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Significance of Black Tea: A Brief Review

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Abstract: *Tea is the second most consumed drink in the world after water and it is also a very popular beverage in middle eastern cultures. Numerous studies have shown that a variety of teas may boost the immune system, fight off inflammation and even ward off cancer and heart disease. Black tea inculcates its vitality due to the aflavin and thearubigins particularly, which is a very important polyphenol of black tea which holds the functions like antioxidant, cancer suppressor and inhibitor of pathogenic micro-organisms. The beneficiary actions of black tea particularly on living cells perform the actions on heart disease and liver disease were also reported. Majority of these beneficial effects of both green tea and black tea are linked to its catechins specifically (-)epigallocatechin-3 gallate. Modern research certifies the international standards and should be performed to detect the major vital measures of green and black tea to illuminate the mode of action..*

Keywords: Catechins, Theaflavins(TF), Thearubigins(TR), Tea polyphenols, EGCG (epigallocatechin-gallate)

I. INTRODUCTION

Tea is one the most ancient and most popularly consumed beverage worldwide, which is produced from infusing dried leaves with hot water. Mostly it is consumed as black and green. In the recent years, polyphenols and its derivatives encountered significant attention due to its biological and pharmacological importance [1,2]. Many polyphenols are occurring in natural compound extracted from herbs, mainly from tea. Polyphenols have a wide range of applications as an antioxidant, anti-inflammatory, anti-cancer, anti-hypertension activities, anti-microbial and other properties. The antioxidant property of the compound is very important to protect damage against free radicals that are produced in our body as a result of biochemical reaction [3,4]. Free radicals are generated due to internal factors such as inflammation and external factors such as environmental pollution and UV exposure, which are harmful for human body and causes oxidative stress which in turn promotes cancer, heart diseases, stroke, respiratory diseases and immune-deficiencies. Tea is a very stable beverage in our Indian household. It is one of the ancient and much popular drink among all over the world. Antioxidants can prevent free radicals, primarily highly reactive oxygen and nitrogen from damaging human health. Oxidative damage is one of the many mechanisms leading to chronic disease. More recently the attention has shifted to polyphenols which are the secondary metabolites occurs widely in plant food. The consumption of tea without milk is a good source of antioxidant and addition of lemon to tea increases its antioxidant potential [5,6,7,8].

1.1 Tea Polyphenols

Tea leaves contain >35% of their dry weight as polyphenols whose nature depends upon manufacturing procedure. In this context, numerous studies have shown that theaflavins, major polyphenols contained in black tea, possess a variety of protective effects [9].

All kinds of tea originate from *Camellia Sinensis* which has two subspecies variants- *Sinensis (China Tea)* and *Var. Assamica (Assam Tea)*. The purpose of using tea is mainly for its aroma taste and health promoting effects and its pharmaceutical activity [10,11,12]. It is the most ancient and widely consumed drink worldwide and gets from the young leaves of *Camellia Sinensis*. Tea leaves can be processed in different ways resulting in a drink which appears and tastes different. It can be processed differently to get White Tea (unoxidized), Oolong Tea (partially oxidized) and Black Tea (fully oxidized). Green tea is a major beverage, consumed in Asian countries, whereas black tea is famous

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among North America and Europe and Oolong tea, whose production and consumption is limited to China. The quality of tea can be determined by presence or absence of chemical compounds which impart to colour, briskness, brightness, strength, flavour and infusion [13,14,15,16]. Despite the fact that mankind has been drinking tea for more than 5000 years tea extracts have gained popularity as ingredients in dietary supplements and functional foods. Interest in tea chemical composition and analysis has increased in last decade due to an abundance of scientific data regarding the positive effect of tea on human health. Primary compounds present in tea are mainly Catechins, Oxyaromatic acids, Flavonols, Theaflavins, Teagallins, Thearubigins Pigments, Alkaloids, Sugars, Amino acids, Vitamins, Dibasic acid, Cations, Metals, Lignans and triterpenoidsaponins [17,18,19,20,21,22].

