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Review on antimicrobial activity of commonly used Ayurvedic preparations

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Abstract

Ayurveda is one of the oldest healing sciences with a vast number of medicines for curing diseases and for protecting the healthiness of healthy people. Relevant medicines possess potent *Jwaraghna*, *Rasayana*, etc. pharmacological activities. Hitherto, antimicrobial activity is given less attention. Nevertheless, microbes were synonymously referred as “*Yathudana*”, “*Rakshasa*”, “*Pishacha*”, “*Asura*”, “*Gandharva*” and “*Krimi*” in *Samhita*. These terms resulted in this research to study the antimicrobial activity of some commonly used Ayurveda medicines. A total of thirteen Ayurveda medicines, including *Churna*, *Arishta*, *Avaleha*, *Vati* and *Rasaushadha*, were tested for antimicrobial activity by using agar well diffusion method and by disc diffusion method under strict aseptic conditions and following standard laboratory guidelines. The findings of this study were very encouraging as all 13 Ayurveda medicines exhibited potent antimicrobial activity in general. *Rasamanikya* and *Shwasakuthara rasa* were shown to be effective against *Staphylococcus aureus*. *Chyawana prashavalehaya* and *Chandraprabha vati* exhibited antimicrobial activity against *Escherichia coli*. *Sudarshana* and *Thrikatu churna* were found to have the strongest antimicrobial activity against *S. aureus* and *E. coli*. *Amrtarishta* was effective in eradicating *Staphylococcus aureus*, *Escherichia coli* and *Salmonella typhi*. *Draksharishtaya* was found to have antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi* and *Bacillus subtilis*, *Dashamularishtaya* was effective against *Shigella flexneri*, *Aspergillus niger* and *Pseudomonas auriginosa*. Only *Thalisadi churna*

exhibited antifungal activity against *Candida albicans*. Exhibit results clearly established the potent antimicrobial activity of all thirteen Ayurveda medicines against common human pathogens and might offer new hopes for controlling infectious diseases and preventing the emergence of resistant variants.

Keywords: Antimicrobial activity, Ayurvedic preparations, Inhibition zone, Extracts

Introduction

Ayurveda sciences have smartly approached to cure of infectious diseases in numerous ways. Moreover, the antimicrobial properties of Ayurvedic herbs and preparations are essentially important and play a vital role in present Ayurveda medicine¹. Many traditional and Ayurveda remedies are rich in chemical compounds which responsible for antimicrobial activity. Multiple research studies have been carried out in order to determine the antimicrobial activity of various Ayurveda preparations.

According to allopathic medicine antimicrobial effect contributes greatly to curing infectious diseases caused by pathogenic bacteria, virus and fungi. Antimicrobial activity can further be defined as a collective term for all active principles (agents) that inhibit the growth of bacteria, prevent the formation of microbial colonies, and may destroy microorganisms. There are a number of methods that use to evaluate the antimicrobial activity of herbal preparation².

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The major aim of this review seeks to find commonly used Ayurveda preparations which enriched with antimicrobial properties (antibacterial, antifungal, antiviral) including *Churna*, *Arishta*, *Avaleha*, *Vati* and *Rasa* preparations and find out commonly used methods in assessing the antimicrobial activity of selected preparations and identify common human pathogens who can be killed by selected herbal preparations. After summarizing the gathered information on the basis of the assessing methods and activity of each preparation against specific microbes.

Methodology

The first phase of the study has been focused on the study of antimicrobial activity and testing methods to assess antimicrobial activity via reading relevant research articles. Research articles, review articles and authentic books which explain the antimicrobial activity of common Ayurvedic preparations have been studied. Among the available several herbal preparations Thirteen number of Ayurveda preparation have been selected to conduct a deep analysis (*Sudarshana churna*, *Thalisadi churna*, *Thrikatu churna*, *Samasharkara churna*, *Amrtarishta*, *Dashamularishtaya*, *Draksharishtaya*, *Chyawanprashavaleha*, *Chandraprabha vati*, *Arogyavardhini vati*, *Manikyarasa*, *Rasaka bhashma*, *Swasakutararasa*). Then for the clear understanding thirteen herbal preparations were divided into five major sections as *Churna*, *Arishta*, *Avaleha*, *Vati* and *Rasa* preparations. The study was separately carried out covering all the five sections with appropriate examples by collecting the necessary information on their antimicrobial activity from several appropriate research findings^{2,3,4}. Moreover, the evaluation procedure relevant to antimicrobial activity was further studied focusing on relevant research articles. Furthermore, specific microbial species which can be killed by each preparation were identified. For example, *Sudarshana churna* has specific antimicrobial activity on *Staphylococcus aureus* (*S. aureus*) and *Escherichia coli* (*E. coli*)¹. Also, the antimicrobial activity of other preparations was analyzed

separately focusing to apposite references. Finally, the collected data were further summarized by using tables and bar charts. Table 01 has shown the selected Ayurveda preparations of the study.

