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ANTIBACTERIAL ACTIVITY OF DIFFERENT TEA EXTRACTS AGAINST *ESCHERICHIA COLI*

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ABSTRACT

The present investigation aims at the comparative antibacterial activity of fresh first leaves of green tea with the commercially available two different forms of tea- granular form and dust form and also green leaf tea. The fresh first green tea leaves collected from the Western Ghats region, commercial green tea, Tea dust and Tea granules were collected from the super market. All forms of tea were processed and their aqueous extractions were prepared. The antibacterial activity of each of the tea extracts were assayed *Escherichia coli* MTCC 439 by agar gel diffusion inhibition technique at 10 mg/100 mL concentration. The fresh first leaves of green tea showed highest zone of inhibition (15 mm diameter) in comparison to commercial green tea (12 mm diameter), granular tea (08 mm diameter) and dust tea (06 mm diameter) respectively. Like a black tea, fresh green tea also effective in inhibiting the growth of bacteria responsible for causing the intestinal diarrhoea such as *E.coli.*

Keywords: Antibacterial Activity, *Escherichia coli*, *Camellia sinensis*, Aqueoustea extracts, Zone of inhibition

INTRODUCTION

Tea is a very popular drink worldwide. It is produced from the plant *Camellia sinensis*, which is grown in at least 30 countries, and grows best in certain tropical and subtropical regions. The tea is an infusion of leaves that has been consumed for centuries as a beverage and is valued for its medicinal properties.

Camellia sinensis is mainly cultivated in India and china. Green tea has many beneficial effects on the body. The recent era is all about herbal treatment of various diseases and green tea is one of the best tonics for healthy well being

Currently, tea in the form of green or black tea, next to water, is the most widely consumed beverage in the world. According to Chinese legends, tea was discovered by the Emperor Shen Nong in about 2700 BC, when a gust of wind blew tea leaves into a kettle of boiling water.

People have been drinking tea for centuries also because of its health effects. Green tea boasts several health benefits, including reducing blood sugar and cholesterol, warding off atherosclerosis, protecting against certain types of cancer, reducing symptoms of inflammatory bowel disease and protecting against diabetes and some liver diseases**.** Tea might reduce the risk of developing certain cancers, including breast, bladder, ovarian, Oesophageal, colorectal, lung and pancreas, skin, prostate and stomach.

The phytochemical screening of tea revealed the presence of alkaloids, saponins, tannins, catechin, and polyphenols. The primary difference between green and black tea is in the fermentation process required to produce tea. In case of black tea the leaves and buds are fermented or oxidized after they have been dried. In green tea the leaves are steamed after they are dried. The phytochemicals present in tea leaves are highly sensitive to oxidation process.

Various studies have demonstrated antimicrobial activity of green tea extract in vitro against some potent pathogens, such as *Esherichia. coli, Staphylococcus aureus, Brochothrix thermosphacta, Pseudomonas putida* **[1-3]**.

Excessive use of tea can result in increased blood pressure, heart rate as well as constipation. Tea has caffeine, which can make some people nervous, or interfere with sleep.

The present study is to evaluate the comparative analysis of antimicrobial activity of different tea extracts viz. fresh green tea, commercial green tea, black

granules and black dust tea against *Escherichia coli.*

The study also helps us to see the antibacterial activity of tea against pathogenic bacteria and to design therapeutic agent against the disease cause by them.

MATERIALS AND METHODS

Collection of Plant material: The fresh green tea leaves used in this experiment were obtained from Wayanad plantation, located in North Kerala on the Western Ghats with altitudes ranging from 700 to 2100 m. north latitude 11degree 2628, on the southern part of India. Commercial green tea leaves, dust and granule tea were obtained from supermarket as per the standard methods **[4]**.

Processing of samples: The fresh first green tea leaves were air-dried at 30 ^{0} C for 4 h, then cut into pieces and ground into powder. Commercial green tea leaves and dust and granules were, weighted and powdered by the mill.

