies

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## Comparative study of novel human monkeypox virus isolates of the 2022 outbreak

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Human monkeypox is a significant zoonotic disease caused by the monkeypox virus (MPXV), the most virulent Orthopoxvirus endangering human public health since the eradication of the variola virus. The virus is endemic in Africa, where its natural hosts are small mammals. Since May 2022, an increasing number of confirmed cases of human monkeypox have been reported from numerous non-endemic countries, declaring a Public Health Emergency of International Concern (PHEIC) by the WHO. As of 25<sup>th</sup> April 2023, 87113 confirmed cases have been reported with 130 deaths. The MPXV genome consists of a double-strand DNA molecule of around 200 kilobase pairs (kbp) and contains around 200 protein-coding genes. It has been questioned whether the current acceleration in human infections could be attributed to recent changes in the viral genome. Current study tries to address this question by looking at the novel virus strains sequenced during 2023. Complete MPXV genomes sequenced from 1<sup>st</sup> January to 12<sup>th</sup> April 2023 (21 sequences) were retrieved from the National Center for Biotechnology Information (NCBI) virus database (<https://www.ncbi.nlm.nih.gov/labs/virus/vssi/#/>). Multiple alignment was carried out between the 23 sequences which includes two reference sequences NC\_003310 (Zaire: Sankuru subregion) and NC\_063383 (Nigeria: Rivers State) using NCBI tools. In the phylogenetic tree, NC\_003310 formed an outgroup. The sequences were submitted to Nextclade (<https://clades.nextstrain.org/>) and NC\_003310 was grouped into clade I and the remaining sequences along with NC\_063383 were grouped into clade II. Sequences showed 71-83 nucleotide substitutions and 32-40 amino acid substitutions relative to the reference sequence NC\_063383 in clade II. The gene annotation data of NC\_063383 reference genome which consists of 175 genes, were compared with the annotated gene sets of the 21 selected isolates. This analysis showed that 22 genes had identical substitution mutations in all 21 selected isolates when compared to NC\_063383. Additionally, 7 genes had similar mutations in the isolates from Germany. These identified variations in the virus genomes could be a contributing factor for the sudden increase of monkeypox disease. However further proteomic studies will be helpful to confirm the above conclusion.

Keywords: Orthopoxvirus; monkeypox; viral genome

**Preliminary study to identify shoot and fruit borer (*Leucinodes orbonalis* Guenee)  
resistance brinjal varieties in Sri Lanka**

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Brinjal is a commercially important vegetable grown in Sri Lanka which is severely affected by brinjal shoot and fruit borer (*Leucinodes orbonalis*). Utilizing host plant resistance is a promising strategy for reducing this pest infestation. This study aimed to assess the resistance of selected brinjal varieties to *L. orbonalis* based on selected physical and biochemical properties. Under natural, consistent management approaches, seven brinjal varieties were grown, such as Amanda F1, HORDI Lenairi 1, Thinnaweli purple, Madduvil muddiyan, Raal kuli, Plastic cultivar, and Eerku vellai. The plots were established with three replications and 25 plants per replicate were selected for the analysis. The resistant status was classified based on the mean fruit and shoot infestation. Simple linear correlation analysis and one-way ANOVA tests were done to explore the influence of selected physical characters, total phenol, and total sugar contents. Results showed significant differences ( $p < 0.05$ ) in fruit and shoot infestation levels among the brinjal varieties. Amanda F1 and Madduvil muddiyan showed minimum shoot infestation of 1.13% and 1.39% and fruit infestation of 12.31% and 13.75%, respectively while HORDI Lenairi 1 recorded the highest shoot and fruit infestation of 6.54% and 29.63%, respectively. Physical properties such as short pedicel and calyx, compactly arranged seeds, thin shoot, and thick pericarp were found to be tolerant to *L. orbonalis* infestation. The moderately tolerant Raal kuli showed the highest amount of total phenol (0.81 mg/g) and susceptible HORDI Lenairi 1 had 0.53 mg/g. The resistant Madduvil muddiyan contained 0.59 mg/g of total phenol and 21.59 mg/g of total sugar. Susceptible Eerku vellai had the highest total sugar (22.77 mg/g). Fruit infestation had a positive (0.3832) correlation coefficient with total phenol and a negative (-0.5394) with total sugar. Amanda F1 and Madduvil muddiyan were found resistant to *L. orbonalis*. Physical properties of them are more responsible for resistance than the analyzed biochemical properties. These varieties can be utilized as potential resistance sources in future breeding programmes and these findings might contribute to develop a key for resistant and susceptible brinjal varieties.

Keywords: brinjal; resistance; *Leucinodes orbonalis*

## **Comparison of the presence of FLT3 receptor on peripheral blood mononuclear cells between newly diagnosed non-Hodgkin lymphoma patients and healthy individuals**

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<sup>1</sup> Department of Zoology and Environment Sciences, <sup>2</sup> Department of Statistics, Faculty of Science, University of Colombo, <sup>3</sup> Department of Medical Laboratory Sciences, Faculty of Allied Health Sciences, <sup>4</sup> Department of Paraclinical Sciences, Faculty of Medicine, General Sir John Kotelawala Defence University, <sup>5</sup> Apeksha Hospital, Maharagama

FLT3 (tyrosine kinase receptor) triggers leucopoiesis, especially in the lymphoid lineage. FLT3 mutations led to developing severity and reduced the survival rate in acute myeloid leukemia. Since this was not well-studied in Non-Hodgkin's Lymphoma (NHL), finding the association between FLT3 levels on peripheral blood mononuclear cells (PBMNCs), and full blood count (FBC) parameters in NHLs, and compared with the healthy population was the objective of this study. Ethical clearance from KDU-ERC and the participant's consent were obtained. Peripheral blood samples were analyzed with flow cytometry to detect FLT3 on PBMNCs from new NHL patients (n=11) before starting chemotherapy. Samples from healthy individuals (n=7) were analyzed to detect the normal receptor level. FBC parameters were compared among three populations as FLT3(+) NHL, FLT3(-) NHL, and healthy individuals. SPSS-26 was used to analyze data and  $p < 0.05$  was the significant level. All patients were monitored after completing chemotherapy cycles. Five NHL patients showed strong positivity for FLT3 while 06 were negative. All healthy individuals were FLT3 negative. The FLT3(-) NHLs and the healthy group showed a significant difference in absolute lymphocyte count (ALC). Examining the PBMNCs of FLT3(+) patients and the healthy group, showed significant differences in total WBC count, absolute neutrophil/eosinophil/ immature granulocyte count, and ALC whereas, the groups of FLT3(+) and FLT3(-) patients showed significant differences between the same with platelet count. Three patients died from the FLT3-positive group during chemotherapy and most of the FLT3(-) patients showed a successful treatment response. Peripheral white blood cell counts were significantly different and the ALC was significantly lower in FLT3(+) NHLs when compared to the healthy population. Therefore, the immunity of FLT3(+) NHLs may be lower than the other two populations. The study population is currently being expanded to establish the results with higher confidence and to investigate the whole FLT3/FL system.

*Keywords:* FLT3 receptor; Non-Hodgkin's Lymphoma;

*This work was financially supported by KDU grant (KDU/RG/FAHS/2021/004)*

**Bio-efficacy and persistence of inert dust formulations as stored-grain protectants  
against *Rhyzopertha dominica* (F.)**

HT Ganhewa, AGWU Perera

Department of Zoology, Faculty of Applied Sciences, University of Sri  
Jayewardenepura

Inert Dust (ID) insecticides make a significant contribution to control storage insect pests. In the present study, the insecticidal activity, progeny inhibition and persistence of three ID formulations, Diatomaceous earth, zeolite and cloisite 20A (modified montmorillonite clay) was evaluated against *Rhyzopertha dominica* (Lesser grain borer) throughout 90 days of storage period. The toxicity and persistence of binary combinations of IDs at their sub-lethal doses was conducted for a storage period of 60 days. Furthermore, the ultrastructural architecture of the test insect pest species was examined via Field Emission Scanning Electron Microscopy (FE-SEM) and Energy Dispersive X-Ray analysis (EDX) to study the penetration/uptake pattern of ID particles by the cuticular layer of target insect pest. The results revealed that all ID formulations exhibited very efficacious toxic and progeny inhibition activities and higher mortality percentages irrespective of the ID used at the end of initial 30 day-long storage period. Thereafter, the mortality percentages and progeny inhibition gradually declined with the progress of the storage time period. Tested ID formulations successfully suppressed F<sub>1</sub> progeny and the lowest average progeny production was recorded at the end of initial storage period. Cloisite 20A was the most efficacious ID followed by zeolite and diatomaceous earth in order. The binary mixtures of IDs induced strong mortality of *R. dominica* adults than each formulation was used alone. FE-SEM and EDX micrographs clearly indicated the presence and distribution of constituting elements of treated IDs on the cuticular layer of the exposed insect pests with the abrasions and scratches that may have led to dehydration and eventual death of respective insect pest. The findings of the present study indicate that diatomaceous earth, zeolite and cloisite 20A and their binary combinations are highly effective for the control of *R. dominica* and could be implemented in management of this destructive storage pest.

Keywords: *Rhyzopertha dominica*; inert dust insecticides

## Molecular phylogenetic analysis on genera *Thrixspermum* (Orchidaceae)

AMWA Wijayabandara <sup>1</sup>, N Lewke Bandara <sup>2</sup>, A Papini <sup>3</sup>, AG Atthanagoda <sup>1</sup>

<sup>1</sup> Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo. <sup>2</sup> Division of Agriculture and Environmental Science, School of Biosciences, University of Nottingham. <sup>3</sup> Department of Biology, University of Florence

Orchidaceae, is the second largest family of flowering plants with 736 genera and 22,500 species widely distributed throughout the world. *Thrixspermum*, commonly known as hair seed, is a genus within Orchidaceae that comprises epiphytic plants with flat, bilobed and coriaceous leaves, axillary inflorescence, short column continuing into the foot and the presence of 2-4 unequal pollinia. Currently, the genus encompasses nearly 160 species, distributed from the Himalayas to the Philippines, Northern Australia, and the Pacific islands. The small, ephemeral flowers of *Thrixspermum* and the high homology between the species, make morphology-based identification insufficient, necessitating the use of DNA barcoding. The objective of this study was to utilize ITS markers to identify problematic placements of new and existing species of the genera *Thrixspermum*. A phylogenetic tree was constructed using the Bayesian method by MrBayes with ten samples collected from different geographic locations in Sri Lanka, 12 available database sequences from *Thrixspermum*, and two outgroup species (*Dimorphorchis lowii* and *Dimorphorchis rossii*). The combined morphological and phylogenetic evidence supports the delimitation of three clades with six, one and two samples suspected to represent subspecies of *Thrixspermum pulchellum*, *Tx. puginofolium* and *Tx. Walkeri* respectively, and one sample depicting similarities with *Tx. formosanum*. The splitting into subgroups might reflect an early differentiation of the flower colour and the lip. However, further studies are required for the confirmation of the results with suspected herbarium samples and outgroup species sequences. Despite the limitation of ITS partial sequences for intrageneric level classification of the genera of interest, the study findings affirm the suitability of ITS as a molecular marker for generating *Thrixspermum* barcodes. Complete sequences of ITS would further enhance the barcode database, benefiting future taxonomic and biodiversity studies.

Keywords: *Thrixspermum*; Orchidaceae; ITS; molecular marker

*This work was supported by IBMBB and constitutes part of the MSc studies of AMWAW.*

## ***In silico* investigation of anticancer properties of *Withania somnifera* on cancer stem cells**

KDC Perera <sup>1</sup>, M Faizan <sup>2</sup>, NHKS Senathilake <sup>2</sup>, SR Samarakoon <sup>2</sup>

<sup>1</sup>Department of Chemistry, Faculty of Science, University of Colombo

<sup>2</sup>Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo

Cancer is a complex and multifactorial disease and it is the second leading cause of death worldwide. A subset of drug-resistant cells in the cancer cell mass known as cancer stem cells (CSCs) plays a key role in chemo- and radiotherapy resistance, metastasis and recurrence posing a challenge in the fight against cancer. Therefore, search for compounds that destroy CSCs has become an urgent need. The current study aims to investigate the natural drug-like molecules that can be used as CSC-targeted therapy. The pivotal role of  $\beta$ -catenin and Human smooth muscle receptor tyrosine kinase (HSMRTK) in stem cell maintaining Wnt/ $\beta$ -catenin and hedgehog signaling pathways respectively, and their oncogenic nature makes them important targets in CSC-targeted anti-cancer drug discovery. *Withania somnifera* (Ashwagandha) is a plant used in traditional medicine to treat cancer. Based on the literature and database search, 80 compounds of *W. somnifera* and standard inhibitors were docked with the target  $\beta$ -catenin and Human Smo receptor using Auto Dock Vina in PyRx. The top compounds and the inhibitor complexes were subjected to molecular dynamics simulation (100 ns) using Schrodinger, LLC's Desmond 2022-1 to understand stability and interactions. The top scoring compounds (based on the docking score of higher than  $-8.0$  kcal/mol for  $\beta$ -catenin and higher than  $-11.9$  kcal/mol for Smo receptor) were evaluated in comparison to the standard inhibitors. The compounds from *W. somnifera* were evaluated based on interactions at the active sites of target proteins with the inhibitors. Physagulin-d, withanoside IV showed high binding stability with the specific amino acid residues of  $\beta$ -catenin and withanolide J, withanolide M showed high binding stability with the amino acid residues of human smooth muscle receptor tyrosine kinase.

Keywords: *Withania somnifera*; cancer stem cells; anti-cancer

**Germline variants in the exon 3 of the *POLG1* gene: optimization of the polymerase chain reaction (PCR) and preliminary analysis in a few selected Sinhalese individuals and breast cancer patients**

CM Kariyawasam, JT Kotelawala, KH Tennekoon, R Ranasinghe

Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo

Mitochondrial DNA (mtDNA) mutations are shown to be profoundly associated with the development of a variety of cancers. Mutations in mtDNA arise during its replication and repair process, which are solely controlled by the human polymerase gamma enzyme. It is encoded by the nuclear encoded Mitochondrial DNA polymerase gamma (*POLG1*) gene. The *POLG1* gene is a frequent target for gene mutations, therefore, is said to play a role in mtDNA instability, leading to mitochondrial diseases and cancers. *POLG1* mutations have also been commonly reported to promote tumorigenesis in breast cancer, however, there are no data for *POLG1* variants for Sri Lanka. The aim of this study was to identify germline variants in exon 3 of *POLG1* which codes for a section of the exonuclease domain (the *exo* motif II) in patients with sporadic breast cancer and healthy individuals in Sri Lanka. Initially, *POLG1* exon 3 specific primers that were designed with primer BLAST were optimized for PCR amplification. Then the DNA were extracted using the Salting out method from 3 breast cancer patients and 3 healthy women [matched for age, body mass index (BMI) and menopausal status]. *POLG1* exon 3 was sequenced and analyzed with reference *POLG1* sequence with BioEdit software, to detect any variants present. No variants were found between the patients and their matched healthy controls. No polymorphism patterns were also observed within the studied samples. Since the present study was carried out using only a few samples due to the limitation of funds, a larger sample needs to be studied to characterize variants in exon 3 of *POLG1* as well as in the rest of the *POLG1* gene in Sri Lankan breast cancer patients and healthy individuals.

**Keywords:** Polymerase gamma; breast cancer; tumorigenesis

*This work was supported by IBMBB and constitutes part of the MSc studies of KCM.*



## **Analysis of *DUOX2* mutations in a cohort of Sri Lankan patients with permanent congenital hypothyroidism**

P Thayaparan<sup>1</sup>, S Hewage<sup>1</sup>, S De Silva<sup>1</sup>, N Athapattu<sup>2</sup>

<sup>1</sup>Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo

<sup>2</sup>Lady Ridgeway Hospital for Children, Colombo 08

Congenital hypothyroidism (CH) is thyroid hormone deficiency from birth, diagnosed at a rate of 1 in 3000 - 4000 live births. Mutations in Dual oxidase 2 (*DUOX2*), a generator of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) which is required for thyroid hormone synthesis, have been identified as a cause of thyroid dysmorphogenesis which can cause permanent CH. Objective of the study was to analyze the presence of selected mutations in the hotspot exon regions of *DUOX2* gene in a cohort of Sri Lankan patients with confirmed permanent CH. The selected four prevalent single nucleotide variants (SNVs) are rs180671269 (exon14), rs774556391 (exon 20), rs181461079 (exon 20) and rs147945181 (exon 30). To achieve the objective, blood samples were obtained from seven children (N=7) aged between two weeks to sixteen years from the Lady Ridgeway Hospital for Children. DNA was extracted from collected samples and the selected four SNVs were screened using allele specific PCR (ASPCR) technique, followed by results of screening the SNV in exon 30 (rs147945181) in all seven samples were verified by sanger sequencing. Out of the SNVs that were screened, all were heterozygous for c.1588A>T (rs180671269) and c.2635G>A (rs774556391). Out of the seven samples, six were heterozygous, and one was homozygous mutant for c.2654G>T (rs181461079). All samples were homozygous wild for c.4027C>T (rs147945181) and this was confirmed with sequencing.

*Keywords:* *DUOX2*; Congenital hypothyroidism

*This work was supported by IBMBB and constitutes part of the MSc studies of TP.*

## **Analysis of *NKX2-5* mutations in a cohort of Sri Lankan patients with ectopic thyroid**

WNT Fonseka<sup>1</sup>, S Hewage<sup>1</sup>, S De Silva<sup>1</sup>, N Athapattu<sup>2</sup>

<sup>1</sup>Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo

<sup>2</sup>Lady Ridgeway Hospital for Children, Colombo 08

Ectopic thyroid is a form of thyroid dysgenesis. It refers to any thyroid tissue present in unusual locations other than its normal position anterior to the upper trachea. Ectopic thyroid is a rare malformation of the thyroid gland which occur as a result of improper descent of thyroid along its natural course during embryogenesis, affects 1 in 100,000-300,000 individuals. As per the location, size and histopathology of ectopic thyroid its clinical presentation may vary. However, in most cases thyroid ectopy leads to congenital hypothyroidism, requiring lifelong hormone replacement therapy. Mutations in regulatory genes expressed in the developing thyroid could lead to disease development. One such gene expressed in early stages of embryonic development is the NK2 homeobox 5 (*NKX2-5*), a homeodomain-containing transcription factor protein coding gene, involved in the thyroid migration stage of thyroid gland morphogenesis. This study was designed to identify mutations in the *NKX2-5* gene in a cohort of children with ectopic thyroid in Sri Lanka. Study participants were selected from patients already diagnosed as having ectopic thyroid condition and being followed up by the pediatric endocrinologist at Lady Ridgeway Hospital (LRH) for children. The coding regions of *NKX2-5* gene were screened for any possible variations by direct sequencing. When sequences were analyzed, exon 1 of three samples (N=3) gave satisfactory electropherograms and from which one patient was identified to have a reported SNP, c.63A>G /rs2277923. Exon 2 of all five samples (N=5) gave satisfactory electropherograms and from which three patients were identified with previously reported benign variant (c.\*61G>T /rs703752 at exon 2 3'UTR region) and a novel variant (c.\*147C>A) was detected in one patient. However, a comprehensive investigation needs to be carried out among a larger cohort in future in order to predict the spectrum of *NKX2-5* mutations among ectopic thyroid patients in Sri Lanka.

**Keywords:** Ectopic thyroid; *NKX2-5*; Sri Lanka

*This work was supported by IBMBB and constitutes part of the MSc studies of FWNT.*

**Detection of selected SNPs of HOX transcript antisense RNA (*HOTAIR*) gene in a cohort of patients with breast cancer in Sri Lanka**

FA Shafeeu<sup>1</sup>, S De Silva<sup>1</sup>, S Hewage<sup>1</sup>, K De Silva<sup>2</sup>

<sup>1</sup>Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo

<sup>2</sup>National Cancer Institute, Maharagama

Breast cancer is a heterogeneous disease that involves a combination of multiple genetic alterations that may lead to breast cancer. Hence, it is necessary to identify genes related to breast cancer aetiology to predict disease susceptibility in a population. There has been much evidence suggesting that the *HOTAIR* lncRNA can act as an oncogenic driver in the initiation and progression of different types of cancer and studies have shown that genetic variants related to its function have been associated with breast cancer risk in certain populations. The aim of the current study was to investigate and screen for two *HOTAIR* genetic variants (rs1899663 G>T and rs920778 T>C) in a cohort of breast cancer patients in Sri Lanka. Nine breast cancer patients (N=9) were screened for the *HOTAIR* intronic variants. Already extracted genomic DNA from tissue samples was used for the current study. Sequence-specific primers were designed and PCR was carried out. Sanger sequencing was used to obtain DNA sequences of patients at the region of interest. Sequence data was analyzed for targeted variants and other variants, if any, by comparing with the reference sequence using bioinformatics software. Previous studies have revealed that TT homozygous and TC heterozygous of rs920778 T>C can be associated with an increased risk of BC susceptibility. Among 9 patients tested for this variant, 7 patients were reported to be homozygous mutants (TT genotype), while the other 2 had heterozygous variant (TC genotype). Among the cohort, the rs1899663 variant was not found in any of the patients, thus showing that rs1899663 had no association with breast cancer susceptibility in the studied cohort. However, further research is needed to evaluate the results in a larger patient cohort.