Table 01: Selected Ayurveda preparations

<i>Churna</i>	<i>Arishta</i>	<i>Avaleha</i>	<i>Vati</i>	<i>Rasa</i>
<i>Sudarshana</i>	<i>Amurtha rishta</i>	<i>Chywana Prasha waleha</i>	<i>Chandra prabha vati</i>	<i>Rasa manikyaa</i>
<i>Thalisadi</i>	<i>Dasha Mula rishta</i>		<i>Arogyaa vardhini Vati</i>	<i>Swasa kutara rasa</i>
<i>Thrikatu</i>	<i>Drakshari shta</i>			<i>Rasaka bhashma</i>
<i>Samasharkara</i>				

Churna preparations

In Ayurveda, "*Churna*" is the most commonly prescribed dosage form which consists of herbal, mineral or herbo-mineral materials in fine powder form.

Assessing the antimicrobial activity of Sudarshana churna

"*Sudarshana churna*" is a very effective Ayurveda preparation which composed of 42 medicinal plants. Ancient physicians used "*Sudarshana churna*" to cure all types of fever due to various reasons as well as a rejuvenate medicine and diuretic. *Swetia chirata* a potent antiviral herb included in *Sudarshana Churna*³.

Antimicrobial activity of *Sudarshana Churna* has been tested against gram-positive bacteria like *S. aureus*, gram-negative bacteria like *Klebsiella pneumoniae* (*K. pneumoniae*) and *E. coli*. Agar disc diffusion method has used in this study. The result of the above study shows that the aqueous extract of *Sudarshana Churna* possesses significant antimicrobial activity. The active effect against gram-positive bacterial strain like *S. aureus* and gram-negative bacteria like *K. pneumoneae* and *E. coli* whereas less effective against gram-positive bacteria *Staphylococcus epidermidis* (*S. epidermidis*) and *Bacillus subtilis* (*B. subtilis*)⁴.

Assessing the antimicrobial activity of *Thalisadi Churna*

Thalisadi churna is beneficial for cough, cold, asthma, diarrhea, bloating, vomiting, side and chest aches, anemia, and spleen diseases. It controls wheezing due to asthma or allergy⁵.

The agar disk diffusing method is used to find out the antimicrobial effect of *Thalisadi churna*. *Candida albicans*, is one of the medically important fungal strains that is used to determine the zone of inhibition which use to prove the antimicrobial effect of *Thalisadi churna*. The result shows that the incredible inhibition of the fungal growth was shown against the tested organism as exhibited in Figure 01.

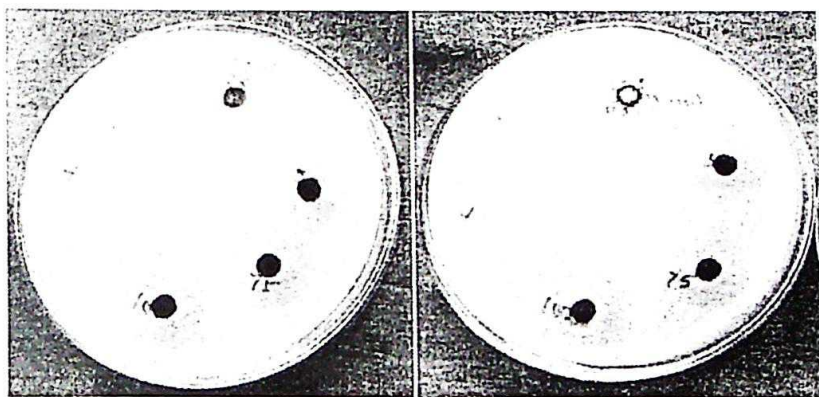


Fig. 01: Antifungal activity of *Thalisadi churna* against *Candida albicans*

Assessing the antimicrobial activity of *Thrikatu churna*

Thrikatu churna is polyherbal preparation which improve digestive power and promotes appetite. *Thrikatu churna* is an absolute remedy for liver disorders (hepatitis, jaundice), infections, bronchitis, common cold, cardiovascular diseases such as heart attack, atherosclerosis, blood clots and is beneficial in weight reducing treatments.