Preparation of aqueous extraction: The aqueous extractions of the fresh first leaves, commercial green tea leaves, dust and granules were prepared as per the standard protocol**.** 10g of each tea i.e. dry tea leaves (fresh) and commercial tea (green tea leaves, dust and granules) were extracted by soaking for 2 days using 100 mL of distilled water in a 250 mL sterile conical flask, and boiled well. The extract was filtered using Whatman filter paper No.1. The filtrates were then concentrated by using hot air oven and stored in universal bottles and refrigerated at 4°C prior to use **[5]**.

Test organism: The Bacterial strain (*Escherichia coli* - MTCC 439)*)* were obtained from Microbial Type Culture Collection (MTCC), Institute of Microbial Technology (IMTECH), Chandigarh, India. These bacterial cultures were maintained by regular sub culturing on nutrient agar slants and stored at 4°C as well as at – 80ºC by making their suspension in 10% glycerol.

Antibacterial assay

The antibacterial assay was done with respect to the leaves extract against the test strain *Escherichia coli* by agar gel diffusion inhibition technique as per the standard methods **[4]**. 15 mL of Nutrient agar was poured into sterilized petriplate and allowed to solidify. After solidification, the petriplate were swabbed with *Escherichia coli*using a sterile swab. Four wells of about 10 mm diameter were aseptically cut on agar-plate using a sterile cork borer allowing at least 30 mm between adjacent wells and peripheral wells and the edge of the petridish. 0.1 mL of the prepared extracts was poured into each well and the plates were incubated at 37°C overnight. Zone of Inhibitions was

measured and data was tabulated. The Plates were made in duplicates.

RESULTS

The antibacterial activity of different aqueous tea extracts were tested against the *E. coli*. The zone of inhibition of different aqueous tea extracts against *E. coli* was as .shown in the **Table 1**. It was clear from the results of **Table 1** that, all the four different aqueous tea extract tested exhibited varied degree of antibacterial activity as evidenced by varied diameter in zone of inhibition for each type of tea tested. The antibacterial activity of Fresh Green Tea leaves, Commercial Green tea, Granules Tea and Dust Tea were found to be 15, 12, 8 and 6 mm in diameter respectively. The Fresh Green Tea leaves showed the highest zone of inhibition against the *E .coli*, whereas the Dust Tea showed the least zone of inhibition. The result shows that the inhibitory effect of fresh green tea leaves on *E. coli* was greater than that of commercial green tea, granules tea and dust tea as well. The inhibitory activity of different tea extracts against *E. coli* was s shown in **Plate 1**.

Table 1: Antibacterial activity of different aqueous tea extract against *Escherichia coli*

Sl. No	Sample	Zone of inhibition in diameter (mm)
1	Fresh Green Tea Leaves	15
2	Commercial Green Tea	12
3	Granules Tea	08
4	Dust Tea	06

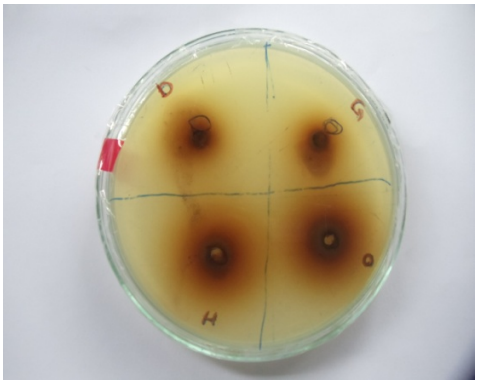

Plate 1

Note: O = Zone of inhibition of fresh green tea; H = Zone of inhibition of commercial green tea; G = Zone of inhibition of granules tea; D = Zone of inhibition of dust tea

DISCUSSION

The antimicrobial activity of *camellia sinensis* against *E. coli* showed significant antibacterial activity of all tea extract, at a concentration of both 10 mg/100 mL. Black granules and dust proved to be significantly effective against *E. coli,* but fresh green tea demonstrated better performance on *E. coli*

(inhibition zone of 15 mm) followed by commercial green tea.