Keywords: *HOTAIR*; breast cancer; gene variants

*This work was supported by IBMBB and constitutes part of the MSc studies of SFA.*

## **Detection of disease-associated variant (n.662G>T) in Colon Cancer Associated Transcript 2 RNA gene in a cohort of patients with colorectal cancer in Sri Lanka**

RP Kehelgamuwa<sup>1</sup>, S De Silva<sup>1</sup>, S Hewage<sup>1</sup>, K De Silva<sup>2</sup>

<sup>1</sup>Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo

<sup>2</sup>National Cancer Institute, Maharagama

Colorectal cancer (CRC) is the third most prevalent malignancy diagnosed worldwide and in Sri Lanka, it is the third most common cancer type in both sexes with many casualties every year. Long non-coding RNAs (lncRNA) have been proven to play a role in the development of CRC by interacting and regulating target genes. The current study was designed to detect disease-related SNP, n.662G>T (rs6983267) in the *CCAT2* gene, based on the studies done in other populations. Previously extracted genomic DNA (N=13) from excised patients' tissues was used for the study. Specific primers were designed to amplify the region containing the selected variant in the gene. Afterward, PCR was performed using designed primers and followed up by Sanger sequencing. The sequencing data were analysed for the selected variant (n.662G>T) in the *CCAT2* gene using bioinformatics software. Analysis of the sequencing data showed homozygous wildtype condition (GG) in four patients, four patients with homozygous mutant (TT), and five heterozygous (GT) patients. However, the wildtype variant (G) is dominant and has been shown to be associated with the development of different forms of cancer including CRC. 69% of patient samples contained the G allele which is associated with the development of CRC. However, a larger sample size along with gene expression studies of affected genes could be carried out to get a comprehensive analysis.

**Keywords:** Colorectal cancer; long non-coding RNAs

*This work was supported by IBMBB and constitutes part of the MSc studies of KRP.*

## **Neanderthal inherited COVID-19 genetic variations: Assessing the Polymerase Chain Reaction conditions and database-based allele frequency analysis**

SH Galagamaarachchi, AS Fernando, KH Tennekoon, R Ranasinghe

Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo

The COVID-19 pandemic continues to spread worldwide. It was observed that the risk level and the severity of COVID-19 were different among individuals. Since all patients do not carry the risk factors and respond to the infection in a similar manner, it is thought that there are genetic factors modulating the outcome of the disease. Some genes that are associated with the disease have been reported as Neanderthal inherited. The SNP on chromosome 3, rs35044562 (A>G) was reported to predispose to the severe form of the disease while the OAS haplotype on chromosome 12, the SNP rs1156361 (T>C) was reported to protect against the severe form of the disease. The main objective of this study was to optimize PCR conditions of sequence-specific primers that were designed to amplify the regions, including Neanderthal inherited COVID-19-related SNPs chromosomes 3 and 12 in a Sinhalese individual. Moreover, to analyze allele frequencies reported in the 1000 genome database to obtain a better understanding of the risk and severity of COVID-19 associated genes in Sinhalese ethnicity. DNA was extracted manually following the salting out protocol, followed by a conventional PCR amplification carried out using manually designed primers. The designed conventional primers had to be optimized well as they were newly designed primers. 1000 genome results were used to compare the gene frequency among the South Asian populations which indicates the frequency distribution of SNPs in healthy individuals.

Keywords: COVID-19; neanderthal inherited genes; optimisation

*This work was supported by IBMBB and constitutes part of the MSc studies of GSH.*

## **PCR optimization and amplification of selected exons of mitochondrial transcription factor A (TFAM) in sporadic breast cancer patients**

MA Fasha <sup>1</sup>, JT Kotelawela <sup>2</sup>, R Ranasinghe <sup>2</sup>

<sup>1</sup>Department of Chemistry, University of Colombo, <sup>2</sup>Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo

Breast cancer (hereditary or sporadic) is the second most common cancer among women worldwide. Sporadic breast cancer is developed from acquired gene mutations occurring spontaneously after birth and constitutes most cases. Mitochondrial Transcription Factor A (TFAM) is located in chromosome 10q21.1 is a key regulator of mitochondrial DNA replication and transcription and is essential for the maintenance and organization of the mitochondrial genome. As TFAM plays a critical role in regulating expression of mitochondrially encoded proteins that are involved in respiration (oxidative phosphorylation) and energy metabolism. Therefore, dysfunction of TFAM is associated with breast cancer. TFAM variations have been associated with greater lactate production and greater metastasis and also it makes cancer cells more sensitive to radiation. Therefore, altered TFAM expression may increase cell death and suggests that it could be a potential therapeutic target for new cancer therapy. Mutations in the TFAM gene could yield valuable insights into the role of TFAM in breast cancer development and progression. PCR optimization is crucial for achieving efficient PCR amplification. In the present study, primers were designed and optimized to amplify two exonic regions of the TFAM genes (TFAM\_1 and TFAM\_3). Each primer was optimized separately for the annealing temperature and magnesium concentrations. The optimized temperature of both TFAM\_1 and TFAM\_3 was 56 °C and 60 °C respectively, while optimized magnesium concentration of both TFAM\_1 and TFAM\_3 was 2.0 mM and 2.5 mM respectively. Further analyses of these products with direct sequence technology will be needed to identify variations in the TFAM gene in sporadic breast cancer patients in Sri Lanka.

keywords: breast cancer; TFAM gene; Sri Lanka

*This work was supported by IBMBB and constitutes the undergraduate research of FMA.*

# **Institute of Human Resource Advancement**



## ***4th International Research Conference on Management and Technology Innovations (IRCMTI 2023)***

***Shaping the Future; Strategies for Achieving the  
Success***

24<sup>th</sup> November 2023

## MESSAGE FROM DIRECTOR



### **Professor W.S. Chandrasekara**

Dear Esteemed Contributors and Scholars. It is with great pleasure to extend my greetings to all of you as we gather for the 4th International Research Symposium on Management and Technology Innovation, hosted by the Institute of Human Resource Advancement at the University of Colombo.

This symposium marks an important juncture in landscape of management and technology innovation. In an era defined by unprecedented challenges and opportunities, it is utmost for scholars, researchers, and practitioners from across the globe to come together and share their insights, discoveries, and experiences. This symposium provides a platform for us to collaborate, learn, and innovate, thus contributing to the advancement of both knowledge and practice in these critical fields. Our theme for this symposium, "Shaping the Future through Management and Technology Innovation," reflects the dynamic nature of our disciplines. The interplay between management strategies and technological advancements has transformed the way businesses and organizations operate. It is our collective responsibility to investigate, analyze, and anticipate these shifts in order to lead organizations toward a prosperous and sustainable future.

The program for this symposium promises a rich array of discussions, presentations, and workshops that will delve into a wide range of topics, from digital transformation to leadership in the age of Artificial Intelligence, sustainable business models, and more. It is an excellent opportunity for us to learn from one another, to challenge our existing paradigms, and to formulate innovative solutions to the challenges. I would like to express my heartfelt gratitude to all the researchers, academics, and industry experts who have invested their time and energy into making this symposium a reality. Your dedication to advancing the fields of management and technology innovation is greatly appreciated, and it is our hope that this symposium will be important for new ideas, and collaborations. As we embark on this intellectual journey, I encourage all of you to actively participate, engage in meaningful discussions, and network with fellow participants. The success of this symposium lies not only in the quality of research presented but also in the relationships and connections we create.

Once again, welcome to the 4th International Research Symposium on Management and Technology Innovation. I am confident that your contributions will help to shape the future of these vital fields. Together, we will explore new horizons and lead the way towards a brighter and more innovative future.

Thank you, and I look forward to productive and enlightening discussions.



## MESSAGE FROM CONFERENCE CHAIR

### **Ms. Kamani Mathotaarachchi**

Senior Lecturer,  
Institute of Human Resource Advancement (IHRA)



As the Co-Chairperson of the 4th International Research Conference on Management and Technology Innovations (IRCMTI 2023), it is my distinct privilege to welcome you to this momentous event. Organized by the Institute of Human Resource Advancement at the University of Colombo, IRCMTI 2023 promises to be a dynamic platform for the exchange of cutting-edge research and innovative ideas.

The date, November 24, 2023, marks an important milestone in our academic calendar, where we congregate to explore a timely and indispensable research theme: "Shaping the Future; Strategies for Achieving Success." In a world characterized by rapid transformations and complex challenges, the pursuit of success is intricately linked to our ability to adapt, innovate, and anticipate. This theme is not just a topic for discussion but a call to action—a call to collectively shape the future we desire.

Our conference tracks span a spectrum of disciplines, encompassing business, service management, labor management for sustainability, social science and library science, science and technology, tourism and event management, as well as language and literature. This diverse array of tracks reflects our commitment to inclusivity, ensuring that researchers and scholars from various fields can collaborate, share insights, and enrich our collective understanding. It is important to note that both abstracts and full papers undergo a rigorous double-blind peer review process, ensuring the quality and integrity of the research presented. Full papers selected for presentation will find their place in our conference proceedings, contributing to the global repository of knowledge and serving as a valuable resource for scholars and practitioners alike.

IRCMTI 2023 offers a unique opportunity to engage with thought leaders, connect with peers, and foster collaborations that transcend geographical boundaries. It is a celebration of intellectual curiosity and a testament to our collective commitment to advancing research and innovation. I extend my heartfelt gratitude to the organizing committee, the reviewers, authors, and all participants who have worked tirelessly to make this event possible. Your dedication is the driving force behind the success of IRCMTI 2023.

I eagerly anticipate the thought-provoking discussions, the insightful presentations, and the invaluable connections that will be forged during our time together. Together, let us shape the future and pave the way for a more informed, innovative, and successful world.

## **ORGANIZING COMMITTEE**

1. Professor WS Chandrasekara – Director
2. Ms Kamani Mathotaarachchi - Conference Chair
3. Professor MGG Hemakumara
4. Mr. Nihal Hewage – Senior Lecturer
5. Ms. Sugandika Sandamali – Lecturer

## PROGRAMME OF SESSIONS

<b>Agenda – 24<sup>th</sup> of November 2023</b>					
9.30 AM	Registration and Welcome Coffee				
10.00 AM	Welcome Address by the Conference Co – Chairs				
10.15 AM	Address by the Director - IHRA				
10.30 AM	Address by the Vice Chancellor – University of Colombo				
10.45 AM	Keynote Address - Emeritus Professor Vernon Cooray - Department of Electrical Engineering, Uppsala University, Sweden.				
11.15 AM	Coffee Break				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Session 1-A</td> <td style="text-align: center;">Session 1-B</td> </tr> <tr> <td style="text-align: center;">Business, Service Management and Tourism &amp; Hospitality Management</td> <td style="text-align: center;">Social Science / Library Science Language and Literature</td> </tr> </table>	Session 1-A	Session 1-B	Business, Service Management and Tourism & Hospitality Management	Social Science / Library Science Language and Literature
Session 1-A	Session 1-B				
Business, Service Management and Tourism & Hospitality Management	Social Science / Library Science Language and Literature				
11:45AM	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Session 1-C</td> <td style="text-align: center;">Session 1-D</td> </tr> <tr> <td style="text-align: center;">Science and Technology Labour Management</td> <td style="text-align: center;">Open Category</td> </tr> </table>	Session 1-C	Session 1-D	Science and Technology Labour Management	Open Category
Session 1-C	Session 1-D				
Science and Technology Labour Management	Open Category				
01.45 PM	Lunch Break				
02.30 PM	Dialogues with Industry Visionaries: Exploring Crucial Contemporary Issues				
3.30 PM	End of the Conference				

## INTRODUCTION TO KEYNOTE SPEAKER

### **Emeritus Professor Vernon Cooray**

Department of Electrical Engineering,  
Division of Electricity, Uppsala University, Sweden.



Professor GV Cooray, born in 1951, began his academic journey at the University of Colombo in 1972, graduating with first-class honors in physics in 1975. He initially served as a temporary assistant lecturer and later as a probationary lecturer at the university. In 1978, he pursued postgraduate studies at the Institute of High Voltage Research, Uppsala University, Sweden, earning his PhD in Electricity with a focus on transients and discharges in 1982. He subsequently became an Associate Professor at the same institute and later joined as a full professor in 2000. Professor Cooray is a world-renowned scientist, renowned for his work in electromagnetic compatibility, electromagnetic wave propagation, lightning physics, lightning protection, and electrical discharges. His extensive body of work comprises over 350 peer-reviewed papers and seven books, earning him the Berger Award in 2012. His influence extends to education and research. He guided more than 30 PhD students globally and played a key role in establishing the atmospheric and lightning research group at the University of Colombo. In recognition of his contributions, Professor Cooray was awarded the Degree of Doctor of Science, *honoris causa*, by the University of Colombo in 2015. His leadership in developing research and education makes him a respected figure in both scientific and academic communities, and his commitment to fostering scientific and cultural ties with Sri Lanka remains unwavering.

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*N.T.K.R. Dias, G.R.P. Silva*

Impact of employee's behavioral pattern of service quality on customer satisfaction; study of government health care institute.

*H.D.D.N. Gunawardhana, A.M.C.P. Atapattu*

Impacts of post-COVID-19 situation on local tourist travel behavior in Sri Lanka

*K.D. Nihal Hewage, M.K. Nilakshi Pabasara, S.K. Illangarathne, S.K.N. Gamage*

Impact of work-related attitudes on employees' engagement in Medical Laboratory Technologists

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Work-related attitudes, organizational commitment,  
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Strategic Thesis Collection Management through Statistical Analysis

*N.M. Karannagoda, A.K.K.K. Athukorala, K.A.C.P. Abeygunawardena,*

*D.D.G.S. Ariyawansa*

## ABSTRACTS

### Causal effect and cointegration of debt and economic growth in Sri Lanka

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University of Colombo.*

Debt is playing a vital role to the economic growth of a country and the main focus of this paper is to study the causal effect of debt and economic growth in Sri Lanka. The research issue of the study is an empirical gap of studying unidirectional or bidirectional causality among debt and economic growth and their cointegration. Both domestic debt and external debt are applied as debt and Gross Domestic Production (GDP) represents the economic growth. Time series data from 1987 to 2022 have been used to examine the causal relationship and cointegration. Stationarity was initially tested by Augmented Dickey Fuller (ADF) unit root test. Then the researchers tested the direction of causality by Granger Causality test. Engle Granger test was applied to examine the cointegration among the debt and economic growth. Results indicated the behavior of variables as random walk with drift and trend. Then the researchers identified that variables are stationary at first difference and they are I(1) variables. Engle Granger test indicated that the variables are cointegrated. Finally, the cointegrated regression model explained that domestic debt and external debt influence on economic growth in the long run. Accordingly, the governments should pay attention for domestic and external debt in the policy decisions towards economic growth.

**Keywords:** *causality, cointegration, domestic debt, economic growth, external debt*

## **The effect of Neuro-Linguistic Programming (NLP) trainings on perceived performance of managerial staff of healthcare services**

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Organizations, especially in the healthcare sector make a substantial attempt to enhance performance through standardized training and development initiatives to enhance organizational performance and the organizational service quality than ever before. Healthcare organizations are increasingly utilizing neuro-linguistic programming (NLP) as a modern approach to enhance employee training and development for improved performance and service quality. However, limited research exists on NLP's effectiveness in the subcontinent. This study examines NLP training's impact on managerial staff performance at ABC Hospital Plc, Sri Lanka. NLP is recognized as a tool for programming the human brain to achieve desired outcomes. Hence, it has become a popular training and development methodology used in organizations for developing their employees. Philosophically it is recognized that the deductive reasoning and survey strategy have been aligned to the data collection from the total population of all managerial staff of ABC hospital. 110 respondents were selected through the convenient sampling technique with respect to fundamental similar studies in Western countries. The study's theoretical synthesis was centered around the pillars of NLP namely rapport, sensory acuity, outcome thinking, and flexibility. Regression analysis and the other related statistical tools were used in drawing the conclusion of the research, specifically, it is revealed that there is a significant positive impact of neuro-linguistic programming-driven training on employee performance. Additionally, it was found that the existence of the moderating effect of the career cycle stage on the relationship between NLP-driven training and employee performance was also investigated. NLP ability is to start by honing your rapport-building abilities before working on the rest and the person must be crystal clear about what they hope to accomplish. Additionally, it is to recognize that managers must turn a habit into a skill, which can only be done through regular, consistent practice. Businesses that use NLP techniques into employee training will have a competitive advantage, which will result in both successful businesses and successful people. It was found that career cycle stages do not have any moderating effect on NLP trainings and employee's performance.

**Keywords:** *service quality, student's satisfaction, vocational education.*

## **Impact of employee's behavioral pattern of service quality on customer satisfaction; study of government health care institute.**

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In the realm of healthcare service delivery, understanding how employee behavior shapes service quality and, in turn, influences customer satisfaction is a critical undertaking. This study examines the impact of employee behavioral patterns on service quality and customer satisfaction within a government healthcare institute in Sri Lanka. In a global shift towards a service-based economy, the service sector has grown significantly, making it crucial to understand the influence of employee behavior on customer satisfaction. Defining service quality is more complex than product quality, as it involves technical and functional aspects. This study employs the SERVQUAL instrument to assess the functional aspect of service quality provided by the subject institute. Employee behavior is a key factor in shaping the overall customer experience. Well-behaved employees contribute to higher team and individual performance and productivity, ultimately affecting customer satisfaction. Moreover, customer satisfaction is a highly subjective decision heavily influenced by customer expectations, whether related to products or services. It essentially reflects consumers' feelings and evaluations. An increase in customer complaints among healthcare workers in some outpatient departments suggests potential issues with service quality, which could lead to reduced customer satisfaction and retention. It's essential to determine whether these increased complaints about employee behavior negatively impact service quality. The study conducted descriptive regression analysis and distributed a closed-ended questionnaire to 270 patients from five clinics in the outpatient department of the subject institute. The research findings highlight that the behavioral patterns of reliability, empathy, tangibility, and assurance dimensions of service quality significantly influence customer satisfaction in the government healthcare institute. However, the behavioral pattern of the responsiveness dimension of service quality doesn't have a significant impact on customer satisfaction. Data analysis reveals that a significant portion of the surveyed customers were over fifty years old and had low to moderate income, which may limit the generalizability of the study's findings. Based on these findings, it's recommended to implement corrective measures to improve employee behavior, especially among junior staff. These measures could include clearly defining service standards relevant to their job descriptions, introducing continuous training and education sessions, and establishing key performance indicators to monitor development.

**Keywords:** *customer satisfaction, employee behavioral pattern, service quality.*



## **Impacts of post-COVID-19 situation on local tourist travel behavior in Sri Lanka**

K.D. Nihal Hewage<sup>1</sup>, M.K. Nilakshi Pabasara<sup>2</sup>, S.K. Illangarathne<sup>3</sup>, S .K.N. Gamage<sup>4</sup>

<sup>1</sup>*Institute of Human Resource Advancement University of Colombo, Sri Lanka,*

<sup>2,3,4</sup>*Rajarata University of Sri Lanka*

The impacts of COVID-19 have resulted in a significant contraction in both developed and developing economies. As travel restrictions and lockdowns persist, global travel patterns have undergone a considerable shift. Consequently, the tourism industry has been severely affected, leading to substantial changes in tourist arrival patterns. Even local tourists find themselves unable to engage in their usual travel experiences due to the heightened risk of infection associated with traveling. Governments have responded promptly by imposing restrictions, launching vaccination programs, and promoting preventive health measures, contributing to the gradual normalization of day-to-day activities. This study empirically investigates the post-COVID-19 impacts on local tourist travel behavior in Sri Lanka. The method employed a survey, with the researcher incorporating primary data gathered from an online survey of over 140 respondents. Four hypotheses were tested in this study: the post-COVID impact on Travel risk and perception, the post-COVID impact on Hygiene and safety, the post-COVID impact on Attitude and preference, and the post-COVID on Pristine travel conditions. The findings reveal that the impact of COVID had a negative effect on Travel risk and perception and a positive impact on overall hygiene practices within the tourism industry. While there was a negative shift in the attitudes of some local tourists due to concerns about health risks, there's also an opportunity for a positive impact. Additionally, the post-COVID-19 situation has led to reduced tourist traffic in many destinations. Moreover, the post-COVID situation has triggered an economic crisis, negatively affecting the tourism sector. Therefore, safety and low-cost travel behavior schemes are recommended to facilitate the recovery of the country's local tourism industry.

**Keywords:** *post-COVID-19 Situation, local tourist travel behavior, Sri Lanka*

## **Impact of work-related attitudes on employees' engagement in medical laboratory technologists**

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Work-related attitudes are the perceptions of the workplace and its surroundings. They influence employee engagement to some extent. This study aims to investigate how work attitudes affect workers' participation as Medical Laboratory Technologists. Work related attitudes are considered to be feelings about the coworkers and the workplace itself. The major attitudes that are important for service engagement are job satisfaction, job involvement, and organizational commitment. Hospital patient care in the area of medical laboratories is crucial. In this medical laboratory field, employee service engagement may be impacted by work-related attitudes. Technologists in medical laboratories work every day of the week. Since their labor cannot be performed by another person, they are required to work even on holidays. Most of them have to sacrifice their personal lives for effective patientcare. They must strike a balance between their personal and professional lives. Effective job performance management is required to meet company goals and objectives. The objective of this study was to identify the impact of work-related attitudes on employee engagement in Medical Laboratory Technologists. Data were collected from 100 Medical Laboratory Technologists in government sector hospitals in Colombo district by using a questionnaire with five-point Likert scale. The study showed that there is a significant impact of work-related attitudes on employees' engagement in Medical Laboratory Technologists. Moreover, when consider the independent sub variables job satisfaction, job involvement, and organizational commitment separately with dependent variable employees' engagement, all the sub variables have significant impact on employees' engagement in Medical Laboratory Technologists. Therefore, for a better employees' engagement, for an effective patient care, work related attitudes are very important.

**Keywords:** *employees' engagement, job involvement, job satisfaction,*

**Work-related attitudes, organizational commitment,  
service quality and student satisfaction; A case of VTA, ICT NVQ level 5**

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Human capital has been recognized as the critical aspect of the engine of the growth of the country by various scholars and it has been the case of the vocational training in uplifting and upgrading the outlook of the skilled workforce of the country. Under the prevailing labor market condition adequacy of the specifically developed labor through vocational training during the past couple of years is in a vulnerable status. An array of many learning and training methods and technologies used does not satisfy the industry as well as the student's requirement as per the surveys conducted in the past. Fundamentally study attempting to address the research issue of poor student satisfaction among ICT NVQ Level 5 students. Along with the constitute problem, the research objective recognized as to identify the impact of the service quality of the vocational training authority and the perceived student satisfaction among the NVQ Level 5 students. Concerning the deductive reasoning research study organized under the survey strategy to collect a sample of 225 respondents from the total population of the students of 17 training centers of NVQ Level 5 students through convenience sampling technique. To triangulate the data and validate the findings informal group discussions were conducted with the representative of the center management teams. Regression analysis, descriptive analysis, and ANOVA analysis were used for the analysis and it was found that infrastructure and support service have a significantly positive impact on student satisfaction which is contrary to the findings of Elton Mayol's Hawthorn Studies. In addition, it revealed that the teaching methods and the course content were the most influential factors of satisfaction among the ICT students of the NVQ Level 5. It is recommended that attention to the content and the teaching method needs fundamental attention from the immediate standpoint.