Ethanol extract of *Thrikatu churna* and individual components have been tested for antimicrobial activity against certain clinical and fungal isolates. Agar well diffusion method has been used for assessing the antimicrobial property of *Thrikatu churna*. The result verified that the *Thrikatu churna* and its individual ingredients perform potent antimicrobial activity⁶.

Assessing antimicrobial effect of *Samasharkara churna*

Samasharkara churna is used in the treatment of piles, cough, cold, asthma, anorexia, indigestion, throat pain and infections.

Disc diffusion method and serial dilution method have been used to evaluate the antimicrobial property of *Samasharkara churna*⁷. *S. aureus* and *S. epidermidis* as Gram-positive bacteria, *Klebsiella* and *E. coli* as Gram-negative bacteria and *Candida albicans* (*C. albicans*), *Aspergillus niger* (*A. niger*) as fungus have been used⁷. The results exhibit that, *Samasharkara churna* has an immense antimicrobial effect against gram-negative bacteria, gram-positive bacteria as well as fungi⁷.

Arishta preparation

Arista and *Asawa* are liquid Ayurvedic preparations or self-generated herbal fermentations. *Asawa* has prepared with the use of fresh herbal juice or herbs which are soaked in water. *Arista* is prepared with a decoction of herbs in boiling water. Both have a sweet taste and an alcoholic smell.

Assessing the antimicrobial activity of *Amrtarishta*

Amrtarishta is a polyherbal, common Ayurvedic liquid preparation which helps to cure chronic fever, cough, cold, boosting immunity and blood purification.

A modified disc diffusion assay method has been used for assessing the antimicrobial activity of *Amrtarishta*. The result verified that the *Amrtarishta* possesses a great antimicrobial effect. Especially *Amrtarishta* holds immense antimicrobial activity against *S. aureus*, *Salmonella typhi*, *E. coli*, *B. subtilis* which are commonly presence as a human pathogen⁸.

Antimicrobial effect of *Dashamularishta*

Dashamularishta is an Ayurvedic preparation composed of ten precious medicinal herbs. It is another self-generated alcohol preparation that acts as a pain killer, immunity booster, strength promoter and also helps to get rid of backache, digestive disorders, mental stress and fever. *Dashamularishta* has a promising effect of speed recovery for new mothers. It contains 3-7% of alcohol which forms by fermentation of herbal materials.

Assessing antimicrobial effect of Dashamularishta

Antimicrobial activity of *Dashamularishta* have been tested against *Pseudomonas aeruginosa* (*P. aeruginosa*), *S. aureus*, *K. pneumoniae*, *S. typhi*, *Shigella flexneri* (*S. flexneri*), *Proteus vulgaris* (*P. vulgaris*), *Enterobacter aerogenes* (*E. aerogenes*) and as a fungi *C.albicans*, *A. niger*, *Trichophyton rubrum* (*T. rubrum*)⁹.

The bactericidal *in vitro* disc diffusion method has been used to evaluate the antimicrobial effect of *Dashamularishta*. The results proved that the ingredients of *Dashamularishta* have immense antimicrobial activity against *S. flexneri*, *P. aeruginosa* and *A.s niger* with highest inhibition zone⁹. Figure 02 shows the zone of inhibition of *Dashamularishta* against *A. niger* and *S. flexneri*.

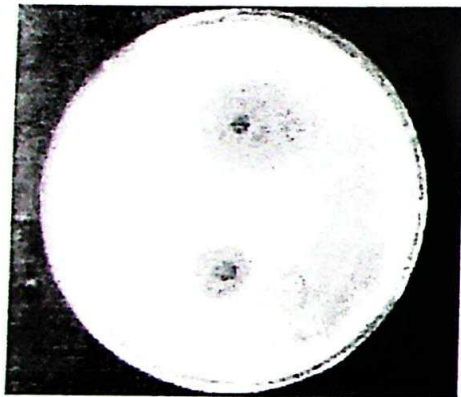


Fig. 02: Ethyl acetate extract of *Dashamularishta* against *A. niger* and *S. flexneri*

Assessing antimicrobial effect of Draksharishtaya

Draksharishtaya improves immunity, digestion and outstanding remedy for constipation, cough, asthma, common cold, insomnia, anorexia and physical weakness. Generally, *Draksharishta* use as tonic and nutritional supplement.

