



**A study of some aspects of chemistry
and bioactivities of Sri Lankan
Broken Orange Pekoe Fannings
(BOPF) grade black tea
(*Camellia sinensis* L.)**

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Abstract

Tea (black, oolong and green) produced from cultivars of species *Camellia sinensis* (L.) O. Kuntze (family: Theaceae), is the most consumed natural beverage in the world beside water. Among the consumers, 80% preferred black tea and Sri Lanka is the world's leading producer in orthodox black tea. Nevertheless, research on the chemistry and bioactivities of Sri Lankan black tea is very limited or poorly documented.

Therefore, this study investigated the phytochemical constituents in Sri Lankan black tea and tea infusion, as well as its potential bioactivities and toxicology in rats. A popular black tea grade, BOPF, obtained from three major agroclimatic elevations (high grown, mid grown and low grown) was used in this study. Acute and chronic bioactivities were evaluated in rats treated with different measures of black tea infusion (BTI): 300, 600 and 2400 mg/kg bw of rat/day, equivalent to 1½, 3 and 12 cups per day respectively for human. Blood glucose levels (in normoglycaemic, hyperglycaemic, streptozotocin-induced diabetic rats), diuretic (in saline-hydrated rats), antioxidative (on free radical scavenging and peroxidation), blood cholesterol levels (in normolipidaemic, hyperlipidaemic and hypercholesterolaemic rats), antiurolithiasis (using calcium oxalate based kidney stones), antiurolithiatic (using surgically removed human kidney stones), gastroprotective (in chemically induced gastric lesion models: ethanol, indomethacin and serotonin), male sexual competence (copulatory behaviour study) and anxiolytic (on hole board test, novel food and drink intake in neo-phobic test models) properties were evaluated. The total polyphenols and antioxidant activity in black tea during 36 months storage was studied. Recovery in BTI of arsenic, lead, mercury spiked black tea, bioavailability in metal loaded rats treated with BTI, were evaluated. Oral toxicology was evaluated in terms of general toxicity, haemotoxicity, serum and urine biochemistry, renotoxicity, hepatotoxicity, histopathology, chronic toxicity.

The results revealed a significant variation in phytochemical contents of black tea and BTI at different agroclimatic elevations. In the bioactivity studies, the highest antioxidant, hypolipidaemic, anticholesterolaemic, antihypercholesterolaemic, aphrodisiac and anxiolytic activities were evident in high grown tea; whereas the highest diuretic and gastroprotection activities were evident in low grown tea. However, in regard to hypoglycaemic, antihyperglycaemic, antidiabetic, antiurolithiasis and antiurolithiatic activities, there was no uniform trend evident in the different agroclimatic elevations. Diminished antioxidant activity and polyphenol contents during storage was evident. Low recoveries of As, Pb and Hg metals in BTI, low bioavailability and metal mopping action in metal loaded rats were evident. Aphrodisiac activity had shown inverse dose dependency. No evidence on oral toxicity effect of BTI on any measured parameters was discernible in rats.

In conclusion, the study on the BOPF grade of Sri Lankan orthodox black tea and its infusion revealed that phytochemical content varied at different agroclimatic elevations. In regard to oral hypoglycaemic, antihyperglycaemic, antidiabetic, diuretic, antioxidative, hypolipidaemic, anticholesterolaemic, antihypercholesterolaemic, antiurolithiasis, antiurolithiatic, gastroprotective, aphrodisiac and anxiolytic properties, a novel findings were recorded. Most of these had moderate potency than positive control, and dosage and elevation dependent bioactivities, mediated via phytochemicals, where concentrations in tea are dependent on agroclimatic elevation. Bioactivity deteriorates with phytochemicals affected by storing conditions. Metal mopping action that varied within the three elevations was, for the first time, recorded. Importantly, daily oral administration of black tea did not create any toxicity symptoms. Scientifically, the findings of this study validated the therapeutic claims and may be useful for developing safe oral drugs. It is clear that the consumption of the BOPF grade black tea on regular basis could have many important health benefits in human.