**Keywords:** *student's satisfaction, service quality, vocational education*

## Strategic Thesis Collection Management through Statistical Analysis

N.M. Karannagoda<sup>1</sup>, A.K.K.K. Athukorala<sup>2</sup>, K.A.C.P. Abeygunawardena<sup>3</sup>,

D.D.G.S. Ariyawansa<sup>4</sup>

<sup>1 3 4</sup>*Main Library, University of Colombo, Sri Lanka*

<sup>2</sup>*Horizon Campus, Sri Lanka*

The thesis collection at the University of Colombo's (UOC's) Main Library (ML) plays a vital role in undergraduate and postgraduate education, serving as a repository of scholarly work produced by the students in Masters, MPhil, and PhD degree programs in five faculties. The collection reflects the academic output of the UOC student and serves as a valuable resource for researchers, academic staff, and students. A comprehensive understanding of the Main Library Thesis Collection (MLTC) content and patterns is required for effective management and utilization. Therefore, in this study, content analysis of the MLTC was done through statistical analysis. Statistical analysis of the thesis collections at the UOC Main Library is the main objective of this research. Further, the paper examined the (1) faculty-wise and year-wise publication of the theses, (2) degree level-wise distribution of the theses, and (3) subject-wise distribution of the theses within the MLTC. For this study, it has used all theses contained in the MLTC, and it is around 1827 theses. Data collection and analysis were done from July 2023 to September 2023. Excel data analysis tool pack and its features were used for data analysis. The MLTC contains theses from six faculties (Arts, Education (FED), Graduate Studies, Law, Management, and Science). According to the findings, FED is the most prominent faculty contributing to the library's thesis collection. The year-wise distribution of the theses at the MLTC indicates that the highest number is from 2000-2009, followed by 2010-2019. The collection includes 181 PhD, 280 MPhil, and 1366 master's theses. When considering the main ten categorizations of the Dewey Decimal Classification, 67% of these are in Social Sciences, and 12% are in Technology. Considering the physical condition of the theses, most of the theses in the MLTC are in excellent condition. It is evident the institution's commitment to maintaining the highest preservation standards. As a result of the findings, the following recommendations were made regarding the MLTC: (1) Increasing the contribution of the Faculty of Law, (2) Increasing the presence of PhD theses, (3) Enhancing representation in underrepresented subject areas, and (4) Digital preservation and access.

**Keywords:** *Bibliometric Analysis, Library, Statistical Analysis, Thesis Collection, UOC*

# **Faculty of Indigenous Medicine, University of Colombo**



**9<sup>th</sup> INTERNATIONAL CONFERENCE ON  
AYURVEDA, UNANI, SIDDHA AND  
TRADITIONAL MEDICINE (*i*CAUST) - 2023  
AND *TRIPHALA* INTERNATIONAL RESEARCH  
SYMPOSIUM AyurEx COLOMBO 2023**

***‘Traditional Knowledge for One Health’***

**8<sup>th</sup> to 10<sup>th</sup> September 2023**

## MESSAGE FROM DEAN

### Professor Pathirage Kamal Perera



It is with great pleasure and pride to send this message on the occasion of the 9<sup>th</sup> International Conference on Ayurveda, Unani, Siddha and Traditional Medicine (iCAUST) and ‘Triphala’ International Research Symposium, Ayurex Colombo – 2023. The symposium was initiated by the Institute of Indigenous Medicine in 2014 and progressively it became the leading research platform of researchers who are engaged in natural medical systems in Sri Lanka. Launching the 9<sup>th</sup> iCAUST remarks a premiere milestone after the momentous conversion of the Institute of Indigenous Medicine to the Faculty of Indigenous Medicine (FIM). On this precious occasion, I would like to extend my gratitude to the co-organizing partner, Department of Ayurveda, Ministry of Health for facilitating the event. Further, I would like to express my appreciation to the Vice chancellor, Senior Professor H.D. Karunaratne for giving his expertise and guidance to arrange this event smoothly and effectively.

Focusing on the theme ‘Traditional knowledge for one health’ we accommodated interdisciplinary participation to share their evidence-based traditional medicine, recent research evidence, innovations, and clinical experiences among the young, upcoming, and renowned researchers. One of the key anticipations of these resourceful scientific sessions is to develop scientific communication skills among the FIM undergraduates and expose them to research culture. The parallel student scientific forums provide opportunities to FIM undergraduate researchers to develop scientific communication skills while being exposed to the research communities. Further, we expect to unveil the novel products and innovations of FIM scholars through the educational exhibition which is planned to be held with the AyurEx Colombo 2023.

I congratulate the authors of the conference and greatly appreciate the team effort extended by the organizing committee and all the committee members of the 9<sup>th</sup> iCAUST and Tripala IRS /AYUEX 2023 to bring this event a grand success.

## MESSAGE FROM CONFERENCE COORDINATOR

**Dr. N.D. Kodituwakku**

*Senior Lecturer  
Faculty of Indigenous Medicine*



I extend my heartfelt wishes with profound pleasure for the fruitful accomplishments of the 9th International Conference on Ayurveda, Unani, Siddha, and Traditional Medicine, in conjunction with the *Triphala* International Research Symposium. This event not only offers a valuable platform for the exchange of knowledge and professional advancement but also holds great historical significance as the inaugural international conference hosted by the Faculty of Indigenous Medicine after the transformation from an institute to a faculty, of the University of Colombo. Additionally, marking a momentous milestone, this conference stands as the inaugural collaborative endeavor between the Department of Ayurveda. Simultaneously, it harmoniously aligns with the *Triphala* IRS, and the AyurEx Colombo 2023. Hence, this significant juncture will stand as a splendid landmark for the Faculty of Indigenous Medicine, illuminating its global reputation and stature. Under the theme of "Traditional Knowledge for One Health" the conference holds a pivotal role within the scientific domain as a dynamic platform where experts, practitioners, and researchers convene to impart their knowledge, facilitate the exchange of ideas, and deliberate on the latest strides in the field. Through the convergence of professionals worldwide, the conference is set to foster collaboration and innovation in the realm of natural and holistic healthcare. Facilitating the integration of traditional practices with modern medicine and technology will promote a transformative shift in healthcare paradigms. It is a great privilege to be the coordinator of this conference and I wish to extend my heartfelt gratitude for the invaluable efforts and guidance provided by the Vice-Chancellor, Senior Professor (Chair) H D Karunaratne, and the Dean, Chief Organizer, Prof. Pathirage Kamal Perera. I would also like to express my sincere gratitude to Dr. Dhammika Abeygunawardena, the Commissioner, Department of Ayurveda, and his team for the immense support provided towards the success of this conference. I would also like to express my heartfelt appreciation to each member of the organizing committee, Faculty of Indigenous Medicine for their unwavering support and dedicated efforts in overcoming every obstacle encountered along this journey.

## ORGANISING COMMITTEE

- Chief organizer: Prof. Pathirage Kamal Perera  
Dean, Faculty of Indigenous Medicine, University of Colombo
- Co-organizer: Dr. Dammika Abeygunawardhena  
Commissioner, Department of Ayurveda
- Conference Coordinator: Dr. N.D. Kodithuwakku
- Organizing secretaries: Dr. K.N.A. Dharmasena (Ayurveda)  
Dr. J. Rumaiza (Unani)
- Joint secretaries: Dr. P.A.N.G. Perera (Ayurveda)  
Dr. M.A.A. Sirajudeen (Unani)

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Prof. N. Fahamia  
Prof. M.I. Manuha  
Prof. R.D.H. Kulathunga  
Prof. K.R. Weerasekara  
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Dr. M.S.S. Fawmiya

Mr. H.M.G. Punchi Banda

**Convenor for the steering committee:** Dr. H.D.R. Fernando

Dr. D.M. Nallaperuma

## Program of the conference

<b>Agenda – 8<sup>th</sup> September 2023</b>		
01:00 PM	Inauguration of iCAUST 2023	
01:05 PM	Lighting of the Traditional Oil Lamp	
01:10 PM	Cultural Event - Pooja Dance	
01:20 PM	Welcome Address by Chief Organizer	
01:30 PM	Address by Co-organizer	
01:40 PM	Address by Chief Guest, Vice Chancellor, University of Colombo.	
01:50 PM	Launching of Abstract Proceedings - ICAUST 2023	
02:00 PM	Keynote Address by Professor Bhushan Patwardhan National Research Professor, AYUSH Ministry of AYUSH, Former Vice Chairman UGC, India.	
02:35 PM	Vote of Thanks by Conference Coordinator	
02:45 PM	Tea Break	
03.00 PM- 06:00 PM	Session 1/Oral Presentation	Session 2/ Oral Presentation Student forum
	Session 1/Poster Presentations	Session 2/Poster Presentations
Tea Break / End of the first day of the Conference		

<b>Agenda – 9<sup>th</sup> September 2023</b>		
09:00 AM- 12:00 Noon	Session 3/ Oral Presentation	Session 4/ Oral Presentation
	Session 3/ Poster Presentation	Session 4/ Poster Presentation
12:00 Noon 01:00 PM	Lunch Break	
01:00 PM- 03:00 PM	Session 5/ Oral Presentation	Session 6/ Oral Presentation
	Session 5/ Poster Presentation-Student forum	
03.30 PM- 06:00 PM	Session 7/ Oral Presentation	Session 8/ Oral Presentation
06:00 PM	Tea Break / End of the first day of the Conference	
<b>Agenda – 10<sup>th</sup> September 2023</b>		
09:00 AM- 12:00 Noon	Session 9/ Oral Presentation	Session 10/ Oral Presentation
	Session 6/ Poster Presentation-Student forum	
12:00 Noon 01:00 PM	Lunch Break	
01:00 PM- 03:00 PM	Session 11/ Oral Presentation	Session 12/ Oral Presentation
03:00 PM	Tea Break	
03:15 PM	Valedictory ceremony	

## INTRODUCTION TO KEYNOTE SPEAKER

Dr. Bhushan Patwardhan

*PhD, FNASc, FAMS*

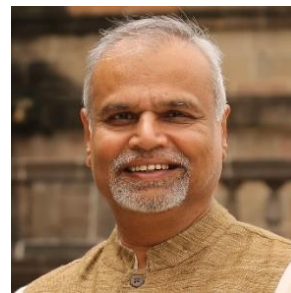
*National Research Professor*

*Ayush and Ram Kumar Rathi Patanjali Yoga*

*Chair at School of Health Sciences*

*Savitribai Phule Pune University*

*India.*



Dr Bhushan Patwardhan, National Research Professor-Ayush, is a Fellow at the National Academy of Sciences and National Academy of Medical Sciences, India. Currently, he is a Senior Consultant to WHO Geneva and Co-chair of the Advisory Group for the Global Centre for Traditional Medicine. He is also a member of the Lancet Citizen's Commission for Reimagining India's Healthcare and an Adjunct Professor at the NICM Health Research Institute, Western Sydney University, Australia. He serves as the Chairman of the Interdisciplinary R&D Taskforce on COVID-19 at the Ministry of Ayush, alongside being a member of several academic research and policy committees including NITI Aayog, UGC, ICMR, and CSIR. He is recipient of several awards and orations including the Sardar Vallabhbhai Patel Award, Sir Ram Nath Chopra Oration, and Waldemar Haffkine Oration. He is also the Founder and Editor-in-Chief of the Journal of Ayurveda and Integrative Medicine (Elsevier), holds eight Indian and two US patents, 175 scientific publications, and over 12,560 citations.

## **ABSTRACT OF THE KEYNOTE ADDRESS**

### **Evidence-Based Traditional Medicine for Planetary Health and Well-being**

**Dr. Bhushan Patwardhan**

We are witnessing increasing awareness and interest in traditional, complementary, and integrative medicine (TCIM) for planetary health and well-being. TCIM can be a good source of new ideas for scientific research and help innovation in research, drug discovery, healthy nutrition, mind-body medicine, and nature-based practices. Reverse pharmacology-based drug discovery, development and repurposing can play an important role in offering promising candidates, especially antivirals and immunomodulators. The experiential wisdom of traditional medicine can help provide a holistic and culturally sensitive approach to One Health and integrative healthcare. This lecture will offer a few glimpses of scientific research on Ayush, especially during COVID-19 times in India.

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Development of *Triphala* based rejuvenating syrup  
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Standardization of polyherbal decoction used in allergic rhinitis  
*J. M. Dahanayake, P.K. Perera, P. Galappaththy, L.D.A.M. Arawwawala*

Role of Ayurvedic and Traditional management of *Khanja* (Pyriformis syndrome): A case study  
*R.M. Peiris, Y.D.S.S. Suraweera, W.K. Jayarathna, E.D.T.P. Gunarathna, R.D.H. Kulathunga*



Impact of patterns and practices of consumption according to Ayurveda and Sri Lankan traditional medicine to nutritional well-being among the school children in selected school

*N.V.Y. Diloopa, E.R.H.S.S. Ediriweera*

Comparison of chemical characteristics of different compositions of *Triphala* powder in various Ayurveda authentic texts

*H.H.S.S. Silva, S.D. Hapuarachchi, K.D.C. Madhushika, P.K. Perera*

Comparative study of physicochemical parameters on different *Kadali kshara* samples from *Musa paradisiaca* plant

*P.R.N.T. Gunawardana, E.D.T.P. Gunarathna, N.D. Kodithuwakku*

Comparative quality evaluation on branded *Triphala* tablets in Ayurveda drug market of Sri Lanka

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## Antioxidant potentials of *Phalatrikadi kwatha* used in *Yakrut roga* wsr to fatty liver disease

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Fatty liver disease is a condition denoted under *Yakrut roga* in Ayurveda, characterized by the accumulation of excess fat in the liver cells. There are two main types, Alcoholic fatty liver disease and non-alcoholic fatty liver disease. Antioxidants play a beneficial role in protecting the liver from various forms of damage caused by *Yakrut roga*, including Fatty liver disease. Both oxidative stress and inflammation are known to contribute to its development and progression. Oxidative stress occurs when there is an imbalance between the production of reactive oxygen species and the body's ability to detoxify them. Antioxidants help to combat oxidative stress by neutralizing reactive oxygen species. In Ayurveda, *Phalatrikadi kwatha* is specially mentioned for the *Yakrut roga* and the formula consists of a variety of plant-based ingredients. Within this scenario, the present study was designed to investigate the antioxidant potential of *Phalatrikadi kwatha* by using *in vitro* assays [Total polyphenolic content, total flavonoid content], 1,1-diphenyl-2-picrylhydrazyl, 2,2-azino-bis-(3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt and oxygen radical absorbance capacity]. Total polyphenolic content and total flavonoid content of *Phalatrikadi kawtha* were 1.311+ 0.055 mg gallic equivalents/g of the drug and 0.026+0.001 mg quercetin equivalents/g of the drug respectively. IC<sub>50</sub> values for DPPH, ABST and ORAC were 8.01+ 0.33 µg/ml, 6.24+ 0.03 µg/ml and 97.19 + 0.61mg Trolox equivalents/g of drug respectively. Thus, can conclude that the *Phalatrikadi kwatha* comprised significant antioxidant activity and it is a very successful treatment for *Yakrut roga* wsr to fatty liver disease.

**Keywords:** *Liver diseases, Ayurveda, Antioxidant, Phalatrikadi kwatha, Fatty liver disease*

## **After-effects of Covid-19 vaccination and the incidence of covid infection among the vaccinated individuals in Sri Lanka: A cross-sectional survey**

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The COVID-19 pandemic's devastating impact on humanity has led to a significant death toll. Vaccination has historically been effective in controlling deadly infections like smallpox and polio. With the rapid development of COVID-19 vaccines, concerns about safety and post-marketing monitoring arise. This study aims to evaluate the after-effects of COVID-19 vaccination and the incidence and severity of COVID-19 infection among vaccinated individuals. The questionnaire included open-ended and close-ended questions and was formulated in Tamil, Sinhala, and English to gather information through an online platform. Additionally, Ethics Review Committee approval has been obtained for the implementation of the survey. The survey garnered responses from 352 participants, with 25.3% being male and 74.7% female. The majority of participants (69.2%) fell within the age range of 20 to 29 years. Moreover, 79.3% of respondents had at least a diploma level of education. Notably, approximately 92.1% reported having no prior COVID-19 infection before vaccination. In addition, 52.1% of participants expressed fear towards receiving the vaccination. The preferred vaccinations were Pfizer and AstraZeneca; however, SinoPharm had 63.5% and Pfizer had 33.9% of participants who received them, respectively. Additionally, an overwhelming majority (94.2%) received more than one dose of the vaccine. Encouragingly, 48.9% reported no post-vaccination symptoms. However, 47% experienced mild to moderate symptoms, while 4.1% reported severe symptoms. 15.2% of vaccinated individuals contracted COVID-19 infection after receiving the vaccination. The survey provided vital insights into participants' vaccination experiences, contributing valuable information to the study.

**Keywords:** *COVID-19, Vaccination, Survey, After-effects*

***In-vitro* anti-urolithic (*Mutra ashmaribhedana*) activity of *Varuna* (*Crateva adansonii* DC) stem bark decoction**

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Many single and poly-herbal formulations used for *Mutra ashmaribhedana* (anti-urolithic) action are mentioned in Ayurveda authentic texts. Among them *Varuna* (*Crateva adansonii* DC) is considered as one of the best litholytic herb. According to the text Chakradaththa, *Varuna twak* (stem bark) decoction is effective in the treatment of *Mutrashmari*. This study was designed to evaluate *in-vitro* anti-urolithic activity of the *Varuna twak* decoction using titrimetric method and to develop standardization parameters. The freeze-dried extract was prepared from *Varuna twak* decoction. Calcium Oxalate crystals were prepared artificially by homogenous precipitation method to assess anti-urolithic activity. *In-vitro* dissolution models were prepared using semi-permeable egg membranes. Dissolution models containing Calcium Oxalate (5mg) and different concentrations of freeze-dried extract (15mg, 25mg, 35mg) were suspended separately in conical flasks containing 100ml of 0.1M tris-buffer solution. All were kept in the hot air oven for 7-8 hours preheated to 370C for 2 hours. Dissolution percentage of Calcium Oxalate in each setup was evaluated by titrimetry with KMnO<sub>4</sub> and dissolution percentage increased when the concentration of the extract increased. The highest dissolution percentage (75.9%) was shown by extract at 35mg concentration. Parameters of standardization like foreign matter content (2%), total ash (9.88%), acid-insoluble (1.32%) & water-soluble ash (4.45%), alcohol-soluble (1.3%) & water-soluble extractive value (10.5%), loss on drying (10.66%), swelling index (7ml) and foaming index (<1000) were determined for the raw material and pH (6.80) and density (0.99799 g/cm<sup>3</sup>) were determined for the decoction. Alkaloids, saponins, tannins, flavonoids, steroids, glycosides and proteins were positive in the freeze-dried extract. Thin Layer Chromatogram (Butanol: Dichloromethane: Water 4:1:5 v/v) showed 03 R<sub>f</sub> values (0.42, 0.67, 0.83) for the freeze-dried extract. The results revealed that this decoction can be used as an effective and quality drug preparation to treat *Mutrashmari*.

**Keywords:** *Varuna twak* decoction, Anti-urolithic, Titrimetry, Freeze-dried extract, Standardization

## Assessment of antioxidant potential of methanol and aqueous extracts of Unani polyherbal mouthwash using total phenolic content, DPPH, and TEAC assays

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The Unani polyherbal mouthwash had been extensively used in the Unani system of medicine and is claimed to have anti-periodontopathic effects. However, there is no scientific evidence for its validation. The objective of the present study was to investigate the antioxidant effect of the aqueous extracts and methanol extract of the Unani polyherbal mouthwash. 2,2-Diphenyl-2-picrylhydrazyl Hydrate (DPPH), Trolox Equivalent Antioxidant Capacity assay (TEAC), and Total Phenolic Count (TPC) assays were used to assess the antioxidant potential of the Unani polyherbal mouthwash. The DPPH and TEAC assay dilutions series (3.13, 6.25, 12.5, 25, 50, and 100 µg/mL) were prepared by aqueous and methanol extracts of the Unani polyherbal mouthwash. Butylated Hydroxy Toluene (BHT) was used as the standard in DPPH and TEAC assays. In the TPC assay, the working standards of different concentrations of Gallic acid were prepared by diluting the stock solution with the appropriate amount of distilled water to plot the standard calibration curve. The results showed that the DPPH and TEAC assays  $IC_{50}$  values of both extracts of the Unani polyherbal mouthwash were not significantly different ( $p < 0.05$ ) with the percentage inhibition of the standard BHT.  $IC_{50}$  of DPPH (BHT  $6.98 \pm 1.59 \mu\text{g/mL}$ , aqueous extracts  $10.03 \pm 0.59 \mu\text{g/mL}$ , methanol extract  $11.36 \pm 0.15 \mu\text{g/mL}$ ) and TEAC (BHT  $7.10 \pm 1.69 \mu\text{g/mL}$ , aqueous extracts  $3.89 \pm 0.40 \mu\text{g/mL}$ , methanol extract  $4.43 \pm 0.17 \mu\text{g/mL}$ ). The average Total Phenolic Count of methanol and aqueous extracts were 2.16 mg/g and 1.21 mg / g respectively. Hence, the Unani polyherbal mouthwash can be used for preventing periodontitis as it possesses a substantial amount of antioxidant potential.