II. Green Tea Vs Black Tea

- Green tea and black tea show variations in their phytochemical contents.
- Many methods are used for the analysis of such complex multi-parts mixtures in tea and are used in enormous way for their identification, estimation and quantitative analysis of tea components.
- Green tea is based on non-fermented process on the other hand black tea is based upon fermented process of making and processing.
- Based on total content of Catechins and Epigallocatechingallate, a key component of chemical composition in various types of teas. Various teas are arranged in the following order:
- Green Tea > Green Tea (leaves) > Black Tea
- The primary phenolic components of black tea are theaflavins,thearubigins and theobromine while in green tea theaflavins and thearubiginsshould not be present in pure green tea or should be present in very small quantity.

III. Composition of Black Tea

Tea contains a wide variety of chemical compounds, but some of the most important in terms of it's taste and coloration are the polyphenols. Black tea is produced by the full oxidation of tea leaves, which are then dried. Commonly flavonoids called Catechins contains 27% of the composition of aunoxidized green tea and due to oxidation process, these are reduced in black tea to around 4%. Due to oxidation, catechins in black tea are polyphenols which have high impact factor on its colour and flavour [23,24,25].

IV. Processing of Black Tea

- Fermentation is the process by which Black Tea are produced which involves enzymatic oxidation process from tea leaves catalysed by polyphenol oxidase [26].
- The oxidation process is proceeded by the action of enzyme named polyphenol oxidase on catechins to form quinones which are catalysed to form dimers and oligomers [27].

4.1 Methods of Processing

1. To enhance the oxidation process the leaf size is reduced by rupturing the withered tea leaves using CTC machine (Crush, Tea, Curl). It is used to disrupt the cells in order to reduce polyphenol oxide to react with catechin.
2. Black tea produced by rollers is more suitable for large leaf type tea and CTC methods used to obtain small particles suitable for tea bags.
3. CTC method produces large surface for the catalytic and enzymatic oxidation.
4. On comparing between CTC and orthodox rollers, CTC has lower catechin content and antioxidant capacity compared to orthodox roller method.
5. Black tea has 20 times more gallic acid than green tea.
   The total phenolics and flavonoids follows the following order:
   Green Tea > White Tea > Black Tea

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Tea contains a wide range of chemical compounds but some of the most important are in terms of its taste and coloration are the polyphenols. Tea have 4000 bio active compounds mainly are alkaloids (theobromine, caffeine), polyphenols, amino acids, proteins, chlorophylls, carbohydrates, organic volatile compounds and other trace elements [28,29].

Black tea is produced by full oxidation of tea leaves, which are then dried commonly called catechin Contains 27% of the composition of un-oxidized green tea and due to oxidation process, these are reduced in black tea to nearly 4%.
Due to oxidation catechin in black tea are polyphenols which have high impact factor on its colour and flavour [30,31].

V. Beneficiary Effects of Black Tea

- Tea is entitled as the second most used beverage in the world after water.
- This inculcate due to its various advantages specifically concerting health properties like antioxidant, cholesterol lowering, anti-inflammatory, anti-aging, antibacterial, reducing risk of cancer and obesity.
- It's most precious and advanced property nowadays for health benefits is in COVID-19.

VI. Polyphenols in Black Tea Serving as an Antioxidant

Ku et al. observed that the composition of bio active compounds and it's antioxidant activity of tea might be directly correlated with several parameters like genetic strain, climatic condition, soil profile, growth altitude, horticultural practices and plucking season.
Black tea have in enormous antioxidative properties due to its compound compositions which are:

- Flavon-3-ols
- Phenolic acids
- Flavanols and flavones
- Theaflavins and thearubigirs
- Theasinensins

Components which are responsible for antioxidants are extracted for beneficial effects against cancers (Mitchells and others 2005), pathogenic bacteria (Yoda and others 2004, Friedan and others 2005) and diabetes (Vinsen and Zhang 2005). It has been proved that more process tea shows less antioxidant capacity and ready to drink tea beverages have less antioxidant capacity then to the cup of prepared tea [32,33,34].

