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The beneficial effects of green tea on human health: an updated review

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Introduction:

Green tea is un-fermented product of Camellia species. The leaves of both Camellia sinensis and Camellia assamica, are used for the production of green tea, but C. assamica is mainly used for the production of black tea. Green tea is widely produced from the leaves of C. sinensis, now a days which is one of the most popular beverages worldwide. Over the past 50 years or more, scientists have studied this plant with respect to potential health benefits. Research has shown that the main components of green tea that are associated with health benefits are the catechins. The four main catechins found in green tea are: (-)-epicatechin (EC), (-)-epicatechin-3-gallate (ECG), (-)-epigallocatechin (EGC), and (-)-epigallocatechin-3-gallate (EGCG). Of these four, EGCG is present in the largest quantity, and so has been used in most of the researches. Among the important health benefits of green tea are: anticarcinogenic, anti-inflammatory, antioxidant, and antimicrobial properties, and benefits in cardiovascular disease and oral health. Research has been carried out using various animal models and cells lines, and is now more and more being carried out in humans. This type of research will help us to better understand the direct benefits of green tea. This review will focus primarily on researches conducted on human subjects to investigate the health benefits of green tea. Green tea, native to China, India and Bangladesh, has been consumed and hailed for its health benefits for centuries globally. Tea is the most consumed beverage in the world behind water. However, 78 percent of the tea consumed worldwide is black and only about 20 percent is green. All types of tea, except herbal tea, are brewed from the dried leaves of the C. sinensis bush. The level of oxidation of the leaves determines the type of tea. Green tea is made from unoxidized leaves and is one of the less processed types of tea. It, therefore contains the most antioxidants and beneficial polyphenols. Cultivation of tea plants is economically important in many countries, and is known to be grown in as many as 40 countries. C. sinensis grows best in certain tropical and subtropical regions . There are four main types of tea produced from this same plant, depending on how the tea leaves are processed. These teas are white, green, Oolong, and black tea. White tea is produced from very young leaves and buds that have not yet turned green, and the only processing is drying. Green tea is produced from mature leaves with minimal processing (only drying). Oolong tea is produced from partially fermented mature leaves, and black tea is produced from fully fermented mature leaves . Green tea, which makes up around 20% of tea production worldwide, is consumed most often in China, Korea, India, Bangladesh and Japan. Oolong tea is consumed most in China and Taiwan. Black tea (around 78% of tea production) is mostly consumed in the United States and the United Kingdom. Black tea contains up to three times the amount of caffeine as green tea . Like other drugs or nutrients within our system, the health beneficial effects of green tea solely depend on bioavailability after its consumption. In recent years, the health benefits of consuming green tea, including the prevention of cancer and cardiovascular diseases the anti-inflammatory, antiarthritic, antibacterial, antiangiogenic, antioxidative , antiviral, neuroprotective , and cholesterol-lowering effects of green tea and isolated green tea constituents are under investigation. However, adding green tea to the diet may cause other serious health concerns.

Objectives:

The active components of green tea that are the most health-promoting relevant medically are the polyphenols, with the flavonoids being the most important. The most pertinent flavonoids are the catechins, which make up 80%–90% of the flavonoids, and approximately 40% of the water-soluble solids in green tea . The amount of catechins in the tea can be affected by which leaves are harvested, how the leaves are processed, and how the tea is prepared. In addition, where the leaves are grown (geographically) and the growing conditions affect catechin amounts . Polyphenols are quickly oxidized after harvesting due to the enzyme polyphenol oxidase. To prevent loss of the polyphenols, green tea leaves are heated rapidly (most commonly by steaming or pan frying) to inactivate polyphenol oxidase. Black tea leaves are dried, then rolled and crushed, which promotes oxidation. Therefore, black tea has far fewer active catechins than green tea. Green tea contains four main catechins: (-)-epicatechin (EC), (-)-epigallocatechin (EGC), (-)-epicatechin-3-gallate (ECG), and (-) epigallocatechin-3-gallate (EGCG). The most abundant of these in green tea is EGCG, which represents around 59% of total catechins. The next most abundant is EGC (around 19%), then ECG (around 14%), and EC (around 6%). The chemical composition of green tea is made up of 15-20% protein, 1-4% amino acids, 30% phenolic compounds, 7% lipids, 7% carbohydrates, 26% fibers, 5% minerals and 2% pigments on a dry weight basis (See Fig 1). Amino acids like glutamic acid, tryptophan, glycine, serine, aspartic acid, tyrosine, valine, leucine, threonine, arginine, and lysine and carbohydrates (5-7% in dry weight basis) such as cellulose, pectins, glucose, fructose, sucrose are partly included in green tea . Other green tea-compounds with interest in human health such as fluorine, caffeine, trace elements such as chromium and manganese. It contains trace elements in lipid form (linoleic acid, alpha-linolenic acid), sterols (stigmasterol), vitamins (B, C, E), xanthine bases (caffeine, theophylline), pigments (chlorophyll, carotenoids), volatile compounds (aldehyde, alcohol, esters, lactones, hydrocarbons). The green and black teas are the products of the same plant, but the basic difference lies in their