**Keywords:** *Antioxidants, Periodontitis, Unani Polyherbal Mouthwash*

## Efficacy of *Rasna panchaka kwatha* with *Murungadi lepa* local application in the management of *Amavata* (rheumatoid arthritis): a case study

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*Amavata* is a systemic disorder that affects food digestion and develops clinical features on joints in the advanced stage of the disease. *Ama* and *Vata* are the chief pathogenic factors responsible for this disease. The disease occurs in the *Madhyama rogamarga*, *Asthi* and *Sandhi* are the chief sites of the disease and cardinal symptoms are pain, swelling, and stiffness of the joints. Based on clinical symptoms, it may be correlated with Rheumatoid Arthritis in modern texts. In the present case, a female patient aged 45 years with a history of pain and morning stiffness in multiple joints for one year, swelling in both hand and wrist joints for 2 months, and intermittent low-grade fever for 2 months and also *Angamarda*, *Trushna*, *Alasya*, *Gurava*, *Apaka*, *Bahu mutrata* with *Alpanidrata* for 2 months was attended to the Out Patients Department, Ayurveda Teaching Hospital, Borella, Sri Lanka. Complete history and clinical evaluation led to the diagnosis of *Aamavata*. The diagnostic criteria of *Amavata* are based on signs and symptoms according to Ayurveda and of Rheumatoid arthritis based on ACR/ EULAR classification criteria 2010. Considering the signs and symptoms, the patient was treated with *Rasna panchaka kwatha* with *Murungadi lepa* (local application) for 14 days. After the treatment, joint pain (50%), stiffness (50%), *Angamarda* (75%), *Aruchi* (50%), *Trushna* (100%), *Alasya* (75%), *Jwara* (75%), *Apaka* (50%) were reduced significantly whereas joint swelling is unchanged. The Rheumatoid factor and Erythrocyte Sedimentation Rate were reduced by up to 65%. There was no side effect observed during and after the treatment. Therapy gives significant relief in symptoms of *Aamavata*. Therefore, it is concluded that *Rasna panchaka kwatha* with *Murungadi lepa* is effective in *Amavata*. However, further research with larger sample sizes, and longer follow-up periods is necessary to establish the long-term efficacy of these Ayurveda treatments.

**Keywords:** *Amavata*, *Ama*, *Rheumatoid arthritis*, *Rasna panchaka kwatha*, *Murungadi lepa*

**Evaluation of the anti-inflammatory effect of *Lokanatha rasa*:  
A mercurial preparation in Ayurveda *Rasa Shastra***

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*Rasa shastra* is a prominent branch of Ayurveda pharmaceutics, where Mercury stands as the primary material of significance. Pharmaceutical formulations utilizing Mercury are termed *Rasaushadies*, renowned for their superiority owing to their quick efficacy, low dosages, and absence of an unpleasant taste. *Lokanatha rasa* holds paramount importance as a potent remedy for liver, and spleen disorders, and edema conditions. This study aimed to conduct an *in vitro* evaluation of the anti-inflammatory potential of self-prepared *Lokanatha rasa* by assessing its effect on hypotonicity-induced lysis of Human Red Blood Cells. For comparison, Diclofenac sodium was used as a positive control. The degree of membrane stabilization was determined at various concentrations of *Lokanatha rasa*. Notably, the *Lokanatha rasa* solution exhibited a maximum membrane stabilization of 79.52% at a concentration (dose) of 500µg/mL, thereby indicating promising anti-inflammatory activity in a concentration-dependent manner.

**Keywords:** *Lokanatha rasa, Rasaushadie, Anti-inflammatory, Human red blood cells membrane stabilization*

## **An observational case study of the management of *Charmakeela* with *Agnikarma* and *Kshara karma***

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*Agnikarma* (therapeutic burn/cauterization) and *Kshara* are unique treatment modalities mentioned in Ayurveda under surgical methods. Acharya Susruta has given a detailed description of *Agnikarma*. *Agnikarma* and *Kshara* show significant importance in *Shalya tantra* because of the non-occurrence of diseases that are treated by *Agnikarma* and it has high success in diseases incurable with *Aushadha*, *Shastra*, and *Kshara*. *Charmakeela* (warts) is a disease mentioned under *Kshudra roga* in the Ayurvedic system and has various treatment principles that explain like administration of *Aushadha* internally, external application, and *Raktamokshana*, *Ksharakarma*, and *Agnikarma*. These treatment methods are minimally invasive procedures that do not cause scar formation, have no recurrence, and are found to be more beneficial in treating warts. In the present study single observational case study has done with the medical records of a 12 years old patient who visited to Shalya clinic of National Ayurveda Teaching Hospital, Borella, Sri Lanka with multiple warts present below the left elbow joint for 06 months and was treated with *Agnikarma* followed by application of *Apamarga theekshna kshara*. Post-operative dressing was done with *Velmi churna*. Weakly follow-up was done for 30 days. Based on these observations, there wasn't any re occurrence and surgical wounds have been cured with minimal scars. Based on this case study further studies are recommended to use *Agnikarma* combined with *Kshara* application is an effective treatment for the Management of warts.

**Keywords:** *Agnikarma, Warts, Charmakeela, Ksharakarma, Ayurveda*



## Antioxidant activity of modified herbal preparation of *Shramahara mahakashaya* and its' effect on post-exercise Interleukin-1 alpha (IL-1A) level

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*Shramahara mahakashaya* is an authentic Ayurveda drug group mentioned by Acharya Charaka which is used to alleviate *Shrama*; that is defined as 'fatigue' occurring after a strenuous workout. Drug groups that have capability of delivering a particular pharmacological action as a single herb, as a part, or as a whole are called '*Mahakashaya*'. Active exercise increases the energy consumption and Cytokines levels; IL-1 $\alpha$  and IL-1 $\beta$ . It leads to a transient acute inflammatory phase and upsurges reactive free radicals, non-free radical oxygen intermediates. This mechanism contributed to the pathophysiology of fatigue. Hence, free radical scavenging activity, superoxide scavenging activity, and IL-1  $\alpha$  level provide the amplitude of fatigue occurring after exercise. The present study was designed to evaluate the antioxidant capacity of the formula and to evaluate the effect on fatigue. Aqueous extracts and alcohol extracts of the formula were investigated using 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay and superoxide dismutase (SOD) assay with different concentrations of the standard control; Ascorbic acid. Post-exercise IL-1  $\alpha$  level was determined using healthy Wistar albino rats subjected to weight loaded swimming test. Twenty-four healthy rats were randomly divided into four groups; 1, 2, 3, and 4, 5ml/Kg of distilled water, Caffeine (20mg/Kg), 200mg/Kg of aqueous extracts and 200mg/Kg of alcohol extracts of the drug were administered orally for groups 1, 2, 3 and 4 accordingly for 14 days prior to the experiment. Aqueous extract of the formula showed higher percentage in DPPH assay (56.74% inhibition at 30  $\mu$ g/ml concentration) and SOD assay (17.24% inhibition at 30  $\mu$ g/ml concentration), yet, not equivalent to Ascorbic acid (86.85% and 30.25% respectively). There was no statistically significant difference of IL-1  $\alpha$  level between the negative control and other groups (p values 0.99, 0.056, 0.82 accordingly). However, a larger data set is required to provide the bottom line of the study. Though *Shramahara mahakashaya* formula showed positive results from antioxidant assays, further studies are needed to evaluate cytokinin levels after exercise.

**Keywords:** Antifatigue activity, DPPH assay, SOD assay, Post exercise cytokinin level

## Development of *Triphala* paste as a rejuvenating herbal preparation and evaluation of its physicochemical, phytochemical and antioxidant properties

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In Ayurveda, rejuvenation is referred to as *Rasayana*, which governs the metabolism and immunity of the human body. *Triphala* is a widely utilized herbal formulation of fruits from three different plant species: *Terminalia chebula*, *Terminalia belerica*, and *Embilica officinalis*. As a result of its extensive therapeutic effects, it can be used in a variety of dosage forms and preparation methods. Applying a *Triphala* paste on a new iron vessel is one of the rejuvenation formulae among the 4 rejuvenation formulae mentioned in Charaka Samhita. No scientific studies have been done for this rejuvenation preparation. Hence, the main objective of this study was to prepare and analyze the standard parameters of the *Triphala* paste on a new iron vessel. The physicochemical, phytochemical, and antioxidant properties of the formulation were detected according to World Health Organization guidelines. Further detection of iron content, analysis of antioxidant activities, Thin Layer Chromatography (TLC) and High-performance thin-layer chromatography (HPTLC) fingerprint patterns of methanolic extract of prepared *Triphala* paste on a new iron vessel were also conducted. The final product is totally black in color, having metallic odor, tasteless, smooth and has a fine texture. Total ash value and moisture content of the prepared *Triphala* paste on a new iron vessel were 10.36% and 8.2% respectively. Qualitative phytochemical analysis of the cold methanol extract of *Triphala* paste on a new iron vessel reveals the presence of Phenols, Flavanoids, Tanins and alkaloids. TLC was developed for the cold methanolic extracts of *Triphala* paste and *Triphala* paste on a new iron vessel by using toluene: Acetic acid: formic acid in 3:5:1 ratio as a solvent system and HPTLC fingerprint pattern showed differences between *Triphala* paste and *Triphala* paste on a new iron vessel. Antioxidant properties of *Triphala* paste on a new iron vessel were also higher than the *Triphala* paste. Hence, this study provides positive evidence for the rejuvenating effect of developed *Triphala* paste on a new iron vessel and these findings will be helpful to future research on development of newly discovered plant-based rejuvenating product as well as an iron supplement.

**Keywords:** *Triphala*, Rejuvenation, Antioxidant, Iron vessel

## Evaluation of gastroprotective activity of different *Asparagus* species in Sri Lanka using *in-vitro* methods

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*Asparagus racemosus* Willd. and *Asparagus falcatus* L. (Family Asparagaceae) are two well-known medicinal plants used in Sri Lankan traditional medicine. The present study evaluates and compares the *in vitro* antacid effect of aqueous and ethanolic root extracts of these two *Asparagus* species. Aqueous root extracts were prepared as decoctions according to Ayurveda whereas ethanolic root extracts were made by refluxing method. Qualitative phytochemical screening of both plants was done separately in accordance with standard procedures. Thin layer chromatograms for individual plant extracts were obtained after extracting them with dichloromethane. Acid neutralising activities of different concentrations of root extracts were evaluated by determining neutralizing effects on artificial gastric acid (AGA), neutralization capacity via the titration method of Fordtran's model and duration of consistent neutralization effect on AGA via the modified model of Vatie's artificial stomach. A commercially available antacid formulation was used as the positive control, whereas distilled water was used as the negative control. Phytochemical screening and thin layer chromatograms reported nearly similar results for both of the plants. Different root extractions exerted significant ( $p < 0.05$ ) acid neutralisation compared to the negative control, based on *in vitro* assays. The aqueous extracts of both plants demonstrated more acid neutralising efficacy than their ethanolic extracts. Aqueous extract of *Asparagus racemosus* (0.73 g/ml) demonstrated the most potent acid-neutralising effect ( $3.74 \pm 0.005$  end pH), neutralising capacity ( $1.37 \pm 0.01$  H<sup>+</sup> mmol) and duration of consistent neutralisation ( $664.01 \pm 4.52$  s), whereas the positive control resulted in  $6.51 \pm 0.01$  end pH,  $1.18 \pm 0.01$  H<sup>+</sup> mmol and 462.38 s in respective assays. Moreover, *Asparagus racemosus* extracts revealed higher antacid activity compared to *Asparagus falcatus* extracts in all three *in vitro* assays ( $p < 0.05$ ). This study confirms the use of *Asparagus racemosus* root as an acid neutralizing agent in Ayurveda formulations. Activity guided fractionation is recommended for both plants.

**Keywords:** Antacid, *Asparagus falcatus*, *Asparagus racemosus*, Thin layer chromatography

## Effectiveness of *Nasya*, *Parisheka* and *Akshi tarpana* in the management of *Vatahata vartma* (ptosis): A case study

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*Vatahata vartma* is a *Vataja vartmagata netraroga*, which is explained under *Varthmagataroga* in Ayurveda, by where in the patient is unable to open the eyelids. The disease is explained as *Asadhya* in nature. But Acharya Vagbhata mentioned *Vata shamana chikitsa* along with *Brumhana chikitsa* can be used for this condition. It can be compared with neurogenic type of acquired ptosis (drooping of eyelids) where the condition can be either uniocular or binocular. The prevalence of bilateral and unilateral ptosis is 1.3% and 3.4% respectively. The present condition discussed a case of *Vatahata vartma* (binocular involuntional ptosis) where A 65-year female patient visited the ENT clinic at the National Ayurveda Teaching Hospital, Borella, complaining of drooping of both upper eyelids associated with the mild double vision of near objects and burning sensation of both eyes since 3 years. Her distant and near vision was observed as 6/12, N10. The treatment was commenced with oral administration of *Amapachana* and *Agni deepana* for a week along with *Vatashamaka* treatments. Followed by *Netra parisheka* with *Ksheera bala kashaya* for 14 days, *Nasya* with *Anu taila* for 14 days, *Akshi tarpana* with *Triphala gritha* for 21 days along with eye exercise for ocular muscles for two months of period followed by one month of follow up period. After completion of this treatments, completely relief (100%) was observed in all the symptoms such as drooping eyelids double vision burning sensation of eyes, and her visual acuity change to 6/9, N 6 both the eyes and any side effects, recurrence, or other affiliated complaints was not found during the follow-up period. No scientific research has been conducted to evaluate the efficacy of these treatments. Therefore, it was decided to administer *Nasya*, *Parisheka* and *Akshi tarpana* in the management of *Vatahata vartma* (Ptosis).

**Keywords:** *Akshi Tarpana*, *Nasya*, *Parisheka*, *Ptosis*, *Vatahata vartma*

***In-vitro* study to evaluate the antibacterial activity of *Seethodaka*, *Visarpahara* and *Neelyadi* oil against *Staphylococcus aureus* and *Escherichia coli***

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This study conveys the determination of the antimicrobial effects of *Seethodaka*, *Visarpahara*, and *Neelyadi* oils against *Staphylococcus aureus* and *Escherichia coli* using standard antibiotic sensitivity tests. All three oil preparations were freshly prepared with the combination of appropriate ingredients in ratios based on the traditional Ayurveda classics. Microbial assays were conducted using Mueller Hinton Agar (MHA) medium. Five wells were made in each plate, and the bottom was sealed using molten agar. Tetracycline (2000 ppm:100 µ L) and DMSO (100 µ L) were used as positive and negative controls, respectively. Three oil samples, along with positive and negative controls, were each added 100 µL to individual plates to assess their antibacterial activity against both strains. Subsequently, inhibition zones were measured after 24 hours of incubation at 37°C. Each experiment was replicated three times, and the mean inhibition zone diameter was calculated for each plate. The outcomes revealed a 12 mm Inhibitory zone diameter for *Seethodaka* oil against *Staphylococcus aureus*, whereas *Visarpahara* oil exhibited a 16 mm inhibition zone, and *Neelyadi* oil displayed a 13 mm inhibition zone against the same bacteria. The positive control, Tetracycline, resulted in a 40 mm inhibition zone diameter against *Staphylococcus aureus*. Based on the findings, all three oils demonstrated significant antimicrobial effect against *Staphylococcus aureus*. Moreover, *Seethodaka* oil exhibited an 8 mm inhibition zone diameter against *Escherichia coli*, while *Visarpahara* oil displayed a remarkable antimicrobial effect with a 24 mm inhibition zone diameter against *Escherichia coli*. *Neelyadi* oil also indicated substantial inhibition, measuring 12 mm against *Escherichia coli*. In contrast, the positive control exhibited a 30 mm inhibition zone diameter against *Escherichia coli*. In conclusion, the tested traditional oils, including *Seethodaka*, *Visarpahara*, and *Neelyadi*, exhibited considerable antibacterial effects against both *Staphylococcus aureus* and *Escherichia coli*.

**Keywords:** *Seethodaka*, *Neelyadi*, *Visarpahara*, *Staphylococcus aureus*, *Escherichia coli*

## **Preliminary physio-chemical and phytochemical analysis of *Amrutadi guggulu***

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*Amrutadi guggulu* is an herbal formulation used by Ayurvedic physicians to treat Obesity and hyper-cholesterol. The quality of this herbal formula can be assessed through various analysis studies such as, physiochemical analysis, phytochemical analysis, microbiological and heavy metal analysis, etc. The main objective of this study is to develop standard parameters for *Amrutadi guggulu*. The formulation consists of nine parts of medicinal plants, prepared following the guidelines given in the Ayurvedic text Bahisajya Rathnavali, chapter 27. The results of the physiochemical analysis showed that *Amrutadi guggulu* contains 10.4% w/w moisture and 5.2% w/w total ash. Additionally, AG contains Tannins, Phenols, Alkaloids, Flavonoids, and Steroids. As for heavy metals analysis, Cadmium was not detected, which is a positive finding as Cadmium is a toxic heavy metal. The quantity of other heavy metals present in *Amrutadi guggulu* formulation was found to be within safe limits: Lead at 1.7 mg/kg, Mercury at 3.1 mg/kg, and Arsenic at 0.6 mg/kg, all of which were below the limits recommended by the World Health Organization. Thin-layer chromatography (TLC) was used to reveal the presence of organic constituents in the plant materials used in the formulation of *Amrutadi guggulu*. This method helps identify specific compounds present in the herbal mixture. Based on the analytical study, *Amrutadi guggulu* was found to be safe and effective for therapeutic use. The results suggest that it can be considered as a standard reference for further investigations in the field of Ayurvedic medicine. The analytical study of *Amrutadi guggulu* demonstrated its safety, efficacy, and adherence to recommended limits for heavy metals.

**Keywords:** *Analytical, Herbal formulation, Amrutadi guggulu, Physiochemical*

## **Endemic medicinal plants for the future: A study on distribution, propagation and conservation of endemic medicinal plant species in Sri Lanka**

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The main objective of this study was to establish a comprehensive inventory of endemic medicinal plant species (EMPSs) and to investigate their distribution, propagation, and conservation. Through a meticulous examination of botanical literature and authoritative online resources, an inventory of 184 EMPSs was compiled. Conservation of these plant species is crucial as 129 EMPSs (70%) are highly threatened; 7% critically endangered, 30% endangered, and 33% vulnerable. Mainly, Sri Lanka's legislative framework for biodiversity conservation resides in the Fauna and Flora Protection Ordinance (2009) operates through two principal strategies; the establishment and regulation of Protected Areas (PA) and the listing of Protected Species. This approach ensures the in-situ conservation of EMPSs within the PA. However, relying solely on in-situ conservation is inadequate for ensuring the longevity of EMPSs. The promotion of ex-situ conservation measures becomes imperative to complement these efforts. The findings of this study revealed that 61% of the EMPSs were ex-situ conserved, and the highest conservation efforts were recorded at the Royal Botanical Garden-Peradeniya and the Ayurvedic Herbal Garden-Pinnaduwa. Investigations on optimal propagation method for a specific plant species and the potential extent of its distribution are imperative for ensuring its conservation. The distribution of these EMPSs with respect to different climatic zones of Sri Lanka was analyzed using the software ArcMap (v10.8): distribution analysis revealed that the majority of EMPSs are distributed within Sri Lanka's wet zone, while the lowest species distribution was in the semi-arid and dry zones. Previous records on the propagation of EMPSs were minimal and attempts at in vitro propagation were limited to a very few such as, *Garcinia quaesita*, *Impatiens repens*, and *Osbeckia octandra*. Hence, it becomes crucial to conduct investigations on suitable propagation methods to promote the conservation of EMPSs. This study revealed the current status of EMPSs used in traditional medicine, further providing crucial insights into their conservation.

**Keywords:** *Traditional Medicine, Endemic, Medicinal plant species, conservation*

## Effect of Ayurveda treatment regimen on *Gridhrasi*: A case study

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*Gridhrasi* is quite significant as more than three quarters of the world's population are affected by the disease. Signs and symptoms of *Gridhrasi* closely enumerated with the symptoms of sciatica which is described in Allopathic Medicine. It is characterized by the onset of *Ruja* (pain), *Toda* (pricking), and *Stambha* (stiffness), initially in *Sphik* (gluteal region) and then radiating distally to *Kati prishtha* (low back), *Janu* (knee), *Jangha* (thigh) till *Pada* (feet). The aim of this case study was to evaluate the efficacy of an Ayurveda treatment regimen for *Gridhrasi*. A 43 years old female patient presented with middle back pain and lower back pain radiating to left lower limb for 02 years and was admitted to In-Patient Department at Ayurveda Teaching Hospital Borella, Sri Lanka was enrolled in the study. The patient was evaluated using the international assessment scales before, during, and after treatment. The patient applied *Prista vasti*, *Abyanga* in the morning and *Mathra vasti* in the evening with *Kubja prasarini* oil for 14 days. At the end of the treatment regimen, it has been observed that the angle of the Straight Leg Raising Test the for left leg was increased by 55%. According to the Visual analog scale of pain assessment the pain decreased; forward bending from 60%, backward bending to 60% left lateral bending from, 50% and right lateral bending from 70% to 0% respectively. The analysis of the pharmacological properties of individual herbs that revealed contain *Vata-Kapha shamana doshanurupa karma* in 93%, *Ushna veerya* in 79% and *Snigda guna* in 50%. Furthermore, most of these plants have analgesic, anti-inflammatory, and aanti-oxidant pharmacological activities that directly relieve the signs and symptoms of the disease condition. Based on the data presented above, it can be concluded that this Ayurveda treatment regimen was effective in the management of *Gridhrasi*. However, the study also suggests that further research with larger sample sizes is recommended to better understand the effectiveness of the treatment protocol.