Theaflavins are regarded as natural antioxidants and the hydroxyl group of phenols in black tea possesses the antioxidant activity as radical scavengers, metal and Gallic acid which are essential. Theaflavin constitutes major part in black tea [35].

Esterification of gallate present in theaflavins increases the effectiveness of theaflavins and enhanced as digallate ester. Among the four major compounds in theaflavins follows the following order of antioxidant activity:

$TF_3 > TF_2A = TF_2B > TF_1$

While on oxidative damage, theaflavins acts as exogenous antioxidant and donates a proton to the radical to form a stable product as to play a crucial role in the anti-oxidative activity of polyphenols and black tea [36,37,38].
If taking the anti-oxidative order in different teas the order is as follows:

Green ≥ low caffeine > White ≥ Black Tea

VII. Polyphenols in Black Tea Serving as Anti-Obesity Agent

Obesity is a disorder of body involving access of body fat that increases the risk of health problems. It results often from taking more calories than are burned by exercise and normal daily activities. It is a major public health issue for the modern generation. Theaflavins which are major part present in black tea performs various vital and protective activities in living tissues [39].

According to the World Health Organization 2010 global reports on non-communicable disease people lived all over the world are now suffered from overweight i.e.so called obesity. Obesity diminished by the polyphenols of black tea and possesses a positive effect by involving following mechanism:

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1. Inhibiting lipid and saccaride digestion, absorption and take, thus reducing calorie intake [40].
2. Promoting lipid metabolism by activating AMP activated protein kinase to attenuate lipogenesis and enhance lipolysis and decreasing lipid accumulation by inhibiting the differentiation and proliferation by preadipocytes [41]. By blocking the pathological processes of obesity and comorbidities of obesity by reducing oxidation stress [42].

VIII. Polyphenols in Black Tea Serving as an Antiviral Agent

The rapid spread of novel coronavirus called SARS-CoV-2 or nCoV has cost countries all over the world. Covid-19 is a viral disease that effects the epithelial cells of the respiratory system and causes inflammation of the mucosal membrane [43].

Tea polyphenolic compound EGCG and black tea theaflavins surpasses the activity of SARS-CoV-23CL - Protease. Coronavirus require the 3 CL-Protease for the cleavage of its polyprotein to make individual proteins functional. EGCG and theaflavins shows dominating action for SARS-CoV-23CL-Protease Inner dose dependent manner and a half inhibitory concentration was 7.858µg/ml for EGCG and 8.44µg/ml for theaflavins. These results suggest that upon further study, EGCG and theaflavin can be potentially useful to treat COVID-19 [44,45].

It has been investigated that tea polyphenols need further detailed evaluation to validate their anti-COVID- 19 applications. Theaflavins especially TF_2B and TF_3 can be used as good prophylactic agents owing to their ability to bind RBD. EGCG and it's stable lipophilic derivative could also be potential prophylactic as well as theraupetic agents. Looking at their properties to dock to various active sites of SARS-CoV-2 [46,47].

IX. Conclusion

It has been proved through many researchers that black tea polyphenols play an important part in treating various activities. This review focused on the anti-oxidative, anti-obesity, antiviral activities of black tea polyphenol treating as an anti-agent. Due to mainly of its functional groups which are responsible to bind the appropriate site for its functionality. Recent research on enhancing the bio availability of tea polyphenols and its glamour as a privilege famous for clinical control trails to translate the basic research findings into clinical use. High consumption of tea worldwide, further study on potential health benefits of tea is just reported. Definitive conclusions on the effectiveness of tea in maintenance of health and prevention of chronic disease will have to come from well-designed interventional and observational epide-miological studies.

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