processing. Black tea is the fermented product and undergoes fermentation process before drying.

Results:

Resistance to antimicrobial agents has been becoming harmful to the environment and accelerating the global problem. Nowadays many antimicrobial drugs cannot destroy their pathogenic microorganisms as they are becoming resistant. Therefore, researchers are finding some new drugs from mangrove species to control the pathogens due to the presence of antimicrobial compounds. The antimicrobial activity of tea was first established almost 100 years ago. Green tea exhibits antimicrobial properties, which are ascribed predominantly to its polyphenols. The degree of animation depends on the bacterial species and the polyphenol structure. Good evidence suggests that the catechin components of green tea are responsible for the observed antibacterial activity owing to the presence of EGC, EGCG, and ECG constituents . Gram-negative bacteria seem to be more resistant to polyphenols than Gram-positive bacteria, due to differences in the exterior membrane. The main components responsible for the antimicrobial activity are EGCG and EGC. EGCG at 10–100 μm has shown to reduce E. Coli growth by approximately 50%. The mechanism of antiviral action of polyphenolic compounds is based on various capacities to go about as antioxidant agents, to inhibit proteinaceous enzymes, to disrupt cell membranes, to avoid viral binding and penetration into cells, and to trigger the host cell. EGCG hinders infections by direct authoritative to biological molecules and persuades agglutination of the flu infection preventing their adsorption to target. The antiviral mechanism of EGCG has been analyzed against endemic HBV (Hepatitis B virus) infection. Many reports demonstrated that green tea catechin, EGCG is the most active compound against HIV infectious diseases. Furthermore, the evaluation has also been done with herpes simplex virus (HSV) and bovine coronavirus (BCV) to realize the resistance power of antiviral activity and therapeutic efficiency of catechin polyphenols .

Conclusion:

The beneficial effects of green tea are being increasingly recognize day by day, so it could be recommended that consumption of tea on regular basis. It is the reach source of phytonutrients like flavonoids, phenolic acids, polyphenols, and catechin tannins. Green tea catechins have proved to be very versatile in providing health benefits. This means that there are potential health benefits for everyone in the consumption of green tea. Even moderate amounts of consumption (drinking 1–2 cups of tea per day) may have benefits. It is a very good thing that it is the second most popular beverage worldwide, as the differences in health in a world without green tea might be significant. Green tea also has several hydrophilic antioxidants properties as Trolox and free radical scavengers. Unlike coffee, green tea contains an amino acid L-theanine, that prevents caffeine rush and gives you the energy to sustain throughout several hours instead. Fortunately, there is a wide variety of research being performed using green tea catechins, and we are starting to see many studies performed using human subjects, as it is extremely important that we are able to show the direct benefits to humans. Laboratory studies already showed the health effects of green tea. As the human clinical evidence is still limited, future research needs to define the actual magnitude of health benefits, establishes the safe range of tea consumption associated with these benefits, and elucidates the mechanisms of action. Development of more specific and sensitive methods with more representative models along with the development of good predictive biomarkers will give a better understanding of how green tea interacts with endogenous systems and other exogenous factors. Definitive conclusions concerning the protective effect of green tea have to come from well-designed observational epidemiological studies and intervention trials. The expansive repertoire of green tea activity in health is important, especially to those people who live in areas where medical assistance is not generally available or affordable. The development of biomarkers for green tea consumption, as well as molecular markers for its biological effects, will definitely facilitate future research in this area.