**Keywords:** *Gridhrasi, Prista vasti, Mathra vasti, Assessment*



## Systematic review on Anti-neoplastic effect and its molecular mechanism of *Triphala*

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*Triphala* is a highly efficacious polyherbal Ayurveda formula which has been researched for its effects including immunomodulatory, adaptogenic, radioprotective and anti-neoplastic effects. The present study was performed to evaluate the anti-neoplastic efficacy and its molecular mechanism of *Triphala*. Google Scholar, PubMed, and ScienceDirect databases were scrutinized for past ten years. Using the search terms of “*Triphala*” for the past ten years, twenty articles on anti-neoplastic effect were retrieved from 250 articles after screening the articles with relevancy, language, full text etc. Apoptosis, reduction of tumor growth and mutations, increase the cytotoxicity of cancer cells, were identified as main mechanisms corresponding to anti-neoplastic effect. Cancer cell growth is reduced by reduction of cell invasion and migration. Moreover, it induces the radiation effect in cancer cells and reduces the effect of radiation in normal cells. Methanol or acetone extract of *Triphala* displayed a significant efficacy of cytotoxicity, antioxidant potential and antiproliferative activity. Molecular mechanisms have been evaluated via human ovarian cancer cell line SKOV-3, cervical cancer cell line HeLa, and endometrial cancer cell line HEC-1-B, pancreatic cell line Capan- 2, pancreatic cancer cell line BxPC-3 human pancreatic ductal epithelial (HPDE-6), breast cancer cell line MCF/7 etc. Activation of Tumor protein 53 (P53) and Extracellular signal-regulated kinase (ERK), regulation of the EGFR/Akt signaling cascade, increasing of superoxide dismutase, and elevation of Bax/Bcl-2 ratio, inhibition of DNA mutagenicity in specific tissues etc. were found as molecular mechanisms of *Triphala*. Further, Evidences showed the role of *Triphala* in neoplasms and its utilization as a preventive measure to the undesired effect of radiation therapy and predicting the potential of *Triphala* as an anti -neoplastic agent.

**Keywords:** *Triphala, Anti-neoplastic activity, Molecular Mechanism*

## Behaviour of bacterial flora in chronic wound with the application of *Apamarga* and *Karanja kshara pichu*: A comparative clinical study

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Chronic wounds affect 1–2% of the general population and are related to increase morbidity and health costs. The healing of chronic wounds is affected by multiple local and systemic factors. Bacterial burden is believed to play a significant role in impaired wound healing. *Kshara* is a para-surgical method that can be used as a debridement agent in chronic wounds. The study aimed to determine the efficacy of *Apamarga* (*Achyranthes aspera*) and *Karanja* (*Pongamia pinnata*) *kshara pichu* in the management of chronic wounds. Study design was randomized, parallel-group, and comparative clinical research. Research is ongoing at the surgery Out Patient Department and In Patient Department of National Ayurveda Teaching Hospital, Borella, Sri Lanka. The microbial content is evaluated as a part of the study. Wound Swab Culture using Levine technique was done at a reputed laboratory before and after the treatment to detect the behavioural pattern of bacterial flora. Analyzed 28 swab culture reports of 14 patients with chronic wounds before and after the treatment. Bacterial species including *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Coliform* bacteria were detected before the treatment. Among those gram-negative *Pseudomonas* species was the commonest bacteria (57%) detected in chronic wounds. After the treatment *Coliform*, *Staphylococcus*, and *Streptococcus* bacteria were detected among those *Staphylococcus* was the commonest (50%). It was observed that gram-negative bacteria in wounds were associated with more pain and tenderness. Both *pichus* were effective in a significant reduction in bacterial colonization and had better compliance in the case of gram-negative bacteria. It was observed that *Coliforms* were detected in most of the patients admitted to the ward and disinfection should be optimized to avoid contaminations. The *Streptococcus* colonization has been detected in a single case and surface hygiene of the clinic and the instruments should be maintained to avoid such growth. Longitudinal studies employing serial sampling are needed to appreciate the role of the dynamic bacterial community in chronic wound healing.

**Keywords:** *Bacterial flora, Chronic wound, Apamarga and Karanja kshara pichu*

## **Development of novel herbal cosmeceutical product and evaluation of its safety and efficacy on hair growth: A study protocol**

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The hair loss has been shown to negatively impact both self-esteem and self-image and it reveals that, women are more influenced psychologically by hair loss. Herbal extracts or natural products to attenuate hair loss or enhance the hair growth has gained popularity recently. The hair care products such as hair growth enhancers, hair conditioners, etc. are now being marketed as containing natural components to prevent hair loss. The present study aims to develop a novel herbal cosmeceutical product and evaluate its efficacy and safety. The first phase of the study is the development of hair oil using a novel herbal formula and the standardization and quality control of the product. The second phase is consisted with the randomized open label clinical trial in hair loss individuals. The efficacy of the product on hair growth will be evaluated following the skin sensitivity test by the hair pull test, hair comb test, daily hair loss count and qualitative and quantitative growth of the hair by using the hair analyzer. Study duration will be for 28 days and the guidelines will be provided for the participants for obtaining the successful outcome with minimal personal errors. Follow up will be done for one month of period. Expected outcome of the study protocol will be the mean difference in the qualitative and quantitative growth of hair and the management of the hair fall rate. Hence, the present study will be the first to evaluate the efficacy of the novel herbal formula and to evaluate the efficacy of hair growth using the given study protocol. The successful outcome of the study will be beneficial in the development of quality controlled safer cosmeceutical product for hair growth by clinically validating for its efficacy.

**Keywords:** *Study protocol, Hair growth, Herbal product*

## Systematic review on Ayurveda management of anemia in children

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Ayurveda describes *Pandu roga* as one of the "*Varnopalakshita roga*," or diseases indicated by a change in color, and it is characterized by changes in skin color to *Shweta*, *Peeta*, *Harita*, etc. Due to the similarities in clinical signs and symptoms, the Ayurvedic illness of *Pandu* and the anemia described in modern medicine can be associated. In society, *Pandu roga* is a relatively common condition, and Sri Lanka has also been affected by it. The Jadad scoring system is a tool for objectively assessing the methodological quality of a clinical trial. The Jadad score served as the "gold standard" for assessing the methodological excellence of investigations. This recognized rating ranges from 0 to 5. The three crucial methodological components of blinding, randomization, and patient accountability, including withdrawals, are used to evaluate studies. Range of Score Quality, 0–2 is Low and 3–5 is high. The aim of this study is to assess the quality and standard of the Research study conducted on Ayurveda management of anemia in children. Data has been collected from Ayurvedic texts, Research Journals, and electronic databases; PubMed, and Google Scholar using '*Pandu roga*,' 'Anemia in Children', and 'Ayurveda Management' as keywords. Research articles on clinical studies published between 2012-2022 were screened initially. Related to Ayurveda Management on Anemia; 5 national types of research and 16 international pieces of research were found and Jadad Score was applied to 10 types of research that fulfill the inclusion criteria. Among them 2 studies scored 0, 4 studies scored 1 mark only, 1 study scored 2 marks, 1 study scored 4 marks and 2 studies scored 5 marks. The range of Score is low in 7 studies, only 3 studies showed high in assessing the quality and standard of the Research study. It can be concluded that more standardization is required when designing future studies on the topic to maintain quality and accuracy.

**Keywords:** *Systematic review, Anemia, Pandu roga, Jadad scoring system*

## Comparative study of the antioxidant capacity of *Rathkaralheba*, *Hatavariya* and *Triphala* tablets

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Antioxidants can prevent or slow cell damage caused by free radicals. Free radicals are waste substances produced by cells. If the body cannot process and remove free radicals efficiently, this can harm cells and body functions. Factors that increase the production of free radicals in the body can be internal, such as inflammation. Piles is also an inflammatory condition and swollen collections of tissue in the anal area. Antioxidants are said to help neutralize free radicals in our body, and this is thought to boost overall health and also to help the reduction of piles also. The sources of antioxidants can be natural or artificial. Certain plants are thought to be rich in antioxidants. For piles, *Rathkaralheba* (*Cyathula prostrata*) and *Hathavariya* (*Asparagus racemosus*) are used as single drugs and *Triphala* tablets *Terminalia chebula*, *Terminalia bellirica* and *Phyllanthus embelica* are also used for control piles. In this study conducted to compare antioxidant capacity of these drugs. In this study, total polyphenolic content (TPC), total flavonoid contents (TFC), Ferric reducing antioxidant power (FRAP), Oxygen radical absorbance capacity (ORAC), 1,1-diphenyl-2-picrylhydrazyl (DPPH) assay, 2,2-azino-bis (3 ethyl benzothiazoline-6-sulfonicacid) diammonium salt (ABTS) assay in hot water extracts of *Rathkaralheba*, *Hathavariya* and *Triphala* were measured. The results revealed that, TFC (mg quercetin equivalents/ g of extracts) of *Rathkaralheba*, *Hathavariya* and *Triphala* respectively  $9.60 \pm 0.10$ ,  $5.62 \pm 0.22$  &  $7.85 \pm 0.23$ ; TPC (mg gallic acid equivalents)  $15.1 \pm 2.13$ ,  $10.23 \pm 0.60$  &  $18.65 \pm 0.32$ ; FRAP (mg Trolox equivalents)  $25.68 \pm 0.97$ ,  $5.51 \pm 0.06$  &  $1124.31 \pm 33.08$ ; ORAC (mg Trolox equivalents)  $52.29 \pm 1.58$ ,  $13.39 \pm 0.37$  &  $336.63 \pm 5.46$ ; DPPH (mg Trolox equivalents)  $4.71 \pm 0.17$ ,  $0.42 \pm 0.01$  &  $1434.19 \pm 56.17$ ; ABTS (mg Trolox equivalents)  $36.81 \pm 1.80$ ,  $6.35 \pm 0.14$  &  $1959.39 \pm 54.14$ . These results have revealed that *Triphala* has more antioxidant activity than of *Rathkaralheba* and *Hathavariya* which are used to treat piles.

**Keywords:** *Triphala*, *Piles*, Anti-oxidants, *Hathavariya*, *Rathkaralheba*

## Organoleptic, macroscopic and microscopic analysis of herbal plant materials of *Amurthashtaka kwatha*: An Ayurvedic polyherbal formulation

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Medicinal plants play a very active role in traditional medicines for the treatment of various ailments. *Amurthashtaka kwatha* is an Ayurvedic polyherbal formulation and one of the oldest and most common *kwatha* used in the treatment of fever associated with inflammation. It is made up of eight plants; bark of *Azadirachta indica*, rhizome of *Cyperus rotundus*, *Picrorhiza scrophulariiflora* and *Zingiber officinale*, seeds of *Holarrhena antidysenterica*, heartwood of *Santalum album*, Stem of *Tinospora cordifolia* and whole plant of *Trichosanthes cucumerina*. This study has focused investigations on organoleptic, macroscopic and microscopic characteristics of plant materials of *Amurthashtaka kwatha*. The Macroscopy of the authenticated plants were studied according to shape, size, colour, surface characteristics, texture and appearance of the cut surface. Organoleptic evaluation results due to an impression on organs of senses according to World Health Organization guidelines. In microscopic identity, transverse sections of the herbs were studied for the arrangement of general and specialized tissues that are specific for the particular herb. Lenticels, calcium oxalate crystals, stone cells and oil globules in *Azadirachta indica*; Tannin containing cells in *Cyperus rotundus*; Cluster of fibers in hypocotyl parts in *Holarrhena antidysenterica*; Cambium layer between phloem and xylem tissues and calcium oxalate crystals in *Picrorhiza scrophulariiflora*; Ray parenchyma with starch grains and oil globules in xylem tissues of *Santalum. album*; Sclerenchyma caps between cortex and phloem tissues as well as ray parenchyma riched with starch grains in xylem tissues in *Tinospora cordifolia*; Segmented trichomes, sclerenchyma ring and holo pith in *Trichosanthes cucumerina* and different shaped and large sized starch grains and oil globules in *Zigiber officinale* were identified as specific identification characters in each plants. This study helps to identify and authenticate the raw materials of the herbal plants as ingredients of *Amurthashtaka kwatha* in the Ayurveda medical practice. The parameters also help to standardize the crude drug and minimize the drug adulteration.

**Keywords:** *Ayurvedic, Macroscopic, Microscopic, Organoleptic and standardize*

## **The importance of healthy sleep and the impacts of insomnia on health and well-being: A systemic review**

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Sleep, often considered a passive activity, is far from being insignificant in its importance. In a fast-paced world dominated by technology and responsibilities, the value of a good night's sleep cannot be overstated. Beyond merely feeling rested, quality sleep plays a pivotal role in maintaining physical, mental, and emotional well-being. Insomnia, a common sleep disorder characterized by difficulty falling asleep or staying asleep, has significant and multifaceted impacts on health. The study aims to identify insomnia's impact on general well-being, cognitive function, and quality of life, and present it alongside with benefits of healthy sleep extracted from scholarly articles. A thorough systematic review was carried out in the databases PubMed and ScienceDirect. The keywords "Health Impacts of Insomnia" and "Health Impacts of Sleep" were employed to select studies from 2013 to 2023. Additionally, a manual search was conducted implementing the reference lists of included articles to gather additional data. Under the search keyword "Health impacts of insomnia across the literature," 224 pieces were discovered in PubMed and 227 articles in ScienceDirect. The theme "health impacts of sleep" yielded 1374 articles in PubMed and 836 listings on ScienceDirect. By searching reference lists, eleven more articles were discovered. All of the articles were manually sorted again depending on the relevancy of the present paper, and duplicates were deleted. Finally, a total of 127 publications were chosen for the present study. This systemic review explores various dimensions of insomnia's effects on physical, mental, and emotional welfare, highlighting its links to chronic conditions, cognitive function, and overall quality of life mechanisms underlying these impacts and considering potential interventions for managing and mitigating the consequences of insomnia. Understanding the benefits of good sleep can have far-reaching implications that extend beyond individual health to impact various aspects of society, including productivity, safety, education, and overall well-being.

***Keywords:*** Sleep, Insomnia, Health, Impact

## HPTLC fingerprinting of *Triphala* containing polyherbal eye drop and comparative evaluation of antimicrobial efficacy

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Eye drops are one of the most popular, convenient, and efficacious ocular drug delivery procedures compared with oral route of administration representing the treatment of choice for plenty of ocular diseases. The present study was focused on HPTLC fingerprinting of *Triphala* containing polyherbal eye drop and comparative evaluation of antimicrobial efficacy. The formula encompasses *Terminalia chebula* Retz., *Terminalia bellirica* (Gaertn.) Roxb., *Phyllanthus embelica* L, *Coscinium fenestratum* (Goetgh.) Colebr, *Glycyrrhiza glabra* L, *Curcuma longa* L. *Pterocarpus santalinus* L.f. and bee honey. It is indicated for conjunctivitis (*Ratha*), early-stage of cataracts (*Suda*), etc. The eye drop was prepared according to the standard manufacturing procedures and assessed the physicochemical and phytochemical parameters. Dichloromethane fractions of the eye drop were used to develop the TLC and HPTLC fingerprints equivalent to gallic acid and tannic acid under the Toluene: Ethyl acetate: formic acid 2:5:1.5 solvent system. In-vitro antimicrobial efficacy was evaluated comparatively with chloramphenicol and distilled water against the *Staphylococcus aureus* (ATCC 25923). Nutrient agar was used and the standard procedures were followed with three replicates. The diameter of the clear zone was evaluated. The organoleptic parameters of the eye drop were a yellowish-brown colour, characteristic odour, sweet taste, and aqueous appearance. Phytochemical screening showed the presence of tannin, saponins, flavonoids etc. and the foaming index was insignificant. pH was 3.2 and TLC ultraviolet detection visualized under  $\lambda$  254 nm and  $\lambda$  366 nm showed several spots. R<sub>f</sub> values of the HPTLC fingerprints were 0.06, 0.10, 0.59, 0.75, 0.77. Antimicrobial efficacy was significant compared to negative control and insignificant for chloramphenicol. The present study confirms its efficacy as an antimicrobial agent and these findings will have scientific validity for further research studies.

**Keywords:** HPTLC fingerprinting, Antimicrobial activity, Eye drop



## Evaluation of anti-inflammatory activity of modified topical dosage form based on Ayurveda formulation '*Anoda kola alepaya*'

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'*Anoda kola alepaya*' is a traditional Ayurveda formulation which is composed of leaves of *Abutilon indicum*, rhizomes of *Curcuma longa*, seeds of *Oryza sativa* and *Cocos nucifera* (coconut milk). The *Alepaya* is used to treat wounds and blisters on skin. The main objective of this research was to evaluate anti-inflammatory activity of modified topical dosage form based on Ayurveda formulation '*Anoda kola alepaya*', using *in-vitro* methods. '*Anoda kola alepaya*' was prepared according to the Ayurveda Pharmacopoeia of Sri Lanka. Aqueous extracts of leaves of *Abutilon indicum*, rhizomes of *Curcuma longa*, seeds of *Oryza sativa* and *Cocos nucifera* (coconut milk) were prepared using the traditional decoction method. Anti-inflammatory activity of '*Anoda kola alepaya*' and its ingredients were evaluated individually using egg albumin denaturation assay. The reference drug used was diclofenac sodium. A cream was prepared, incorporating freeze-dried plant extracts and physical observations were made for a period of three months at 8°C, 25°C and 40°C. Formulated cream was evaluated for physical appearance, pH, spreadability, centrifuge testing and freeze thaw test. Anti-inflammatory activity of prepared cream was compared against the commercially available diclofenac sodium gel. Statistical analysis was performed, using SPSS version 26. '*Anoda kola alepaya*' and its ingredients demonstrated significant anti-inflammatory effects ( $p < 0.001$ ) except extracts of *Oryza sativa* and *Cocos nucifera*. Diclofenac sodium, demonstrated an  $IC_{50}$  value of 529.4 mcg/ml, while '*Anoda kola alepaya*' exhibited  $IC_{50}$  value of 318.7 mcg/ml. Individual ingredients extracted from *Abutilon indicum* and *Curcuma longa*, had  $IC_{50}$  values of 460.4 mcg/ml and 672 mcg/ml respectively. Commercially available diclofenac sodium gel and the formulated cream have exhibited  $IC_{50}$  values of 535.5 mcg/ml and 351.4 mcg/ml respectively. Formulated cream was stable throughout three months at 8°C, 25°C and 40°C. Formulated cream using the ingredients of '*Anoda kola alepaya*' has exhibited potent anti-inflammatory activity.

**Keywords:** *Abutilon indicum*, Anti-inflammatory, *Curcuma longa*, *Cocos nucifera*, *Oryza sativa*

## Development of *Triphala*-based rejuvenating syrup

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*Department of Ayurveda Pharmacology, Pharmaceutics and Community Medicine, Faculty of Indigenous Medicine, University of Colombo, Sri Lanka.*

Generally, herbal syrups are prepared using infusions or decoctions concentrated with sugar solutions. Syrups are more palatable and convenient in comparison to other dosage forms especially used in pediatric and geriatric care. Present study was conducted to develop a syrup using *Triphala* (*Terminalia chebula*, *Terminalia bellirica* and *Phyllanthus emblica*) as a polyherbal formulation. The syrup was developed with the decoction prepared with *Triphala* in the ratio of 1: 2: 4 which is mentioned under *Triphala Rasayana* that provides rejuvenating effect. The decoction was prepared according to the traditional method and concentrated into a syrup with required amount of sugar according to the *Paribhasha* of *Sharbath* (*Sharkara*). Organoleptic properties and major physicochemical characteristics including ash content, brix value (TSS) and pH were assessed for the herbal syrup. The ethyl acetate fraction of the syrup was evaluated for its phytochemical parameters and chromatographic profile. Solvent system for the chromatography consisted toluene, ethyl acetate and formic acid in the ratio of 2: 5: 1.5. Developed herbal syrup was reddish brown in colour, viscous in texture with characteristic odor and astringent-sweet taste. Obtained results for Total ash, brix value (TSS) and pH were  $048\pm 0.04\%$ , 79% and 3.14 respectively. Phytochemical screening of the ethyl acetate fraction of the syrup revealed the presence of carbohydrates, reducing sugars, phenols, flavonoids, tannins, alkaloids and saponins. Chromatographic profile showed four (04) peaks for ethyl acetate fraction of the syrup, under the wave length of 254nm and one (01) peak under the wave length of 366nm. It is concluded that the results obtained from phytochemical screening, physicochemical evaluation and chromatographic profile can be used as standardization parameters for the developed rejuvenating syrup based on *Triphala*.

**Keywords:** *Rejuvenation, Sharkara, Brix, Chromatography*

## Standardization of polyherbal decoction used in allergic rhinitis

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Decoction is a liquid dosage form which used commonly in Ayurveda and Traditional medicinal system of Sri Lanka. *Tamalakyadi* decoction is a poly herbal formulation used for the treatment of allergic rhinitis, Asthma and cough conditions. Standardization and quality control are essential procedures to ensure the safety and efficacy of quality herbal preparations. Due to the absence of scientific findings on standardization of *Tamalakyadi* decoction, this study was designed to analysed standard parameters of *Tamalakyadi* decoction to confirm purity and quality. This decoction is mentioned in Sarasankshepaya and contains 12 plant ingredients. Raw materials were standardized according the World Health Organization guidelines and three batches of decoctions were prepared as per standard procedures. Prepared decoctions were evaluated for organoleptic, physico-chemical, phytochemical and chromatographic parameters. Results of the raw material standardization were comparable with the values mentioned in Ayurveda pharmacopeia of India and Sri Lanka. Values of heavy metals analysis and microbiological analysis of 12 plant materials showed that the results are within the limits according to World Health Organization guidelines. Organoleptic evaluation of the decoction revealed that it was bitter in taste, dark brown in colour and had characteristic odour. The specific gravity of the decoction found to be 1.056 for all 3 batches and mean pH was 4.6 (1% solution). TLC fingerprint profile was developed for the dichloromethane fraction of *Tamalakyadi* decoction using dichloromethane, ethyl acetate and cyclohexane in a ratio of 3:0.5:1.5 v/v. The plate was visualized under UV radiation (both 254 nm and 366 nm). HPTLC profile was observed bearing Rf values of 0.12, 0.32, 0.43, 0.59, 0.70, and 0.93 (at 245 nm). This standardization study helps to authenticate and evaluate the quality and purity of the raw materials of *Tamalakyadi* decoction and developed HPTLC fingerprint pattern and other quality parameters can be used as standard references for quality control of *Tamalakyadi* decoction.