Disc Diffusion Assay method have been used to assess antimicrobial effect of *Draksharishta*. Zone of growth inhibition have been measured to assess the antimicrobial activity of *Draksharishta*. *Draksharishta* exhibit immense antimicrobial activity against common human pathogens such as *S. typhi*, *B. subtilis*, *E. coli*, *S. aureus*¹⁰.

Avaleha preparations

Avaleha is a semisolid secondary preparation which is utilized in various diseases. *Avaleha kalpana* reach high popularity because of its palatability, easy administration and long shelf life¹¹. Different kinds of decoction or *Swarasa* along with sweetening agents such as sugar, jaggery or sugar candy are used to utilize *Avaleha*. These preparations consider as an *Upa kalpana* of *Kwatha kalpana* and *Leha*, *Lehya*, *Raskriya* are the synonyms of *Avaleha*.

Assessing antimicrobial activity of Chyawanprasha valeha

Chyawanprashavaleha is rich in many potent herbs which promote rejuvenation and longevity. This remedy can use to treat any lung and breathing disorders, aid digestion, enhance cardiac functioning as well as expand brain function. The magical content of *Chyawanprashavaleha* provides useful nutrients such as anti-oxidant, protein, dietary fibers and alkaloids¹².

The study has been focused on the antimicrobial effect of a chloroform extract (CHCl_3) of *Chyawanprasha valeha* and hydrolyzed *Chyawanprashavaleha* against *E. coli* and *S. aureus* on nutrient agar medium¹³. The cup plate method has been used to evaluate the antimicrobial property of *Chyawanprashavaleha*. After the incubation period zone of inhibition have been measured to assess the antimicrobial activity of *Chyawanprashavaleha* against the *E. coli* and *S. aureus*¹³. The exhibited inhibition zone diameter showed that, both chloroform extract of *Chyawanprashavaleha* and hydrolyzed CHCl_3 extracts of *Chyawanprasha valeha* are rich with excellent antimicrobial activity against *E. coli* according to the concentration¹³.

Vati preparations

Vati kalpana is one of the commonly used Ayurvedic preparations which is a derivative of the *Xalka kalpana*. Among the Ayurvedic classics, *Sharangadara samhitha* give large explanation and made an individual chapter for *Vati kalpana*. *Vati* (tablets), *Gutika* (pills), *Modaka* (large size pills)

and *Varthi* (dragges) are the synonyms that *Acharya Sharagadara* suggested for *Vati*¹⁴.

Assessing antimicrobial effect of *Chandrababha vati*

Chndrababha vati is a *Vati* preparation which has commonly use in treatments of diabetes, men's infertility, prostate enlargement, nephritic syndrome, kidney stones, proteinuria, glycosuria, heel pain, constipation, anxiety, mental depression and painful menstruation. It contains a large number of ingredients which provide multiple healing effects with their significant properties¹⁵.

The antibacterial activity of *Chandrababha vati* have been evaluated by tube dilution method using a varying concentration of the drug, which have been added to Luria Bertani broth. The tubes have been incubated at 37°C for 24hrs. The results have been studied with growth curve analysis¹⁵ and this study found *Chandrababha vati* has antimicrobial action against the *E. coli*.

Assessing antimicrobial effect of *Arogyavardhini vati*

Arogyavardhini vati is a miraculous Ayurvedic remedy which is commonly practiced in diseases such as liver, skin, stomach, heart and gallbladder. Agar well diffusion method with Mullar Hinton Agar have been used to evaluate antimicrobial property of *Arogyavardhini vati*¹⁶. *P. aeruginosa*, *E. coli*, *S. aureus*, *Candida albicans* have been utilized to evaluate antimicrobial property of *Arogyavardhini vati*¹⁶. The results have proved that the *Arogyavardhini vati* possess incredible antimicrobial activity against *P. aeruginosa*, *S. aureus* and no considerable antimicrobial activity against *C. albicans*¹⁶. Figure 03 has shown the antimicrobial activity against *S. aureus* with agar well diffusion method of *Arogyavardhini vati*.