In the present study, the obtained results of antibacterial activity of different aqueous tea extracts was in concordance with the observation of Saikia *et al..,***[6]**. who found that the aqueous extract of the fresh green tea produced larger zone of inhibition (15 mm) against *E. coli.* He also observed that it may be attributed to green tea catechin compounds and polyphenols. These compounds have been found to possess antibacterial action. In general antibacterial activity decreased, when the extent of tea fermentation increased.

The testing of various tea extract on ethnopharmacological data for antimicrobial activity has been successful in several studies **[4, 7]**.

Our findings suggest that, the microbiological effects of tea extracts are selective and it depends on their type of extract. The fresh first green leaf extract had a better antimicrobial activity in comparison to other forms of tea extracts. Similar experiments on other bacterial species have shown that, these effects may also differ depending on the bacterial species so that they may be either growth inhibitory or stimulatory **[8, 9]**. Both black tea and green tea extract may have synergistic or antagonistic effects on antistreptococcal antibiotics **[10]**.

The antimicrobial properties exhibited by the tea are due to the dominants of phytochemically active compounds. There are reports that, *Camellia sinensis* is a rich source of antimicrobial property and is due to presence of group of polyphenols compounds called catechins, which play an important role in inhibition of bacterial growth **[7]**.

The complex chemical composition of green tea contains abundant polyphenols. The catechins in green tea (specific antioxidant polyphenols) play an important role in inhibition of bacterial growth. Several catechins include epigallocatechin-3-gallate (EGCG), Epigallocatechin (EGC), epicatechin-3-gallate (ECG), epicatechin (EC) and gallocatechin-3-gallate (GCG). Green tea leaves extract tested in current study have also shown strong activities against *E. coli*. The active substances found in tea are supposed to reduce the growth and development of microorganism. The highest antimicrobial activity of tea is due to the presence of catechins and polyphenols. The green sort of tea has shown higher antimicrobial activity than black ones **[3, 11]**.

The herbal green tea mouthwash could reduce the aerobic mouth bacterial load and may prevent plaque formation on teeth

and come over halitosis due to infection of the bacteria. Also, it is a safe and nontoxic mouthwash especially for children and pregnant women **[12]**. The antibacterial effect of green tea against *Escherichia coli* in the prevention and treatment of Urinary tract infection was reported **[13]**. The antibacterial activity of the *C. sinensis* is due to non polyermic phenolic and polymeric tannin constituents **[14]**.

In conclusion, this experiment has shown that, tea have antimicrobial properties. Almost all of the tea extract tested, does seem to inhibit bacterial growth, however the fresh green tea does show highest effectiveness in inhibiting bacterial growth, the result do support our hypothesis that, the fresh green tea extract would be the most effective bacterial inhibitor.

CONCLUSION

Traditionally people use black tea as a natural remedy for the prevention of diarrhoea and our findings showed that, green tea also have the antibacterial activity for the control of *E. coli* growth. So we can also use green tea for lowering the risk of developing infection in intestine, especially by *E. coli*.

Green tea is effective as an anticarcinogen. It lowers the LDL level, prevents heart diseases, provides oral hygiene, and has antioxidant property. Our findings proved that the green tea has greater antibacterial activity than black tea. So it is more effective than black tea for combating microbial infection.

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REFERENCES

[1] Kim, Ruengwilysup, Fung C, Antibacterial Effect of Water Soluble Tea Extracts on Food borne Pathogens in Laboratory Medium and in a Food Model, Journal of Food Protection, 67 (11), 2004, 2608-2612.