**Keywords:** *Tamalakyadi decoction, quality control, Standardization*

## Role of Ayurvedic and Traditional management of *Khanja* (pyriformis syndrome): A case study

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*Khanja* is a disease that contracts the tendons of thighs manifested by *Vata dosha* localized in the waist with functional deficit. It greatly impacts the quality of life of the patients and becomes lame according to Ayurveda. The study has been focused to manage the *Khanja* disease based on the treatment principles mentioned in Ayurveda and Traditional medicine. A thirty-two-year-old female patient diagnosed as *Khanja*; presented with shooting pain (*Shoola*), stiffness (*Sthabdata*) of the hip joint and restricted movement in the right lower limb since 2 years was reported to the In Patient Department, Department of *Kayachikitsa*, National Ayurveda Teaching Hospital, Borella was selected to the study. The treatment period was twenty eight days. The intensity of the pain was assessed by visual analogue scale (VAS) while stiffness and restricted pain was assessed using the mcgill pain questionnaire scale before and after treatment regimen. During the treatment, the patient was advised to take 120 ml of *Simhasya panchamuli kashaya*, 500 mg *Tryodashanga guggulu* two times per day after meals and 250 mg *Kuchila vati* nocte after meals as internal treatments along with *Vara koladi paththuwa* were administered as external treatments for initial consecutive fourteen days. *Maha narayana taila matra vasti* followed by *Vara koladi paththuwa* carried out for next fourteen days. After completion of the treatment; it has observed that 80% of pain (*Shoola*) and 90% of stiffness (*Sthabdata*) were relief while the restricted movement of the right lower limb was completely cured. The anti-inflammatory and analgesic action of *Vara koladi paththuwa* showed the significant relief of pain. In view of the above; it can be concluded that the therapeutical protocol is effective in the management of the disease of *Khanja* and further clinical studies with larger samples are needed for generalized it findings.

**Keywords:** *Khanja, Ayurveda, Traditional, Matra vasti, Vara koladi ppaththuwa*

## **Impact of patterns and practices of consumption according to Ayurveda and Sri Lankan Traditional Medicine to nutritional well-being among the school children in selected school**

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Ayurveda and Sri Lankan traditional medicine (SLTM) describe dietary patterns to maintain health. Modern science also proves the benefits of some food consumption methods mentioned in Ayurveda and SLTM. WHO recommends the Body Mass Index (BMI) as a biomarker of nutritional assessment. Hence, identifying the impact of healthy food consumption practices per Ayurveda and SLTM to nutritional wellbeing is important to deciding of lifestyle modifications in emerging health consequences. This cross-sectional study conducted among the 147 of volunteer students of 14- 15 years age group in either sex who were not having any known hereditary disorders or under any medication for chronic illnesses, from a selected school in Kaluthara District. They were subjected to an interview by administering a questionnaire consisting dietary patterns and practices of food consumption mentioned in Vriddatraya, Bhava Prakasha and Sarartha Samgrahaya. Their adherence to the recommended dietary practices per Ayurveda and SLTM has been calculated into a percentage per person using SPSS. Individual adherence above 50% is considered as individuals practicing the recommended dietary behaviors. BMI of each participant has been measured and compared with the respective result of questionnaire analyzed to obtain their adherence to the recommended dietary practices. By this, prevalence of being underweight was recorded as 22.45% and 57.75% of them were not practicing recommended food practices. Obesity and overweight were recorded as 36.05% of whole sample and 75.47% of them were not practicing recommended food practices. In both groups of underweight and overweight or obese, adhering to recommended dietary practices are below 52%. Normal BMI was recorded in 41.5% and all of them are practicing recommended dietary practices more than to 60% of adherence. The study concludes that considerable influence of practicing recommended dietary patterns and practices as per Ayurveda and SLTM to maintain the normal BMI. Further, studies with a wider scale of population are important to find needed lifestyle modifications per Ayurveda and SLTM to having maintained BMI leading to improvement of health status and prevent the emerging health consequences resultant of unbalanced nutritional status.

**Keywords:** *Ayurveda, BMI, Dietary practices, Nutritional status*

## Comparison of chemical characteristics of different compositions of *Triphala* powder in various Ayurveda authentic texts

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*Triphala* constitutes a time-honored polyherbal formulation deeply rooted in both Ayurvedic and Sri Lankan Traditional Medical practices. Various combinations of this formulation are documented in diverse Ayurveda Authentic Texts. The present study endeavors to compare the chemical characteristics of distinct compositions of *Triphala* powder as stipulated in various Ayurveda Authentic Texts. The fruits of *Harithaki* (*Terminalia chebula*)-TC, *Vibhithaki* (*Terminalia bellirica*)-TB, and *Amalaki* (*Phyllanthus emblica*) -PE were procured from the local market and authenticated. The ingredients were cleaned, washed and desiccated. The resultant dried materials were finely pulverized, yielding five samples, S<sub>1</sub> (1:1:1), S<sub>2</sub> (1:2:3), S<sub>3</sub> (1:2:4), S<sub>4</sub> (1:2:2) for the powders of TC:TB:PE respectively and S<sub>5</sub> – 1:2:4 for the fruits of TC:TB:PE, in accordance with the specified compositions documented in authentic Ayurvedic texts. Ethanol extracts were meticulously prepared from 5.0g of each sample, using Soxhlet apparatus. A comparative analysis was conducted with the High-Performance Thin-Layer Chromatography (HPTLC) of the samples against the standard solutions of Gallic acid (GA) and Tannic acid (TA) at concentrations of 2 mg/ml. The mobile phase composition was Toluene: Ethyl acetate: Formic acid (2:5:1.5). The HPTLC profiles revealed the presence of nine distinct peaks in all samples, characterized by a range of R<sub>f</sub> values spanning from 0.01 to 0.88. The R<sub>f</sub> values corresponding to GA and TA were identified as 0.88 and 0.73 respectively. The consistent comparability of R<sub>f</sub> values among all samples and standards was observed under UV illumination at wavelengths of 254nm and 366nm. Antioxidant activity was detected in all five samples and subsequently evaluated using the 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay. Based on the comprehensive evaluations conducted, the chemical characteristics of different compositions of *Triphala* powder were found to be similar. It is recommended that future research could be done on bioactivity studies to assess the therapeutic efficacy of different compositions of *Triphala* powder based on Ayurveda Authentic Texts.

**Keywords:** *Triphala* powder, Compositions, Chemical characteristics, Ayurveda Authentic texts, HPTLC

## Comparative study of physicochemical parameters on different *Kadali kshara* samples from *Musa paradisiaca* plant

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*Kshara Karma* is one of the most commonly practiced methodologies among Ayurveda physicians, due to the therapeutic potential and the advantages of *Kshara*, *Kadali Kshara* is one of the most common *Kshara* and at present, it was found that different parts of *Kadali* plant (*Musa paradisiaca*) have been used by the manufacturers to prepare the *Kadali Kshara*. Therefore, the present study aimed to evaluate the differences among *Kshara* prepared using different plant parts of *Musa paradisiaca* and to scientifically validate the usage part for the *Kadali Kshara*. *Kshara* was prepared from samples of *Kadali Kanda* (corm), *Kadali* stem and leaves, *Kadali Vahalla* (stalk), and the whole plant separately for analysis as mentioned in the authentic. The one-way ANOVA followed by post hoc test, Games-Howell was used to analyze the results. Results were expressed as mean  $\pm$  SE;  $P < 0.05$ . The organoleptic properties of the samples indicated similarities among the samples such as white color, characteristic odor, salty taste, powder appearance, and slimy touch, while physicochemical parameters revealed distinct characteristics. *Kshara* prepared from *Kadali Kanda* exhibited the highest pH ( $11.2467 \pm 0.012$ ). *Kadali Vahalla* had the highest density ( $1.01250 \pm 0.013 \text{ g/cm}^3$ ), total ash ( $99.9 \pm 0.0112 \%$ ), and acid insoluble ash ( $5.3959 \pm 0.01\%$ ), water insoluble ash ( $4.16 \pm 0.03$ ) while *Kadali* stem and leaves demonstrated the highest water-soluble ash ( $98.47 \pm 0.01 \%$ ). Based on the data the *Kadali Kanda* showed the highest pH value with the aspect of the therapeutic application. However, other specific laboratory tests, pre-clinical and clinical trials are further required to confirm the efficacy and potency of the different parts of the *Kadali* plant.

**Keywords:** *Kadali kshara*, Standardization

## Comparative quality evaluation on branded *Triphala* tablets in Ayurveda drug market of Sri Lanka

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At present, the market of all commodities has become global and standardization is essential to guarantee the quality of products. *Triphala* is a well-known poly-herbal formula consisting of pericarps of fruits of *Terminalia chebula*, *Terminalia bellirica* and *Phyllanthus emblica*. The objective of this study was to comparatively evaluate the quality of four different branded *Triphala* tablets (A, B, C, D) and one capsule (E) available in Ayurveda drug market of Sri Lanka. All the brands were purchased from Ayurveda drug market and assessed for organoleptic, physical, chemical and pharmaceutical parameters. Results revealed that loss on drying at 105<sup>0</sup>C of all brands were below 10%. Total ash values (5.4%, 5%, 3.3%, 5.7%, 4.9% respectively) were above the standard limit of 2%. Water soluble ash (0.9%, 2.4%, 1.6%, 2.7%, 1.2%) and acid insoluble ash (2.5%, 2%, 1.9%, 2%, 1%) values were assed. Water soluble extractive values (7.35%, 13.08%, 20.03%, 11.28%, 8.18%) were higher than alcohol soluble extractive values (7.25%, 12.23%, 13.48%, 9.7%, 8.15%) in all brands. Only A and C passed the weight variation test. Friability of A, B and C were below standard limit of 1% indicating that friability is normal. Only the disintegration time of A was below the standard limit of 15minutes. Hardness ranged from 172N to 503N. Ethanolic extracts of all were positive for tannins, flavonoids, phenols, steroids, glycosides and carbohydrates and negative for alkaloids, terpenoids and proteins. Only C was positive for saponins. Thin layer chromatogram (Toluene: Ethyl acetate: Formic acid/3:5:1) showed similar patterns for all brands. HPTLC fingerprints of all brands were similar in terms of number of peaks and their intensity, except tablet C with four additional peaks in the HPTLC. Results can be concluded that, as there is a considerable variation in physical and pharmaceutical parameters of all brands, it is urgent to maintain common standardization parameters in Ayurveda drug market.

**Keywords:** *Triphala, Standardization, Physical parameters, Pharmaceutical parameters, HPTLC*



**National Institute of Library and  
Information Sciences (NILIS)**

**University of Colombo**



**06<sup>th</sup> International Research Symposium**

***“Research Excellence in  
Library & Information Science”***

**15<sup>th</sup> November 2023**

## MESSAGE FROM THE DIRECTOR AND SYMPOSIUM CHAIR

**Dr. Pradeepa Wijetunge**

National Institute of Library and Information Sciences (NILIS)  
University of Colombo



The Annual Research Symposium of NILIS is a significant component of the series of annual symposia of the University of Colombo. This year, we selected the theme “*Research Excellence in Library & Information Science*” in conformity with the main theme of the university symposium, “*Research Excellence and Beyond*”. This symposium is unique because it is the first time a full symposium is dedicated for research in Library and Information Science in Sri Lanka. We strongly believe that the opportunity will generate a timely discourse on the contemporary issues and concerns of the LIS research in Sri Lanka. In keeping with the tradition, some select abstracts are presented here, while the complete volume of the NILIS symposium will include all national and international abstracts presented.

I am thankful to the Chief Guest, Vice-Chancellor of University of Colombo, Senior Prof. H.D. Karunaratne for his valuable leadership, and to the Keynote Speakers Senior Prof. Premakumara De Silva, Member of the UGC, Sri Lanka and the Chairman of the Board of Management of NILIS, Dr. David Prosser, Executive Director of Research Libraries UK (RLUK) and Dr. Rajesh Singh, Librarian, University of Delhi, India for gracing this occasion and their immensely inspirational addresses. I am also thankful to Prof. Tharusha N Gooneratne, Chairperson of the ARS 2023 for her constructive guidance, and to all invited international and national speakers, to all the presenters, and to NILIS Graduate Student presenters for their remarkable presentations, to the Acting Librarian Mrs. Sajeewanie D. Somaratna, and all the academic staff of NILIS and the university library for their extensive support, visiting staff of NILIS, the reviewers, and the other staff lead by the Senior Assistant Registrar Mr. J. Wipularathne and the Acting Senior Assistant Bursar Mr. Charitha Bandara for their continuous dedication and commitment to NILIS. I wish a very successful symposium.

## MESSAGE FROM THE CO-CHAIRS

### **T. Ramanan**

*Senior Assistant Librarian*

*Faculty of Technology, University of Colombo*



### **Dr. Chiranthi Wijesundara**

*Senior Assistant Librarian*

*Library, University of Colombo*



Symposia are great platforms to share and bring new ideas amongst the likeminded professionals; hence such events strengthen the bondage between seekers and receivers of knowledge. In this vein, it is our great pleasure to co-chair this International Research Symposium of the National Institute of Library and Information Science (NILIS) held on 15<sup>th</sup> November 2023. Every year NILIS invests into creating such an academic atmosphere for the young researchers and incumbent librarians to listen to experienced local and overseas veteran librarians and scholars with a wide spectrum of interests in librarianship. This year, the theme of the research symposium is “*Research Excellence in Library & Information Science*” that connotes the undisputed explorations happening in the field of librarianship across the country. Nevertheless, the symposium has invited a number of delegates from around the world to share their thoughts and experience. The talks and presentations have been accommodated in various sub-themes such as research impact, data management, research ethics, informetric, digital technologies and sustainable development goals. We are honoured and thrilled to have worked towards the success of this event under the patronage of Dr. Pradeepa Wijetunge, the Director of NILIS, University of Colombo and the Chair of the symposium. We thank every contributor and participant of the symposium and wish everyone a fruitful engagement.

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## PROGRAMME

<b>Agenda</b>	
08.30 am	Registration
09:00 am	Inauguration of the 06 <sup>th</sup> International Research Symposium- NILIS
	National Anthem
9.15 am	Welcome Address by the Director, NILIS and Conference Chair Dr. Pradeepa Wijetunge
9.25 am	Address by the Chief Guest Senior Professor (Chair) H.D. Karunaratne Vice Chancellor, University of Colombo
9.40 am	Introduction of the Keynote Speakers
9.45 am	Keynote I: Academic libraries in the digital age? an overview By: Senior Prof. (Chair) Premakumara De Silva
10.15 am	Keynote II: Building strength through collaboration: the role of research libraries UK in supporting our members By: Dr. David Prosser
10.45 am	Keynote III: Measuring research productivity and impact: tools and techniques By: Dr. Rajesh Singh
11.15 am	Vote of Thanks By: Conference Co-Chairs
	<i>Tea Break</i>
11.45 am	Session I: Invited Speakers Global Trends in LIS Research
1.30 pm	<i>Lunch Break</i>
2.00 pm	Session II - LIS professionals from Sri Lanka
	Session III- NILIS Graduate Student Session
5.00 pm	End of the Symposium

## INTRODUCTION TO THE KEYNOTE SPEAKER I

### **Senior Prof. (Chair) Premakumara De Silva**

*Department of Sociology*

*University of Colombo*

*Member of the UGC, Sri Lanka*

*Chairman of the Board of Management/ NILIS*

*University of Colombo*



Professor Premakumara de Silva received his B.A. (Hons) and M.A. in Sociology from the University of Colombo and MSc and PhD in Social Anthropology from the University of Edinburgh, UK. He has won several prestigious international fellowships and awards including British Academy, American Academy of Religion, Sir Radcliffe-Brown and Sir Remond Firth Fellowship of Royal Anthropological Institute in the UK, Award of Commonwealth Countries of University of Edinburgh (Sir Ernest Cassel Award), Overseas Research Student (ORS) Award from the Committee of UK Vice-chancellors, and Wenner-Gren Foundation for Anthropological Research in New York.

In 2016, Prof. de Silva won the Vice Chancellor's award for best researcher at the Faculty of Arts, University of Colombo, and the Senate Awards for best researcher in 2017 and 2018. In 2018 he won the most prestigious CVCD (Committee for Vice Chancellor's and Directors) Excellence Award for the most outstanding senior researcher in the field of Humanities, Aesthetic and Social Sciences in Sri Lanka. In the same year he also won the State Literary Award for the best academic book translated.

He is a prolific writer who has published with reputed publishers and currently holds several positions; Chair Professor of Sociology at University of Colombo, member of University Grants Commissions, and the Chairman of several UGC Standing committees including Social Sciences and Humanities, Education, Fine and Visual Arts, Library and Information Science, and Social Reconciliation. Prof. de Silva is also the Chairman, Board of Management of National Institute of Library, and Information Science at University of Colombo.

## **ABSTRACT OF THE KEYNOTE ADDRESS I**

### **Academic libraries in the digital age? an overview**

**Senior Prof. (Chair) Premakumara De Silva**

Libraries provide access to a wide range of digital resources, including e-books, online databases, and other digital materials that are not available elsewhere. One of the primary roles of libraries in the digital age is to provide access to a wide range of digital resources. Libraries can provide access to digital resources, technology training, and programs that help people develop the skills they need to navigate the digital world effectively and ethically. It will also enhance the availability of e-resources for digital research and publication. Digital age characterized by efficient graphical user interface, digital imaging, efficient transfer, and storage of texts, is presenting important challenges for the libraries. Information privacy, copyrights, and information security are some of the challenging issues faced by libraries in the digital age. Digital libraries are collections of online resources that can help you access, organize, and share information for your research and learning goals. Over the Internet platform, academic libraries are able to set up web-oriented information resources and services, such as Ask-a-Librarian, Bibliographic Instructions, Computerized Library Catalogues, Distance Learning Services, e-Government Information Resources, Information Literacy Programmes, Instant Messaging (IM). They can include books, journals, databases, multimedia, and more. Therefore, my talk will be mainly focused on academic libraries in the digital age while focusing on the challenges and their adoptability in the fast growing field of digital libraries.

## **INTRODUCTION TO THE KEYNOTE SPEAKER II**

### **Dr. David Prosser**

*Executive Director*

*Research Libraries UK*

*PO Box 3671*

*Stoke-on-Trent, ST8 9BL*

*United Kingdom*



Since March 2010 David Prosser has been the Executive Director of RLUK, the representative body for the UK's leading research libraries. Before moving to RLUK, he was, from 2002, the founding Director of SPARC Europe, an alliance of over 110 research-led university libraries from 14 European countries advocating new models of scholarly communication. Previously, he spent ten years in science, technical, and medical journal publishing for both Oxford University Press and Elsevier Science. During this time, he was involved in all aspects of publishing from production through to editorial and financial management of journals. Before becoming a publisher, he received a PhD and BSc in Physics from Leeds University, UK.



## ABSTRACT OF THE KEYNOTE ADDRESS II

### **Building strength through collaboration: the role of research libraries UK in supporting our members**

**Dr. David Prosser**

Collaboration and cooperation are deeply embedded features of library communities. And Library Associations are often the vehicle through which that collaboration and cooperation is organised. Regional, national, and international associations; associations based on library type, from public, through university to business; and associations ordered by subject – art libraries, legal libraries, science and technical libraries, etc. Many libraries will be members of multiple associations as their interests cover a range of areas – a complex Venn Diagram of overlapping connections and networks.

Research Libraries UK (RLUK) is one such library association. RLUK represents the most significant research libraries in the United Kingdom and the Republic of Ireland. These are libraries that have exceptional research collections, and which provide superb services to enable researchers to undertake their work. The majority of our members are the libraries of leading universities (including all of the UK's Russell Group of universities). However, we also have the UK's national libraries as members, together with the Wellcome Trust.

The role of RLUK is to bring our 39 members together around the issues that affect them; to represent their collective voice; advocate on their behalf; and to support them as they face shared challenges. This presentation will describe how RLUK fulfils this role, with a focus on the current RLUK strategy: *Transforming the Library*. Through consideration of the strategy, the way in which UK research libraries collaborate and cooperate will be discussed.

## INTRODUCTION TO THE KEYNOTE SPEAKER III

### **Dr. Rajesh Singh**

*University Librarian*

*University of Delhi*

*Delhi, India*



Dr. Rajesh Singh, a Gold Medalist from Banaras Hindu University, Varanasi, has served various organizations in different professional capacities. He has served Indian School of Mines, Dhanbad, MJPRohilkhand University, Bareilly, and Dr. RML Avadh University, Faizabad before moving to University of Delhi. His areas of interest and specialization include Information Literacy and Competency, WWWResources, Online Information Retrieval Techniques, Meta/FederatedSearching, Academic Integrity, Citation Analysis Databases and ResearchMetrics including Impact Factor and h-Index, etc. He has delivered invited lectures and keynote addresses in various national and international seminars, conferences, workshops, orientation courses, refresher courses, and other faculty development programs. He has authored two books and published widely in reputed national and international journals, seminars, and conferences. Dr. Singh is the recipient of ILA- Gidwani-Deshpandey best Academic Librarian Award in 2019. He has recently been conferred with “Best University Librarian Award” by COLLNET in 2022 at the 16<sup>th</sup> International Conference held at Chulalongkorn University, Bangkok, Thailand.

## **ABSTRACT OF THE KEYNOTE ADDRESS III**

### **Measuring research productivity and impact: tools and techniques**

**Dr. Rajesh Singh**

Research and publications have witnessed exponential growth in the networked digital information environment. The numbers of research publications are increasing day by day in all the disciplines across the world. There has always been a practice to measure the research productivity and impact of scientists and scholars. From total number of publications to total number of citations for all publications and further average number of citations per publication, the academia has devised many systems to judge the productivity and impact of research publications.

