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A Review on Medicinal Benefit of Green Tea

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ABSTRACT: White, green, and black teas are all produced from the Camellia sinensis plant. Tea is one of the world's most popular drinks, second only to water in terms of pleasure and health. In terms of health advantages, green tea has been shown to be superior to black tea. The polyphenols, which are responsible for green tea's antioxidant and other health advantages, are the main components of interest. Flavonoids are the most abundant polyphenols in green tea. Epicatechin (EC), epigallocatechin (EGC), epicatechin gallate (ECG), and epigallocatechin gallate (EGG) are the four main flavonoids found in green tea (EGCG). The most important active ingredient is epigallocatechin gallate. The methods used to make black tea are known to reduce monometric catechin levels to a far higher degree than the less harsh conditions used to make other teas. There is a lot of evidence showing the health advantages of green tea for a range of conditions, such as cancer, heart disease, liver illness, and so on. Green tea may also help with diabetes, exercise, inflammatory bowel disease, skin problems, hair loss, weight reduction, and iron overload, among other things. The main health advantages of green tea will be reviewed in this article, with an emphasis on catechins.

KEYWORDS: Green tea, Catechins, Epigallocatechin Gallate (EGCG), Health benefits, Polyphenols.

1. INTRODUCTION

Tea is the world's second most popular beverage, behind water, and well ahead of coffee, beer, wine, and carbonated soft drinks. Green (unfermented), oolong (partially fermented), and black (fermented) teas are the three kinds, depending on the degree of fermentation. In the tea industry, the word "fermentation" is often misused. The more accurate word is oxidation, which refers to drying in the open air without the use of any additives. White tea, for example, is produced from fresh growth buds and young leaves that have been boiled to prevent polyphenol oxidation before being dried. To inhibit chlorophyll production, the buds may be protected from sunlight. Only 20% of the 2.5 million metric tons of dry tea produced is green tea, with oolong tea accounting for less than 2%. Green tea is a popular beverage all throughout the globe, especially in Asian nations like China, Korea, and Japan. Green tea is the only food or drink that has been claimed to offer as many health advantages as it does. The ancient Chinese proverb, "Better to be without food for three days than to be without tea for one," emphasizes the significance of tea in Chinese daily life. Since ancient times, the Chinese have known about the therapeutic properties of green tea, and have used it to cure anything from headaches to depression. Green tea has been used as a medicine in China for at least 4000 years, according to Taylor's book "Green Tea: The Natural Secret for a Healthier Life" [1]–[3].

Climate, season, agricultural methods, and the location of the leaf on the harvested stalk all influence the chemical makeup of green tea. Polyphenols are the main components of interest. Flavonoids are the most abundant polyphenols in green tea. Epicatechin (EC), epigallocatechin (EGC), epicatechin gallate (ECG), and epigallocatechin gallate (EGCG) are the four main flavonoids found in green tea. The most important active ingredient is epigallocatechin gallate. The EGCG content is highest in the leaf bud and early leaves. The average total polyphenol content in dried green tea leaves is 8–12%. Gallic acid, quercetin, kaempferol, myricetin, caffeic acid, and chlorogenic acid are some of the other chemicals found in dried green tea leaves [4].

Journal of The Gujarat Research Society

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1.1.Health Benefits

Green tea's secret lies in its high catechin and polyphenol content, especially EGCG. EGCG is a potent antioxidant that not only slows the development of cancer cells but also destroys them without hurting healthy tissue. It's also good at decreasing LDL cholesterol, preventing blood clots from forming abnormally, reducing platelet aggregation, regulating lipids, and stopping smooth muscle cells from proliferating and migrating. When you consider that thrombosis (the development of aberrant blood clots) is the main cause of heart attacks and strokes, inhibiting abnormal blood clot formation becomes even more important. Any of these variables may help to lower the risk of cardiovascular disease. Green tea's main and most chemo-preventive component, (-)-epigallocatechin-3-gallate, is responsible for various biochemical or pharmacological actions. Many labs are working to figure out the molecular processes behind these benefits of green tea.

Green, oolong, and black teas are all made from the Camellia sinensis plant's leaves. The way green tea is prepared is what distinguishes it. Green tea leaves are steamed to avoid oxidation of the EGCG component. Black and oolong tea, on the other hand, are produced from fermented leaves, so the EGCG is transformed into other chemicals that aren't nearly as helpful in preventing and combating illnesses. Green tea, due to its greater concentration of EGCG, has been shown to be superior to black tea in terms of antioxidant activity. The methods used to make black tea are known to reduce monometric catechin levels to a far higher degree than the less harsh conditions used to make other teas. China is the only place where partly fermented oolong tea is produced and consumed.

Scientific study in both Asia and the West is now giving concrete proof supporting the health advantages of drinking green tea, which have long been linked with it. For example, an epidemiological research published in 1994 in the Journal of the National Cancer Institute found that drinking green tea decreased the incidence of esophageal cancer in Chinese men and women by almost 60%. Green tea contains a chemical that slows the development of cancer cells, according to Purdue University researchers. Drinking green tea has also been shown to decrease overall cholesterol levels and increase the ratio of good cholesterol (HDL) to bad cholesterol (LDL) (LDL).