[2] AHN YJ, Sakanaka , Kim MJ, Kawamura, Fujisawa, Mitsuoka, Effect of Green Tea Extract on Growth of Intestinal Bacteria, Microbial Ecology in Health and disease, 3(6), 1990, 335-338, DOI: 10.3109/08910609009140256.

[3] Elodie Rozoy, Laurent Bazinet, Monica Araya-Farias, Anthony Guernec, Linda Saucier, Inhibitory

Effects of Commercial and Enriched Green Tea Extracts on the Growth of *Brochothrix thermo sphacta*, *Pseudomonas putida* and *Escherichia coli*, Journal of food research, 2(1), 2013, DOI:105539/jfr.v2n1p1.

[4] Archana S, Abraham J, Compa, rative analysis of antimicrobial activity of leaf extracts from fresh green tea and black tea on pathogens, Journal of Applied Pharmaceutical Science 1(8), 2011, 149-152.

[5] Samaneh Bagheri, Barat Ali Fakheri, Nafiseh Mahdi Nezhad, Comparison of Antimicrobial and Antioxidant Activities of Four Different Tea Extracts. Journal of Medical Microbiology and Infectious diseases, 3 (3-4), 2017, 57-61.

[6] Abinash Pratim Saikia, Venkat Kishore Ryakala, Pragya Sharma, Pranab Goswami, Pranab Goswami, Ethnobotany of medicinal plants used by Assamese people for various skin ailments and cosmetics, Journal of Ethnopharmocology, 106(2), 2006, 149-57.

[7] Amit Kumar, Ajay Kumar, Payal Thakur, Sandip Patil, Chandani Payal, Anil Kumar, Pooja Sharma, Antibacterial activity of green tea *(Camellia sinensis)* extracts against various bacteria isolated from environmental source,. Recent Research in science and Technolog, 4 (1), 2012, 19-23.

[8] Maksum Radji, Rafael Adi Agustama, Berna Elya, Conny Riana Tjampakasari, The antimicrobial activity of *Camellia sinensis* against various pathogenic bacteria including MRSA and MDR-*P. Aeruginosa,* Asian Pacific Journal of Tropical Medicine, 3(8), 2013, 663-667.

[9] Abdolmehdi Araghizadeh, Jamshid Kohanteb, Mohammad Mehdi Fani, Inhibitory Activity of Green Tea (*Camellia sinensis*)Extract on Some clinically Isolated Cariogenic and Periodontopathic Bacteria, Medical Principles and Practice, 22 (4)2013, 368–372.

[10] Tirang R, Neyestani, Niloufar Khalaji, Azam Gharavi, Black and green teas may have selective synergistic or antagonistic effects on certain antibiotics against *Streptococcus pyogenes* in vitro, *Journal of Nutritional & Environmental Medicine*, 16(3-4), 2007, 258-266, DOI: 10. 1080/ 13590840701703934.

[11] Marcia Reto, Maria Eduardo Figuerira, Helder Mota Filipe, Cristima, Chemical Composition of Green Tea (*Camellia sinensis*) Infusions Commercialized in Portugal, *Plant Foods for Human Nutrition,*2007,Vol. 62. (4): 139-144.

[12] Abdolhosein Moghbel, Ahmad Farjzadeh, Nasrin Aghel, Homayoon Agheli, Nafiseh Raisi, The Effect of Green Tea on Prevention of Mouth Bacterial Infection, Halitosis, and Plaque Formation on Teeth, *Iranian Journal of Toxicology,* 5 (14), 2011, 502-515.

[13] Afsaneh Noormandi, Fatemeh Dabaghzadeh, Effects of green tea on Escherichia coli as a uropathogen, *Journal of Traditional and Complementary Medicine,* 2015, 5 (1), 15-20.

[14] Eric W.C. Chan, Eu Ying Soh, Pei Pei Tie, and Yon Peng Law, Antioxidant and antibacterial properties of green, black, and herbal teas of Camellia, *pharmacognosy res,* Vol.3. (4), 2011, 266-272.