Many new concepts and indexes have been developed to measure the research productivity and impact of scientists and scholars in the new information environment. These are commonly known as 'Research Metrics'. It is the quantitative analysis of scientific and scholarly research outputs and their impacts. It includes a variety of measures and statistical methods for assessing the quality and broader impact of scientific and scholarly research, as well as to track researcher impact. It measures impact and provides insight into the influence of specific journal publications, individual articles, and authors. The presentation will discuss the techniques, features, advantages and limitations of Impact Factor and h-Index.

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## **Examining the use of the Delphi research method to advance research in library and information science**

Prasanna Ranaweera

*National Institute of Library & Information Sciences, University of Colombo, Sri Lanka*

Greek mythology, which is linked to the capacity to see into the future, is where the word Delphi originated. The Delphi method is a blend of qualitative and quantitative methods that develops concepts and future forecasts using the opinions of expert panelists. The Delphi technique, which enables getting the most reliable consensus of a group of experts by a chain of concentrated surveys combined with controlled feedback, was reportedly utilized in research at the RAND Corporation as early as the 1950s. Researchers in the social sciences and information and communication technologies frequently use the Delphi approach. This method avoids direct interaction between the expert panelists by utilizing multiple rounds of anonymous questioning of specialists. Due to its adaptability and utility, the Delphi approach has been used in many disciplines. The following are the primary attributes of the Delphi research method: 1. Panelists are kept anonymous; purposeful or reputational sampling is utilized; 2. Having at least two rounds; 3. Distributing comments on the responses; 3. Open-ended or literature-based round one questions; 4. Round two consensus building based on round one results; 5. Round three 5-point Likerttype survey. The final verdict is reached using statistical evidence. The study's validity and reliability are upheld by selecting the right number of panelists. 15 to 20 people are taken into consideration if the panel is homogeneous. If the group is heterogeneous, more people are taken into account. At the same time, the Delphi technique consistently yields a collective decision. Agreement on the items by over 75% of the participants in the second round or later can be considered as the final agreement. The measurements of central tendency (means, median, and mode) and degree of dispersion (standard deviation) are the statistics employed in Delphi investigations to display data regarding the group agreements of respondents. Thematic investigation and content analysis are both important elements in the research process according to the Delphi approach. Delphi's analytical techniques enable a deeper comprehension of the collected data and aid in identifying important trends and topics. In summary, the Delphi research method can be a valuable research tool in Library and Information Science, particularly when addressing complex, forward-looking, or controversial issues. When used appropriately, it can provide insights and consensus from experts to inform decision-making, planning, and policy development in the field.

**Keywords:** *Delphi method, research, library and information science*

## **Impact of open book examinations in online mode on student's performance: some observations**

Uditha Alahakoon and J.A.Wipularatna

*National Institute of Library & Information Sciences, University of Colombo, Sri Lanka*

Covid-19 pandemic compelled the National Institute of Library and Information Sciences (NILIS), University of Colombo to offer its education programs and the examinations in the online mode using the Learning Management System (LMS) and WhatsApp Groups. Of the programs, Diploma in School Librarianship (DSL) at SLQF Level 3, has the highest number of students, covers eight subjects with 30-hours of classroom contact hours for each module. LMS is used extensively for the teaching and learning process and the examinations were held in online open-book mode. Each question paper consists of eight questions of which the students have to answer any five, within a three-hour period. Twenty marks are allocated to each question. Despite the open-book nature of the examinations, it was evident that the students' results are mediocre. The objectives of this study were to analyze the marks gained by the students, and to identify the significant characteristics of the answer scripts. The study is expected to help understanding the answering pattern and to help improve the teaching/ assessment strategies and guidance, in order to stimulate better examination results. The candidates (58) of the Information Literacy paper of the 2020/2021 cohort of the DSL were the study population. Data was collected through an in-depth content analysis of the answer scripts, and interviews with the teachers/ evaluators of the module. The majority (77%) have written elongated answers for the first two questions they have answered, and relatively short answers for the next three questions. This illustrates a problem of time management across the questions, 15% have not answered five questions, as required, but a lesser number. Though they were allowed to use their notes and books, it was not evident that they had exploited them to provide quality answers, 8% have written factual details successfully but not the analytical part of the questions, and 8% have been able to develop their own writing style. Interviews with the lecturers revealed that this could be due to the poor direct interaction between students and lecturers throughout the semester. Based on the findings it can be concluded that the open book examinations model is not the ideal method for the DSL program, because the students need more support through direct contacts in time management and analytical answering skills at the examinations despite the online guides provided. It is recommended to provide more direct support in developing their examination answering skills, to augment the written guidelines and video clips already provided. It is also recommended to invite the students to NILIS for at least one or two on-site sessions to motivate and have individual discussions with the lecturers about their teaching/learning issues.

**Keywords:** *open-book examinations, online examinations, online learning, analytical writing skills*

## Attention on ChatGPT research in Sri Lankan media

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<sup>1</sup>*National Institute of Library and Information Sciences, University of Colombo, Sri Lanka*

<sup>2</sup>*Maldives National University, Maldives*

ChatGPT has gained significant attention in Sri Lanka over the past few months. However, there is a lack of understanding of which types of publications are more likely to mention research on ChatGPT. By understanding which types of publications are more likely to give attention to trending topics, researchers can better understand the dynamics of attraction to their work. It also offers insights into media behavior and biases. To analyze which Sri Lankan media frequently mentioned ChatGPT, Altmetric Attention Scores (altmetric.com) were used. A search on the Altmetric explorer was conducted on 14 August 2023. Mentions were categorized into articles and news mentioned in social media, and articles and news mentioned in news stories. Descriptive analysis was applied to these categories for comparison. Accordingly, from among all social media, only 'Twitter' (now 'X') was mentioning ChatGPT news and research within the Sri Lankan context. Other social media such as Facebook and LinkedIn have no mentions. Although ChatGPT and related research have gained significant attention in Sri Lanka's media, the outlet "nation.lk" is noticeable. This indicates a high level of interest in AI and machine learning technologies in the country. On the contrary, the number of outlets interested in the topic is very low. Average scores for articles mentioned in Tweets and news stories were 2505.45 and 1787 respectively. News stories about ChatGPT that are in a 'News' format have the lowest average score (446.4). It reveals that the highest Altmetric Scores are with articles shared on Twitter. Articles mentioned in news stories also gain a high score. On the contrary, news stories in a 'News' format have lower scores. This concludes that research on trending topics is highly mentioned on Twitter, followed by research discussed in news stories. However, news on these topics is not attractive as such. Therefore, media and researchers may focus on promoting research articles via social media to maximize reach and impact. The low average score for news stories in the 'News' format suggests a need for re-evaluation. Tweeting snippets or highlights from the articles that are covered in news stories may boost overall attention.

**Keywords:** *altmetrics, ChatGPT, Sri Lanka, news, social media*

## University libraries and Sustainable Development Goals (SDGs): a global perspective on practices and contributions

Sivalingam, K.<sup>1,2</sup> and Gamage, R.C.G.<sup>1,3</sup>

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<sup>2</sup>*Trincomalee Campus, Eastern University, Sri Lanka*

<sup>3</sup>*Maldives National University, Male, Maldives*

This research highlights the integral role of university libraries globally in advancing the United Nations' Sustainable Development Goals (SDGs), showcasing their strategies, initiatives, and contributions to sustainable development. The specific strategies and contributions of university libraries towards SDGs remain ambiguously documented and understood, necessitating a focused exploration. This research bridges the knowledge gap by detailing university library practices related to SDGs, providing vital insights for academic institutions and policymakers, and emphasizing libraries' pivotal role in driving sustainable development agendas and community awareness. The primary objective was to illuminate the role of university libraries in advancing the SDGs. A Qualitative mixed method was used to address the research questions of libraries' SDG integration, and tangible contributions. Data sources comprised academic journals and authorized institutional websites, with 74 pertinent articles analyzed from an initial pool of 103. A limitation was the study's primary dependence on available literature and website content, which might overlook certain unrecorded practices or nuanced SDG initiatives. Findings established that the university libraries globally are actively embedding SDGs into their regular functions, strategic plans, and community outreach, and five core themes define their initiatives: capacity building and partnership, access and inclusion, environmental responsibility, innovation, and ethics. Contrary to initial perceptions, libraries significantly contribute to all SDGs, including sustainable agriculture, water conservation, and biodiversity. Besides regular services, they are proactive in projects, partnerships, and programs tailored to SDGs. They play pivotal roles in knowledge dissemination, research support, and fostering a culture of sustainability. Importantly, these institutions exhibit commitment through strategic alignments, stakeholder collaborations, and broad-reaching community initiatives promoting sustainable development. University libraries globally are pivotal in advancing SDGs through integrated operations and outreach, however, SDG reporting by Sri Lankan Universities is lacking. They should intensify collaborations with stakeholders, update SDG strategies, prioritize underrepresented SDGs, boost awareness programs and share best practices globally to optimize their contributions to sustainable development initiatives. For Sri Lanka, focused research is essential to ascertain SDG implementation within university libraries.

**Keywords:** *sustainable development goals, university libraries, academic libraries, library services*



## Formats of library material preferred by visual and performing arts undergraduates

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<sup>1</sup>*National Institute of Library and Information Sciences, University of Colombo, Sri Lanka*

<sup>2</sup>*Swami Vipulananda Institute of Aesthetic Studies, Eastern University, Sri Lanka*

<sup>3</sup>*University of the Visual and Performing Arts, Sri Lanka*

The exponential growth of resources for visual and performing arts education presents opportunities and challenges for librarians to develop effective collection development plans in academic libraries. A disciplinary investigation is needed to get a better idea of the format preferences of library material on its' user community as their preferences widely vary by discipline. It would help to make possible modifications in the current acquisition models and to build and maintain the library collection to satisfy the disciplinary needs of the users. Therefore, this study was carried out to explore the formats of library materials preferred by visual and performing arts undergraduates. A sample of 381 undergraduates was selected from the total population of three selected universities by using two stages of stratified random sampling. A structured questionnaire was administered to collect the data and analysed it through SPSS. The findings revealed that visual and performing arts undergraduates access a wide range of information materials for their learning and research development. Books (94.7%) were the most accessed materials while music scores (60.6%) were the least accessed. Correspondence analysis revealed that the type of material was significantly associated with the student's academic discipline. The discipline of drama and theater art is significantly associated with videos, journals, and reference materials ( $p < 0.05$ ) compared to other types of materials. The dance is significantly associated with videos and reference materials ( $p < 0.05$ ). The discipline of music is significantly associated with audio ( $p < 0.05$ ) while visual art is significantly associated with images ( $p < 0.05$ ). Further, they preferred to access printed books (53.9%), music scores (39.2%), and magazines (35.5%). In contrast, they prefer to access digital and online formats of journals, audio, and videos while they gave conditional preference (34.4%) to access images or artworks. Undergraduates prefer both print and e-resource collections based on availability, easy access, usage, needs and personal interest, and they want the library to acquire more performance-based digital collection. Finally, this study suggests that librarians make possible modifications to the current acquisition plan, considering the necessity for purchasing physical media collections, finding a way to use faculty materials, and educating students on the reliability, quality, and comfort level of resources freely accessible.

**Keywords:** *library materials, performing arts, resources, visual arts*

## Use of digital information resources and digital assistive devices by the undergraduates with visual impairments

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<sup>1</sup>*National Institute of Library and Information Sciences, University of Colombo, Sri Lanka*

<sup>2</sup>*Science Library, Faculty of Science, University of Colombo, Sri Lanka*

<sup>3</sup>*Faculty of Technology, University of, Colombo, Sri Lanka*

Visual impaired undergraduates (VIUs) mostly rely on digital information resources (DIR) for accomplishing academic tasks with the help of assistive devices and technologies (ADT). Despite the availability of latest technologies and devices, accessing such DIR by the VIUs was affected by many other factors. Technological improvements make digital devices more accessible to the VIUs. Accordingly, the nature of the use of DIR also changed. Therefore, it is important to investigate the use of DIR and ADT under the present circumstances that created new challenges. Previous research studies on this topic focused only on the responses of the VIUs, but finding out the observations of other related parties is equally important. This study aimed to find out the use of DIR and ADT by the VIUs and investigate the challenges faced when accessing DIR and using ADT. The study adopted a qualitative research approach and interviews were conducted to collect data. The study population (n=77) was the VIUs in three state universities in the Western Province of Sri Lanka. Additionally, selected teachers of VIUs, and library and special center staff who support them were interviewed. Descriptive statistics and thematic analysis were used to analyze the data. Qualitative data were visualized using NVivo 10. Google and other search engines (52.7%) were mostly used to get information, followed by social media. Smartphone (83.8%) was the mostly used device. Laptop or desktop with a screen reader was ranked the second highest-use device by VI students. The lack of subject-related audiobooks, followed by poor Internet connectivity and the cost of mobile data were the key issues faced by them. The lack of compatibility of screen readers with some websites and PDF documents, and the inability to employ screen readers to access Sinhala text was the second most prevalent issue encountered by the respondents when using assistive devices. The most challenging factor was the high cost of assistive devices which prevents them from using them unless provided by libraries or disable-units. Devices such as smart phones and laptops were frequently used compared to traditional assistive devices. Access to the Internet and online information resources has increased as devices are more user-friendly to the VI in accessing the Internet although certain challenges need to be addressed. It is recommended to conduct training to enhance IT and language skills, and to develop self-confidence in learning new technologies. Institutions have to provide the required facilities and resources.

**Keywords:** *visually impaired students, digital information resources, assistive devices*

# Postgraduate Institute of Medicine



*“Optimising postgraduate medical training  
amidst constraints.”*

01<sup>st</sup> December 2023

## MESSAGE FROM DIRECTOR, PGIM

### Professor Senaka Rajapakse

Director  
Postgraduate Institute of Medicine  
University of Colombo



The Postgraduate Institute of Medicine (PGIM) is the sole institute in Sri Lanka that is responsible for the specialist training of medical doctors. Currently, more than 400 doctors obtain Board Certification each year from the PGIM, and each of these graduates complete a research study as part of their training programme. In addition, many other medical doctors complete training programmes at Masters level, which may also include a research project.

PGIM has recognized research as an important component in the development of a competent and evidence-based practitioner. We strive towards improving the quality of the research studies done by our trainees through several initiatives, including conducting regular research methodology workshops. We have also provided more opportunities for the trainees to publish their research and gain recognition for their efforts in their examinations.

The Annual Research Symposium of the PGIM would be another opportunity for the trainees, trainers and for any researcher focusing on areas related to medical sciences to disseminate their study findings. The symposium will also be a gathering for both trainees and trainers and an opportunity to share their experiences as well as to learn together transforming the future postgraduate medical education in the country.

I take this opportunity to thank the organizing committee for their effort and wish all the participants a memorable academic experience.

## MESSAGE FROM SYMPOSIUM CHAIR

### **Dr Kamani Samarasinghe**

Senior Lecturer  
Postgraduate Institute of Medicine  
University of Colombo



The Sri Lankan healthcare system has achieved many accolades over the years for achieving higher level health indicators sometimes even comparable to most of the developed countries. However, there are many gaps within the Sri Lankan health system which requires high quality evidence to overcome them effectively. PGIM is the sole institution in Sri Lanka, which trains medical specialists, and it has endeavored to maintain the high standards in postgraduate medical education despite the constraints the country has faced recently.

Therefore, the theme selected for this year's Annual Research Symposium, "Optimising postgraduate medical education amidst constraints" reflects the importance assigned by the PGIM to maintain and improve these standards by evidence-based practices. The PGIM believes that research carried out by its trainees as well as the trainers will lay the foundation for national level studies and practice related decisions within the health system and postgraduate medical education in Sri Lanka. Therefore, it is vital that the trainees and trainers of the PGIM have an opportunity to share their research findings and engage in a critical discussion as to how these findings may be used to uplift the healthcare system and academic training in medical education. The PGIM Annual Research Symposium 2023 therefore will be the perfect opportunity for such interaction.

Thus, it is a pleasure for me to chair the Annual Research Symposium of the PGIM for the year 2023 and I believe that in the years to come, the ARS of the PGIM will play a central role in disseminating medically related scientific knowledge in Sri Lanka.

## **ORGANISING COMMITTEE**

Dr. Kamani Samarasinghe – Senior Lecturer, PGIM

Dr. Himani Molligoda – Senior Lecturer, PGIM

Dr. Pandula Siribaddana – Senior Lecturer, PGIM

Dr. Lilangani de Silva – Senior Lecturer, PGIM

Dr. Amodini Rajakaruna – Senior Lecturer, PGIM

Ms. Dilhani Munasinghe – Senior Assistant Librarian, PGIM

Ms. Chandima Wadasinghe – Senior Assistant Librarian, PGIM

Mr. K G K Palitha – Systems Analyst, PGIM

Mr. Supun Weerasinghe – Audio Visual Technician, PGIM

Ms. Inoka Silva – Senior Staff Management Assistant, MERC, PGIM

Ms. Tharushi Wickramasinghe, Research Assistant, MERC, PGIM

Ms. K G Pathmasekera, Research Assistant, MERC, PGIM

Mr. Sajitha Dilanka– Office Assistant, MERC, PGIM

## Programme of Sessions

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<sup>1</sup>Postgraduate Institute of Medicine, University of Colombo, <sup>2</sup>RDHS Office, Kalmunai, Batticaloa, <sup>3</sup>Ministry of Health, Sri Lanka

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<sup>1</sup>Postgraduate Institute of Medicine, University of Colombo, <sup>2</sup>Provincial Director of Health Services Office, North Western Province, Sri Lanka
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<sup>1</sup>Postgraduate institute of Medicine, University of Colombo, <sup>2</sup>University of Ruhuna, <sup>3</sup>Base Hospital, Udugama, Sri Lanka

# **The Library**

## **University of Colombo**



*Libraries for Research Excellence*

07<sup>th</sup> November 2023

## MESSAGE FROM THE LIBRARIAN

**Mrs. H.M.D. Sajeewanie D. Somaratna**  
**Acting Librarian**



It is with immense pleasure that I write this message regarding the proceedings of the Annual Research Symposium, 2023, at the University of Colombo, one of the most significant events organized by the University. This year's theme, "Research Excellence and Beyond," timely emphasizes the need for research in contributing to the sustainable development of the country. This marks the 6th consecutive research symposium of the library (LRS 2023), focusing on the theme "Libraries for Research Excellence." This theme underscores the crucial role libraries play in the research and development efforts of the country, aligning with the vision of the library and the university. University libraries are pivotal in fostering research excellence within academic institutions. These libraries house extensive collections of scholarly resources, including books, journals, and digital archives, providing students and faculty access to essential materials. They offer advanced research tools, fostering an environment conducive to academic inquiry. Skilled librarians provide valuable research assistance, guiding researchers through complex databases and helping refine their inquiries. University libraries also frequently engage in interlibrary collaborations, ensuring access to a vast wealth of knowledge. In essence, these libraries serve as the intellectual heart of universities, propelling research and scholarship to greater heights. I extend my sincere gratitude to the Vice-Chancellor of the University of Colombo, Senior Professor (Chair) H D Karunaratne, for gracing LRS 2023 as the Chief Guest. Additionally, I would like to express my heartfelt gratitude to the Keynote speaker, Professor A.A.C. Abeysinghe, from the Faculty of Management and Finance, for sharing an insightful presentation on "Libraries for Research Excellence." I also appreciate the contribution of Emeritus Professor K A P Siddhisena as the resource person of the conference workshop on "Capacity Building of Librarians through Research." Furthermore, I wish to extend my sincere thanks to the reviewers and the presenters for their diligent work, which contributed to the successful completion of their assignments. On behalf of the library, I express my profound gratitude to the chairperson of LRS 2023, the Library Symposium Committee, and all the participants in this Annual Research Symposium 2023. I offer my heartfelt wishes for a highly rewarding and productive event.

## MESSAGE FROM THE SYMPOSIUM CHAIR

**Mrs. Anuja Silva**

Senior Assistant Librarian

University of Colombo, Sri Lanka



I am delighted and honoured to present this message as the Chair of the Library Research Symposium 2023 of the Library, University of Colombo held under the theme of “*Libraries for Research Excellence*”. The theme of the LRS-2023 aimed to showcase the innovative ways in which libraries contribute to research excellence in the universities in two sessions were presented by the library professionals. LRS -2023 has been a platform for the dissemination of research work in the areas of research support services, digital literacy skills, digital divide on online learning, social media usage for research activities, health literacy, and library marketing.

I would like to express my sincere gratitude to the Vice-Chancellor of the University of Colombo, Senior Professor (Chair) H D Karunaratne, for gracing LRS 2023 as the Chief Guest. Furthermore, my heartfelt gratitude goes to the Keynote Speaker Professor A.A.C. Abeysinghe, Faculty of Management and Finance, University of Colombo for the thought-provoking keynote address on “*Libraries for Research Excellence*”. I would like to express my sincere thanks to Emeritus Professor K.A.P. Siddhisena for his contribution as the resource person of the conference workshop on “*Capacity Building of Librarians through Research*”. I am immensely grateful to the Acting Librarian, Mrs. Sajeewanie D. Somaratna, for her guidance and excellent leadership. I am very grateful to all the reviewers and session chairs for their contribution to this symposium. I congratulate all authors and co-authors who have submitted their research papers to the LRS 2023. I also take this opportunity to thank the symposium convener, members of the organizing committee of LRS 2023, and all other academic, administrative, and Library staff for their tireless efforts to make this event a success.