Rasa preparations

The ancient Indian Ayurvedic science rich with various medicinal concepts. *Rasa shasthra* is one of the outstanding concepts which build up on mercury (*Parada*) majorly while other minerals (*Hingula* (HgS), *Swarna makshika* ($CuFeS_2$), *Palmanikkam* ($CuSO_4$), metals (*Swarna*, *Vanga*, *Lauha*) along with non-metal compound such as *Gandaka* (S)¹⁷.

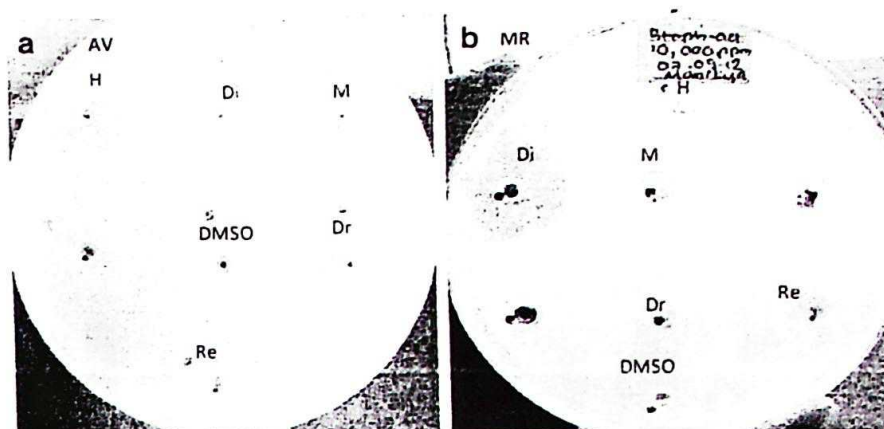


Fig. 03: Antimicrobial activity against *S. aureus* with agar well diffusion method of *Arogyavardhini vati*

Assessing antimicrobial activity of *Manikyarasa*

Manikyarasa is a really popular rasa drug among Ayurvedic physicians which is made up with *Harithala* as the major ingredient. It is commonly used in conditions of bronchial asthma, bronchitis, fistula (*Bagandara*), skin diseases such as leprosy, dryness of skin, rashes social diseases such as, syphilis and nervous diseases too.

Eleven human pathogenic microbes have been used to evaluate the antimicrobial activity of *Manikyarasa* [18]. According to the result, *Manikyarasa* shows unbelievable antimicrobial activity against *S. aureus*. Figure 04 shows zone inhibition of *Manikya rasa* against *S. aureus*.



Fig. 04: Antimicrobial activity of *Manikya rasa* against *S. aureus*

Assessing antimicrobial activity of Raska bhashma

A *Bhasma* means an ash obtained through incineration, the starter material undergoes an elaborate process of purification and this process is followed by the reaction phase, which involves the incorporation of some other minerals or herbal extract.

Rasaka (Zinc), which classified under the *Maharasa* is a mineral containing zinc. It is a zinc combination with carbonate, sulfide and oxide. *Kharpara*, *Thamra ranjaka* and *Nethra rogari* are the synonyms of *Rasaka* [19].

Agar disc diffusion method have been used to study the antimicrobial activity of *Rasaka bhashma* against gram positive and gram-negative bacteria. *S. pneumonia*, *S. aureus* and *S. pyogenes* have been used as gram-positive bacteria and *K.pneumonia* have been used as gram-negative bacteria. Finally, results have evaluated the antimicrobial activity of *Rasaka bashma*. Both $ZnCO_3$ and ZnO showed great antimicrobial activity against *Streptococcus* compared to other organisms. But, comparing to ZnO , $ZnCO_3$ showed better activity against selected organisms¹⁹.

Assessing antimicrobial activity of Swasakutara rasa

Shwasakutara rasa is an outstanding Ayurvedic preparation which has commonly been applied on conditions of respiratory disorders, in tablet or powder form. This herbo-mineral preparation shows the amazing curative effect on diseases such as, common cold, asthma, anorexia, chronic bronchitis, dyspnea and indigestion²⁰.

