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A NOTE ON THE ANTI-MICROBIOLOGICAL ACTIVITIES OF BLACK TEA

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ABSTRACT

Tea is widely used beverage with medicinal benefits. Black tea is the complete fermented/oxidized form of tea leaves. Black tea contains complex flavonoids called theaflavins and thearubigins, which are responsible for a number of potential health benefits. Antioxidant, anticancerous, antidiabetic effects of theaflavins from black tea was well documented and reviewed. But the antimicrobiological effects of black tea were not extensively reported. Tea flavonoids can act against foodborne and other pathogenic bacteria, virulent protein toxins produced by bacteria, virulent bacteriophages, pathogenic viruses and fungi which includes the bioavalibility of the flavonoids. Moreover the sustenance of antimicrobial potential was also correlated with the shelf life of black tea. In this perspective the focus of this review is to introspect the antibacterial, antiviral, antiprotozoal, antifungal activities of black tea.

KEYWORDS: Black tea, theaflavins, thearubigins, antimicrobial, antiviral, antiprotozoal, antifungal.

INTRODUCTION

Tea is the most widely used ancient beverage in the world with the observation of medicinal benefits. During the fermentation process, in which green tea oxidizes to form black tea usually caffeine content tends to remain constant, while the types of flavonoids present in the tea differ. Green tea usually contains simple flavonoids called catechins, while black tea contains complex flavonoids called theaflavins and thearubigins, which are responsible for a number of potential health benefits (Preedy, 2015). Nowadays it is found that black tea is most widely consumed in Western countries, probably due to its good storage properties, which indirectly promotes active trade with tea-producing countries in Asia including India. Black tea represents over 90% of all tea sold in the West and the main tea beverage in India, Europe, Russia, North America, the Middle East, Indonesia, North Africa, Chile, Hong Kong, Australia, and New Zealand (Waugh et al., 2017). The therapeutic uses of black tea were mostly investigating its antioxidant properties and correlated with the brewing time (Nikniaz et al., 2016). It could therefore be interesting to review the therapeutic potential of black tea in relation to lifestyle and health effects from a microbiological perspective. In view of the perceived positive health effects of black tea as the body weight reduction by black tea was reported by Pan et al., 2016. Black tea is the fermented/oxidized form of tea. Tea leaves produce organic compounds which are involved in the defense of the plants against invading pathogens including insects, bacteria, fungi, viruses. Tea flavonoids can act against foodborne and other pathogenic bacteria, virulent protein toxins produced by bacteria, virulent bacteriophages, pathogenic viruses and fungi which includes the bioavalibility of the flavonoids (Zhao and Shah, 2016). They had described concomitant ingestion of lactic acid bacteria and black tea synergistically enhances flavonoid bioavailability. Black tea shows its antioxidant property by inhibiting lipid peroxidation and chelating metal ions (Horie et al., 2017). The anticancerous (against ovarian cancer, lung cancer, colon cancer) effect of Black tea was already established (Bhattacharya et al., 2017; Zhan et al, 2017). The antidiabetic effects of Black tea were established as well. Anti-hyperglycemic effect of black tea was demonstrated by Fu et al., 2017. The Black tea infusions have antimicrobial effects as well. The aim of this review is to focus on the various aspects of antimicrobial effects of Black tea on different types of microorganisms including bacteria, virus, fungi, protozoa as well.

- **Antibacterial activities of Black tea**

Chan et al., 2011 have found that the black tea inhibited the growth of *Micrococcus luteus* and *Bacillus. cereus*. The growth of *Staphylococcus aureus* was inhibited by Black tea reported by Chopra and Greenwood, 2001. Naderi et al., 2011 have reported antibacterial activity of Black tea against *Streptococcus mutans* in *in vitro* studies. Mughal et al., 2007 have demonstrated the antibacterial activity of black tea along with the synergistic effects with Chloramphenicol, Tetracycline, Levofloxacin antibiotics. Patil et al., 2016 have

demonstrated wide range of antibacterial activity of black tea against Gram positive organisms as *Bacillus cereus* ATCC13061, *Staphylococcus aureus* ATCC6538p, *Staphylococcus saprophyticus* KCTC3345, *Listeria monocytogenes* ATCC7644 and Gram negative bacteria *Proteus vulgaris* KCTC2512, *Pseudomonas aeruginosa* KCTC2004, *Pseudomonas putida* ATCC49128 and *Serratia marcescens* KCTC42171. Obwoge, 2017 had reported the antimicrobial effects of black tea against *Staphylococcus aureus*, *Streptococcus faecalis* and *Escherichia coli*.

- **Antiviral activities of Black tea**

Cantatore et al. 2013, have demonstrated the antiviral effects of Black tea against simplex virus-1 infection. Research had demonstrated that theaflavins of Black tea contain antiviral activity against Herpes simplex virus 1 & 2 (HSV-1 & HSV-2) and on the Sindbis virus (SINV) (Villagomez, 2017). Epigallocatechin gallate and theaflavin digallate (TF3) from black tea had inhibited the infectivity of both influenza A virus, influenza B virus (Yang et al., 2014). Black tea extract (BTE), containing flavonoids theaflavins, could inhibit herpes simplex virus type-1 (HSV-1) infection in cultured A549 (human epithelial) and Vero cells inhibited by Cantatore et al., 2013. Quercetin from black tea can be as antiviral agent against Dengue virus DENV-2 strain (Rahaman, 2015).

- **Antiprotozoal activities of Black tea**

Antihemolytic, hepatoprotective and nephroprotection action of black tea against *Plasmodium berghei* was done by Nakichat et al., 2017. Obwoge, 2017 had demonstrated the antiprorozoal activities of black tea against *Entamoeba coli*.

- **Antifungal activities of Black tea**

Battikh et al., 2012 have demonstrated the antifungal effects of black tea against *Candida* sp. anti-Candida activity of tea polyphenols was demonstrated by Sitheeque, 2009. Obwoge, 2017 had demonstrated the antifungal activities of black tea against *Candida albicans*. *In vitro* antifungal activity against *Candida* species of Sri Lankan orthodox black tea belonging to different agro-climatic elevations was demonstrated by Ratnasooriya et al., 2017. The antifungal activities of black tea against *Candida albicans* ATCC 14053, *Candida albicans* ATCC 64548 and *Candida krusei* ATCC 6258 strains were done by Camargo et al., 2016.

CONCLUSION

Olosunde et al., 2012 had also demonstrated the various aspects of the Black tea extracts on different microorganisms. Antimicrobial effects of Black tea extracts were observed against *Pseudomonas Aeruginosa* isolated from eye infections (Flayyih et al., 2013) and the antimicrobial capacities were compared with different antibiotics viz. Carbenicillin, Tetracycline, Cefotaxime. The Minimum Inhibitory Concentrations were determined and the zone of inhibitions were measured with respect to different concentrations of Black tea extracts. The antimicrobial activities along with Physicochemical, Biochemical parameters of Black tea were determined by Saha and Shyam Choudhury, 2016. This paper also have shown the change in antimicrobial potential during storage in different packaging—which established the superiority of Black tea to retain the Biochemical properties which are the responsible candidate for the antimicrobial properties.

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