## **ORGANISING COMMITTEE**

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Mr. K.A.C.P. Abeygunawardena (Assistant Registrar)



## Programme

10.00- 10.10 a.m.	<b>Inauguration</b>
10.10- 10.20 a.m.	<b>Welcome Address by the Chair LRS- 2023</b> <b>Mrs. Anuja Silva</b> Senior Assistant Librarian, University of Colombo
10.20- 10.30 a.m.	<b>Address by the Acting Librarian</b> <b>Mrs. H.M.D. Sajeewanie D. Somaratna</b> University of Colombo
10.30- 10.40 a.m.	<b>Address by the Chief Guest</b> <b>Senior Professor (Chair) H.D. Karunaratne</b> Vice Chancellor, University of Colombo
10.40- 10.45 a.m.	<b>Introduction to the Keynote Speaker</b>
10.45- 11.15 a.m.	<b>Keynote Address</b> <b>Professor A.A.C. Abeysinghe</b> Faculty of Management & Finance, University of Colombo
11.15- 11.25 a.m.	<b>Vote of Thanks by the Convener – LRS 2023</b> <b>Mrs. W.P. Gayani Perera</b> Senior Assistant Librarian, University of Colombo
11.25-11.45 a.m.	<b>Tea Break</b>
11.45 a.m. -1.30 p.m.	<b>Workshop on <i>Capacity Building of Librarians through Research</i></b> <b>Emeritus Professor K.A.P. Siddhisena</b> University of Colombo
1.30-2.00 p.m.	<b>Lunch Break</b>
2.00 - 3.15 p.m.	<b>Technical Session 1</b>
3.15- 4.00 p.m.	<b>Technical Session 2</b>
4.15- 4.30 p.m.	<b>Tea</b>

## INTRODUCTION TO KEYNOTE SPEAKER

### **Professor A.A.C. Abeysinghe**

Department of Accounting  
Faculty of Management & Finance  
University of Colombo



Professor Chandrasiri Abeysinghe obtained his PhD in Management Accounting from the Manchester Business School, University of Manchester in 2010. He is a professor in Accounting at the Department of Accounting, University of Colombo since 2020. He has more than 30 years of experience in his field of expertise since 1992 when he joined the university. Before joining the University of Colombo he served as an Assistant Director of the Public Enterprises Division, General Treasury, Ministry of Finance, Sri Lanka. In addition, Professor Abeysinghe currently serves as the Coordinator of the Internal Quality Assurance Cell and the PhD Programme of the Faculty of Management & Finance of the University of Colombo. He was the Head of the Department of Accounting from 2011 to 2017. Professor Abeysinghe extended his service as a Member, Board of Studies for Professional Studies, Faculty of Graduate Studies, Member, Board of Studies, School of Accounting and Business, Institute of Chartered Accountants of Sri Lanka (ICASL), and Coordinator, MBA Programme, Faculty of Graduate Studies, University of Colombo. Furthermore, he currently serves as a Member of the National Intellectual Property Advisory Committee and a Member of the Pricing Committee of the National Medical Regulation Authority. He has served as a Team Leader in preparing strategic plans of Sri Lanka Rupavahini Corporation, University of Colombo, and Ceylon Electricity Board. His national contribution extends to be the Consultant to prepare the revised curriculum of the Higher National Diploma in Accountancy programme (currently being operated), Sri Lanka Institute of Advanced Technological Education (SLIATE). Professor Abeysinghe was the first coordinator for the MBA program offered by the NSBM Green University Town, Homagama. He has contributed immensely to the development of the field of accountancy, for example, he was a Moderating Examiner, Advanced Management Accounting at Management Level and Strategic Management Accounting at Strategic Level examinations of the Institute of Certified Management Accountants of Sri Lanka. He has served as reviewer, panel chair in conferences, and in editorial committees. He has published a number of academic works including journal articles and textbooks. Professor Abeysinghe is one of the precious assets of the University of Colombo.

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## Libraries for research excellence: research support service through subject liaison librarians

Chiranthi Wijesundara, Anuja Silva & Sajeewanie D. Somaratna  
*Library, University of Colombo, Sri Lanka*

University libraries adopt diverse methods to enhance the research productivity of their patrons, and research support is one such vital service among them. The library of the University of Colombo has continuously provided research support for students in numerous ways over the decades; however, awareness of these services was limited. Therefore, the research support services were restructured, customized with the subject liaison librarians, and promoted among the students via social media, academic and student groups. The service is delivered by the subject liaison librarians of the library at the University of Colombo, who are specialized in diverse subject domains. This research overviews the status of the current research support service as a preliminary survey for the patrons' benefit in the future. A survey research design was used for the study. A census was conducted by administering a structured questionnaire as a Google form. The authors collected 128 student requests from February to August 2023. The obtained data were analyzed with descriptive statistics and the Pearson Chi-Square Test, and significance was determined at a 5% level. Out of 128 total requests, 83.59% (n=107) were made by undergraduates following the special degree, while general degree students made 16.41% (n=21). The majority (58.59%, n=21) of the research support requests were made by the undergraduates of the Faculty of Arts, whereas the Faculty of Law made the least (10.16%, n=13) requests. When analyzed by degree program, the highest number of requests (16.41%, n=21) were made by the Business Administration (Honours) students of the Faculty of Management. There were seven categories related to research support, and the requests for *writing an assignment/ report* and *selecting reading materials* were the highest requested areas, while the *writing an abstract/ proposal* was the least requested. The Chi-Square test proved a significant relationship amongst the faculties for the research support services on *writing an abstract/ proposal* ( $p=0.0213$ ). In contrast, other research support services did not reveal any significant relationship among the faculties. The undergraduates following the general degree expected more general skills, for instance, information retrieval, while the honours degree students required more subject-specific research support related to their final year dissertation topics, highlighting the importance and expertise of the subject liaison librarians. The study emphasizes that the involvement of librarians with multidisciplinary subject knowledge is essential to provide a better service through research support for the undergraduates of the university.

**Keywords:** *library, research support, subject liaison librarians, undergraduates, Sri Lanka*

## **The implications of the digital divide on online learning among university students amidst the covid-19 pandemic: A systematic review**

Sakeena Alikhan & T. Sritharan  
*Library, University of Colombo, Sri Lanka*

The COVID-19 pandemic caused a rapid transformation in higher education, forcing the adoption of online learning methods. However, this transformation has shown a significant disparity in the availability of technology, internet connection, and digital literacy, leading to an increase in the digital divide among university students. The objective of this systematic review was to examine the challenges associated with the digital divide within the realm of online education, along with the basic causes that contribute to this inequality. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA – identification, screening, eligibility and included) method was used to retrieve articles. A systematic search was conducted using the keywords "digital divide," "COVID-19," "online learning," and "university students" in the Scopus and Web of Science databases. A total of 190 articles were initially extracted based on specific keywords. However, after applying inclusion criteria, the number of papers analyzed was reduced to 29. A qualitative analysis was conducted using thematic analysis with the help of NVivo to identify themes pertaining to the difficulties and their causes encountered by students in their online learning process during the COVID-19 pandemic, particularly as a result of the digital divide. Previous studies mostly focused on first (digital access divide) and second level (digital capability divide) digital divide rather than third level (digital outcome divide). First level divide was a major challenge such as lack of digital devices (computers, laptops, smartphones and relevant software) and poor internet connectivity rather than second level which encompasses low computer skills and technology literacy in the online learning. The key factors contributing to these challenges were financial limitations, geographical location, and technological infrastructure deficiencies. Students coming from disadvantaged socio-economic backgrounds and residing in rural and remote regions experience a disproportionate impact on their studies and academic success due to first level digital divide. Addressing the challenges caused by the digital divide requires the implementation of an integrated strategy encompassing governmental policies, educational institutions, and community initiatives. This approach aims to ensure that all students have equitable opportunities for success within digital learning environments, without any individuals being left behind.

**Keywords:** *digital divide, Covid-19 pandemic, online learning, higher education, university students*

## The impact of social media usage on the academic and research engagements of undergraduate students in Sri Lanka: a case study

S.G.N.C. Senanayake<sup>1</sup> & R.D. Liyanage  
<sup>1</sup>Library, University of Colombo, Sri Lanka

The arrival of social media networks like Facebook, YouTube, WhatsApp, TikTok, and Telegram made global connectivity faster and more advanced. This research examined the engagement of undergraduate students in Sri Lanka with social media platforms for academic and research purposes. This is a case study based on a state university in Sri Lanka. The primary objective of this study was to identify the impact of social media usage in educational and research activities of undergraduates. This study was mainly based on a quantitative approach. A structured questionnaire was used to identify the basic information about the social media users. The validated questionnaire developed by Gupta & Bashir (2018)<sup>1</sup> was used for the study. All the variables were measured using five-point Likert scale, which ranged from Strongly Agree to Strongly Disagree. The study population was the total number of undergraduates (5,456) including the selected four faculties related to social sciences, and a sample of 346 students was selected by applying the stratified random sampling technique. According to the findings, the percentage of active users of social media is 98 % (n=339). The most used social media platforms are WhatsApp 56% (n=194), Facebook 23% (n=80), and YouTube 16% (n=55). Out of the total respondents, 60% (n=208) stated that they use social media for academic work such as academic discussion groups on WhatsApp and Facebook. Whereas, 58% (n=201) of the respondents stated that online usage had a positive impact on their academic and research activities. The findings of the study confirmed that all determinants have an impact on academic performance and they have a moderately positive relationship between social media usage and academic activities as well as students' research activities. Social media provide opportunities to connect with current students, ask questions, and get their feedback on relevant studies. The factor analysis described five main factors related to the students' social media usage, namely, informative; educational; social; entertainment; and financial factors. The study recommends that enhancing the awareness of exploiting social media may maximize the benefits of educational and research activities of students at the university taken into account.

**Keywords:** *social media, academic activities, research activities, factor analysis*

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<sup>1</sup> Gupta, S. & Bashir, L. (2018). Social Networking Usage Questionnaire: Development and Validation in an Indian Higher Education Context . *Turkish Online Journal of Distance Education*, 19 (4) , 214-227 . <https://doi:10.17718/tojde.471918>

## Exploring the dimensions of community health literacy: a scoping review

K.I.D.F. Senanayake<sup>1</sup> & D.C. Kuruppu<sup>2</sup>

<sup>1</sup> Library, Faculty of Nursing, University of Colombo, Sri Lanka

<sup>2</sup> Library, Faculty of Medicine, University of Colombo, Sri Lanka

Community Health Literacy (HL) is a multidimensional concept that plays a pivotal role in promoting individual's understanding, access to, and utilization of health information and services within their respective communities. A scoping review was conducted following PRISMA guidelines aiming to explore the key concepts including health information sources used, related socio-demographic factors, knowledge gaps, and interventions to improve HL. Three electronic databases (PubMed, Medline and CINAHL) were consulted using terms "health literacy, community, and the general public". The search generated a total of 3899 articles. After removing duplicates, the publication year was limited to 2018-2023 and 1151 articles were screened through Rayyan software, 481 articles were included in the final analysis. The extracted data was analysed and synthesized using both quantitative and qualitative approaches. Majority of the research related to HL has been conducted in the European Region (n=210, 44%) followed by the Americas Region (n=160, 33%), South-East Asia Region (n=48, 10%), Western Pacific Region (n=32, 7%) and Eastern Mediterranean Region (n=31, 6%). Most of the community uses television, social media, celebrity webpages, friends, family members, and pharmaceutical companies as health information sources rather than information from healthcare specialists. Age, gender, education level, language proficiency, economic status were the identified major socio-demographic factors associated with HL. Majority of the research studies (n=331, 69%) have examined HL in a general aspect, while the remaining 36% (n=54) focused on Mental HL (n=54, 36%), COVID-19 HL (n=29, 19%) and Digital HL (n=28, 19%). HL related to prescribed medication management and decision-making in medical management were found to be significant knowledge gaps. Community-based health education programs and collaborations between healthcare providers and community organizations were identified as leading interventions to enhance community HL. The review suggests Librarians are ideally placed to raise awareness of the impact of low HL and to work with health professionals by contributing to improving the quality and accessibility of healthcare information for the public. The study recommends that addressing the identified knowledge gaps is essential to provide equitable healthcare outcomes, reduce healthcare costs, and improve overall well-being for individuals and communities.

**Keywords:** *community health, general public, health literacy*

## **Factors influencing digital literacy skills among visually impaired undergraduates: a qualitative analysis of viewpoints of academic staff**

M. A. Lankathilake <sup>1</sup> & T. Ramanan <sup>2</sup>

<sup>1</sup> *Library, Faculty of Science, University of Colombo, Sri Lanka*

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Digital literacy skills of undergraduates with visual impairments influence their use of digital resources. Academic staff is the principal group who work closely with the students on their academic work, whose views of the academic staff members on the digital literacy of undergraduates with visual impairments were equally important. The objectives of the study were to investigate the impact of digital literacy skills of undergraduates with visual impairments on their academic performance and find out the issues facing them in accessing digital information resources from the viewpoints of academic staff. Three state universities in the Western Province of Sri Lanka were purposively selected. Undergraduates with visual impairments are attached to the Faculties of Arts, Humanities and Social Sciences and Education of those three selected universities. The study population consisted of the academic staff members of the respective faculties of the selected universities. Researchers administered questionnaires among 20 academic staff in respective faculties. Furthermore, interviews were conducted with purposively selected respondents in the academia who teach undergraduates with visual impairments. Descriptive statistics and thematic analysis were used to analyze the data obtained from the survey. NVivo 10, qualitative data management software, was used to visualize the findings, where 80% of the respondents stated that undergraduates with visual impairments who perform well in their academic work use digital resources effectively. Meantime, 70% of the respondents had observed that undergraduates with visual impairments who perform well in their academic work have good digital literacy skills. The researchers identified 38 different observations by analyzing the respondents' comments. These observations were categorized under 10 different themes, among which, lack of IT skills, lack of devices, lack of audiobooks and accessibility, and poor knowledge and skills were the main issues identified. Apart from that subject-specific issues were also noted. Researchers recommended that training programmes should be conducted to develop digital literacy skills and enhance their motivation and encourage attitudinal changes of students with visual impairments. Furthermore, the academic staff members should be given an opportunity to train in 'disability inclusive education'. Moreover, faculties and libraries should work towards developing the audiobook collection.

**Keywords:** *digital literacy skills, visually impaired students, digital devices*



## Evaluating some key features of systematic reviews on PubMed with Sri Lankan affiliations from 2013 to 2022

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Systematic reviews help answer a particular research question with evidence produced and published on a particular topic. The objective of this study was to facilitate the systematic reviewers in the medical discipline, hence the authors attempted to investigate four (04) characteristics of systematic reviews published by Sri Lankan researchers in PubMed; namely, 1) the extent and variety of databases used, 2) the extent and variety of gray literature sources being used, 3) national and international collaborations, and 4) how far the librarians or information professionals supported such systematic reviews undertaken by authors with Sri Lankan affiliations. A total number of 234 systematic reviews published in PubMed from 2013 to 2022 were extracted, and a double-blind review was conducted. PubMed/Medline (n=222, 95%) was the leading platform that Sri Lankan researchers have used to extract data for systematic reviews, followed by EMBASE (n= 91, 39%), SCOPUS (n= 83, 35%), Cochrane (n=80, 34%), Web of Science (n=74, 32%), and CINAHL (n= 68, 29%), since authors used multiple sources. It was found that only 10% of the systematic reviews (n= 24) consulted with gray literature. Amongst gray literature sources, institutional reports (n=8, 50%), Open Gray (n=4,25%), and personal collections (n=3,19%) were prominent sources. Furthermore, researchers from state universities have contributed 97% (n= 228) to the systematic reviews. University of Colombo (n=77, 33%), University of Peradeniya (n=47, 20%), and University of Rajarata (n=3, 10%) were the leading state universities. Research teams consisting of Sri Lankan researchers affiliated to institutions other than state universities have contributed 9% (n= 21) to the systematic reviews. Of the total systematic reviews, 30% (n=70) were published by research teams composed only of Sri Lankan authors while 70% (n=164) were published with foreign collaborations. Australia (n=98, 26%), the UK (n= 67, 18%), India (n=28, 7%) and the USA (n= 22, 6%) were the leading collaborated countries. Only 10% (n= 23) of systematic reviews was supported by librarians or information professionals. To facilitate Sri Lankan researchers conducting systematic reviews, the need for subscriptions to a few essential databases would be recommended. It was identified that Sri Lankan authors had opportunities to have collaborated more with certain countries whereas their local collaboration was low. Since the use of grey literature was low, the librarians can promote the use of grey literature sources.

**Keywords:** *systematic reviews, PubMed, Sri Lanka, gray literature, librarians, information specialists*

## Utilization of *Ola* leaf and handwritten manuscripts for research: a case study of the students at the Faculty of Indigenous Medicine

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In ancient time in Sri Lanka, the *Ola* leaf was one of the primary means of communication for disseminating knowledge, particularly, Indigenous Medical Knowledge (IMK) or Traditional Medical Knowledge (TMK) that is primarily passed down orally from generation to generation. Similarly, *Ola* leaf (OL) or palm leaf and handwritten manuscripts (HM) are other forms of Indigenous knowledge transmission. They provide insights into traditional healing practices, herbal remedies, diagnostic techniques, and treatment methods. Researching these manuscripts helps document and preserve this valuable traditional knowledge, ensuring its continuity and preventing its loss. The Faculty of Indigenous Medicine (FIM) library has a collection of 531 OL and 108 HM (*Khanda Vaidya Grantha*). With a formal approval, students are permitted to use OL and HM. This study aims to find out whether the *Ola* leaf and handwritten manuscripts have been used for students' research at the faculty of Indigenous Medicine. Hence, the study was carried out to find out as to which level those two sources were utilized by students who conduct research at the FIM from 2016 to 2022, excluding 2021 due to the Pandemic. Two methods were used to collect the data. One was to look at students' written requests to utilize the FIM's OL and HM collections for research, and the next strategy was to examine the titles of Level IV students' research projects that were accomplished based on OL and HM. The Level IV students of both Bachelors' programmes - Ayurvedic and Unani Medicine, require students to complete their research projects. Highest recorded requests (n=55) were made to the library in 2016, of which 71% were for HM and 29% were for OL, which was used for research. The number of request letters for 2017 was the same as it was for 2016; among them, 58% of students utilized HM and 42% used OL. The lowest number of requests were received in 2020, 43% for HM and 57% for OL. Based on the research project titles, the highest number of research students (n=154) was in the Academic year 2012/2013, but student usage of 10% for HM and 0% for OL. The lowest research students (94) were in 2011/2012, but the highest research usage of HM was 22%. The highest usage of OL was in 2010/2011 (6%). According to the findings, using conventional information sources for the research was relatively low. To preserve and spread IMK for future generations, the FIM should encourage and mentor their students to do research using HM and OL. In this regard, expanding digitization of HM and OL collection will increase the exploitation of these valuable resources.

**Keywords:** *Ola leaf, handwritten manuscripts, indigenous medical knowledge, undergraduates*

## Enhancing library services through student feedback: a case study

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The role of academic libraries is to support teaching, learning, and research of the parent institute and mainly focus on user services. User feedback is important in the scenario to understand the requirements of library patrons and improve its services accordingly. It is vital to develop a continuous responding mechanism for user feedback to better serve the patrons. This study aims to develop a robust mechanism to get students' feedback and improve library services of University of Colombo to enhance the quality. A user survey was conducted to get the undergraduates' feedback and the population comprises 12,000 registered library users from faculties: Arts, Management & Finance, Law and Education. Sample size (373) was calculated based on the Krejcie and Morgan table. Data were collected using Google Form-based questionnaires during the period from March to July 2023. Data were analyzed using descriptive statistics and thematic analysis. 365 (97.85%) students responded to the questionnaire and the majority were from the Faculty of Arts (63.3%) studying in the Level-I. According to the results, 73% of students received services for reading material requests. Also, they are satisfied with the support / services given by the staff of the library in different sections. The majority of the students were satisfied with e-resources provided by the library: e-journals and e-databases 78% (n=285); E- books 42% (n=153); and library website resources 57% (n=208). According to the feedback obtained for overall user experience on the library, only 68% (n=248) were satisfied. Inadequate number of copies of some books, access restrictions to borrow books from some specific sections, insufficient books in Tamil, and lack of updated collection were identified as drawbacks of the library's physical collection and services. The respondents suggested adding more e-books and e-journals to the collection. Furthermore, the respondents expected a user-friendly, content-rich website, and they have requested to conduct more training sessions, especially on e-resources and alert services for new additions. The importance of having a plagiarism-detecting service through the library was also identified. However, undergraduates appreciated the support given by the library staff. The findings of the present study led the library to provide up-to-date scholarly communications for the undergraduates through social networking sites and monthly meetings with student representatives which enable two-way communication to enhance the quality of library services. This feedback mechanism should be continued, and the library management should address the user requirements to enhance the quality of the library services.

**Keywords:** *library services, student feedback, undergraduates, Sri Lanka*

## **A bibliometric analysis of publications of library marketing: based on Google Scholar publication from 2017 to 2022**

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In order to effectively inform and educate existing and potential library users about the varying resources and services available to meet their specific needs and interests, library marketing is essential. Mastery of marketing skills is essential not only to raise awareness about the intrinsic value of the library but also to expand its user base. This study is significant as it provides library marketing scholars with a consolidated data set for future research. As such, this study utilized Google Scholar as its foundational source of data to analyze the spectrum of research outputs within the field of library marketing. In addition to this main objective, it delved into the dynamic growth trajectory in library marketing research publications. The research further explored country-specific contributions, revealing the global landscape of library marketing research. The study also examined the various types of libraries that were the focus of these publications. The bibliographic analysis is the methodology used in the study. The study was limited to using the keyword "*Library Marketing*" in publish or perish software's "Keyword" tag. The data was limited to years, 2017 to 2022, using the "Years" range tag. This study engaged with 246 publications, and the data retrieval process was done through the "Publish or Perish" software, harnessing the extensive prowess of Google Scholar. Data analysis and visualization were complemented by VOSviewer software and MS Excel package. During this intensive exploration, the following illuminating insights emerged. India led the global contributors with 55 publications (22%), followed by the United States with 40 publications (16%), and Nigeria with 35 publications (14%). In 2022, 49 articles (20%) were published, representing a significant increase over the previous year. There was a strong focus on University Libraries, resulting in 111 publications (45%). Scholarly journals emerged as the prime breeding ground for these insights, with 193 articles (78%) emerging from this field. This research has reverberations across the scholarly landscape, providing researchers with a solid foundation for venturing into the uncharted territory of library marketing. The study recommended additional research based on the index journals database to gain greater insight into publications related to library marketing. Additionally, models, concepts, and technology supporting marketing are recommended for future studies.

**Keywords:** *library marketing, bibliometric analysis, Google scholar, Publish or Perish, VOSviewer*



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