The Agar disc diffusion method has been used to evaluate the in-vitro antimicrobial activity of *Swasakutara rasa*²¹. *S. aureus* has been used as a major microbe and it has been grown on mullar hinton agar. According to the result, *Shwasakutara rasa* shows antimicrobial activity against *S. aureus*.

Table 02 shows the selected herbal preparations against the specific microbes along with the assessing method.

Table 02: Selected herbal preparations against the specific microbes along with the assessing method.

Name of the preparation	Microbes which kill by selected preparations	Assessing method
<i>Sudarshana churna</i>	<i>S. aureus</i> , <i>E. coli</i>	Agar disc diffusion method
<i>Thalisadi churna</i>	<i>C. albicans</i>	Agar well diffusion method
<i>Thrikatu churna</i>	<i>S. aureus</i> , <i>E. coli</i>	Agar well diffusion method
<i>Samasharkara churna</i>	<i>S. aureus</i> , <i>E. coli</i> , <i>S. epidermidis</i>	Agar disc diffusion method
<i>Amrtarishta</i>	<i>S. aureus</i> , <i>E. coli</i> , <i>S. typhi</i>	Agar disc diffusion method
<i>Dashamula rishta</i>	<i>S. flexneri</i> , <i>A. niger</i> , <i>P. auriginosa</i>	Agar disc diffusion method
<i>Draksha rishta</i>	<i>S. typhi</i> , <i>S. aureus</i> , <i>E. coli</i> , <i>B. subtilis</i>	Agar disc diffusion method
<i>Chyawana prashavaleha</i>	<i>E. coli</i>	Agar disc diffusion method
<i>Chandraprabha vati</i>	<i>E. coli</i>	Tube dilution method
<i>Arogyavardhini vati</i>	<i>P. aeruginosa</i> , <i>S. aureus</i>	Agar well diffusion method
<i>Rasamanikya</i>	<i>S. aureus</i>	Agar well diffusion method
<i>Rasaka bhashma</i>	<i>S. aureus</i> , <i>S. pyogenes</i>	Agar disc diffusion method
<i>Shwasakutara rasa</i>	<i>S. aureus</i>	Agar disc diffusion method

Figure 05 shows the methods which use to evaluate antimicrobial activity against a number of preparations.

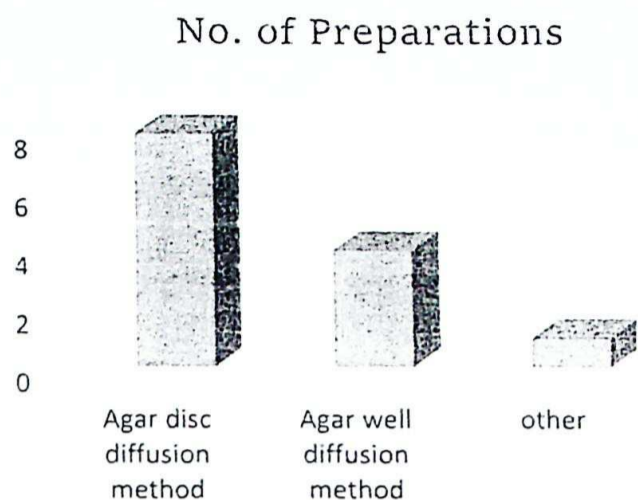


Fig. 05: Methods which use to evaluate antimicrobial activity against number of preparations.

Figure 06 depicts the different methods which used to evaluate antimicrobial activity together with a number of preparations which are assessed by each method.

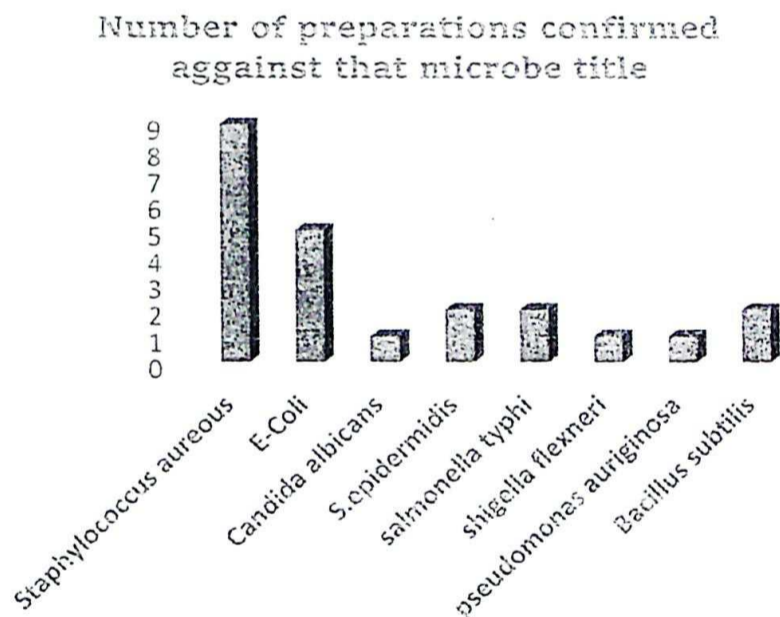


Fig. 06: Microbes which kills by selected preparations against a number of preparations.

The highest number of preparations have been tested with the agar disc diffusion method and four preparations have been tested with the agar well diffusion method. Figure 6 shows the microbes which can kill by selected herbal preparations. Eight number of preparations have an antimicrobial effect

on *S. aureus*, six preparations have an inhibitory reaction against *E. coli* and two preparations can destroy *Salmonella typhi* among the selected preparations.

Discussion

Present review study has revealed antimicrobial activity of commonly used Ayurvedic preparation via a number of research studies which associate with laboratory experiments. There are several methods which use to evaluate antimicrobial activity as, the Agar disk diffusion method, antimicrobial gradient method, Agar well diffusion method, Agar plugs diffusion method, Cross streak method, and Agar dilution method are some of them. Among them, agar disc diffusion method and agar well diffusion method has used commonly in the studies of assessing the antimicrobial activity of Ayurvedic preparations. The agar mediums play a major role in the above laboratory findings. Blood agar, nutrient agar, MacConkey Agar and mullar hinton agar are the agar plates which commonly used in laboratory experiments, associate with the antimicrobial activity of Ayurvedic preparations. Five to ten percent of blood of sheep or horses have used to prepare blood agar plates and it is utilized to spot organism such as *Neisseria gonorrhoeae* and *Haemophilus influenza* ²².

According to the present review study, some species of microbes are commonly killed by selected Ayurvedic preparations. Gram-positive bacteria, *Staphylococcus aureus* have been destructed by well-known Ayurvedic preparations such as, *Sudarshana churna*, *Thrikatu churna*, *Amurtharishta*, *Draksharishta*, *Arogyavardhini vati*, *Rasamanikya* and *Rasaka bashma*. *S. aureus* is a common human pathogen which majorly involve in skin infections (abscess) and sometime respiratory diseases (pneumonia), endocarditis, and osteomyelitis. Above drugs which exhibit antimicrobial activity against *S. aureus* also have been prescribed in the same conditions. As an example, *Sudarshana churna* and *Thrikatu churna* has amazing action in *shwasa*, *kasa* conditions. *Manikyarasa* indicates for both skin diseases and

respiratory tract diseases which are mainly origin due to the action of *S. aureus*.

Conclusion

The present study has been conducted to investigate the antimicrobial activity of the commonly used thirteen Ayurveda medicines against the common human bacterial and fungal pathogens using the agar well diffusion method and by disc diffusion method under strict aseptic conditions and following standard laboratory guidelines.

The findings of this study were very encouraging as all 13 Ayurveda medicines exhibited potent antimicrobial activity in general. Particularly, *Rasamanikya* and *Shwasakutara rasa* were shown to be effective against *S. aureus*. Next, *Chyawanaprashava leha* and *Chandraprabha vati* exhibited antimicrobial activity against *E. coli*. Then, *Sudarshana Churna* and *Thrikatu churna* were found to have the strongest antimicrobial activity against *S. aureus* and *E. coli*. *Amrtarishta* was effective in eradicating *S. aureus*, *E. coli* and *S. typhi*. Then, *Draksharishta* was found to have antimicrobial activity against *S. aureus*, *E. coli*, *S. typhi* and *B. subtilis*, apart from that, *Dashamularishta* was found to be effective against *S. flexneri*, *A. niger* and *P. auriginosa*. Only *Thalisadi churna* exhibited good antifungal activity against *C. albicans*.

The results of this study clearly established either the potent antimicrobial activity or inhibitory action of all thirteen Ayurveda medicines against the common human bacterial and fungal pathogens and might offer new hopes for controlling infectious diseases and preventing the emergence of resistant variants.

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