The consequences of drinking green tea have been linked to the 'French Paradox.' Researchers have long been perplexed by the fact that, despite eating a high-fat diet, the French had a lower rate of heart disease than Americans. Red wine, which contains resveratrol, a polyphenol that reduces the harmful effects of smoking and a fatty diet, was discovered to be the solution. Researchers at the University of Kansas discovered that EGCG is twice as potent as resveratrol in a 1997 study, which may explain why the incidence of heart disease among Japanese men is so low, despite the fact that 75 percent of them smoke. To summarize, drinking green tea is thought to be beneficial for a variety of medical problems, including cancer, rheumatoid arthritis, high cholesterol, cardiovascular disease, infection, and poor immunological function [5]–[7].

1.2.Anti-Carcinogenic Properties

Green tea's cancer-preventive properties have been shown in a number of population-based studies. In nations like Japan, where green tea is widely drunk, cancer rates are generally low. It's impossible to say if green tea prevents cancer in individuals based on these population-

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based research. Emerging animal and human research, on the other hand, are starting to indicate that EGCG may have a significant role in cancer prevention. It's been proposed that EGCG and other tea catechins prevent tumor development by blocking the production of tumor necrosis factor-alpha, which is thought to promote tumor initiation and progression in both started and pre-malignant cells. Furthermore, EGCG has been found to decrease the specific binding of both 12-tetradecanoylphorbol-1-3-acetate (TPA) and okadaic acid-type tumor promoters to their receptors. The interaction of EGCG with the phospholipid bilayer of the cell membrane results in this 'sealing' effect. Green tea stopped 50% of non-lymphoma Hodgkin's tumors from taking root and substantially slowed tumor development in mice when non-lymphoma Hodgkin's cells were implanted.

In several animal models, topical therapy or oral intake of green tea polyphenols has been demonstrated to prevent chemical carcinogen- or UV radiation-induced skin tumorigenesis. The presence of EGCG in green tea, according to Hirofumi Tachibana's team at Kyushu University in Japan, protects against a variety of malignancies, including lung, prostate, and breast cancer. Their findings revealed that consuming two or three cups of green tea substantially inhibited the development of human lung cancer cells with the 67 LR cell receptor. The study also discovered that 67 LR is implicated in the spread of prion illnesses in humans, such as mad cow disease. The impact of EGCG on 67 LR may thus have ramifications in the therapy of various illnesses. Experiments in in vitro and in vivo models show that GTPs or EGCG protects against photocarcinogenesis via a number of pathways involving numerous molecular targets.

Tea intake and the incidence of cardiovascular illnesses are thought to be inversely related, according to epidemiological findings. The effects of polyphenolic chemicals in tea on the function of the cardiovascular system, particularly on different signal transduction pathways in cardiovascular cells, are discussed in a recent study. However, the fundamental processes of tea polyphenols in reducing cardiovascular disease are yet unknown. The reason why the incidence of coronary events (death due to coronary heart disease or non-fatal myocardial infarction) in Japanese people is much lower than in Western populations is well recognized, yet it remains a mystery.

Green tea intake was recently shown to be inversely related with cardiovascular disease mortality in a large population-based cohort research in Japan that included 40 530 participants. Green tea intake was also shown to be substantially greater in individuals without coronary artery disease than in those with the condition. The review gathers information on the health benefits of tea for the cardiovascular system. These molecular interactions seem to be genuine. However, in cell culture systems, the majority of the effects of tea polyphenols are achieved with very large doses of these chemicals, levels that are not consistent with regular tea consumption. Furthermore, tea catechins have a poor bioavailability. Because tea is made up of so many distinct components, it's unclear if the health benefits are attributable to EGCG, tea flavins, or a combination of any of the chemicals. The idea that dietary tea consumption lowers the risk of cardiovascular events is yet unproven, and further clinical studies are needed to determine the effects of tea polyphenols in people before they can be recommended as a treatment for cardiovascular illnesses [8]–[11].

1.3.Benefits Of Green Tea

1.3.1. Green tea for Skin Treatment:

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Green tea polyphenols have been found to regulate biochemical pathways involved in inflammatory responses, cell proliferation, and chemical tumor promoter responses, as well as UV light-induced inflammatory indicators of skin inflammation when applied to the skin. The application of EGCG to the skin of mice prevents UVB-induced immunosuppression and oxidative damage. Green tea's preventive benefits on human skin, whether applied topically or eaten orally, against UV light-induced inflammatory or carcinogenic reactions remain unknown. Many pharmaceutical and cosmetic firms are augmenting their skin care products with green tea extracts based on proven substantial positive benefits of green tea on mouse skin models and very little in human skin.

The normal development of human keratinocytes (skin cells) was compared to the growth of the cells when exposed to EGCG in a research utilizing pooled human keratinocytes (skin cells). EGCG revived dying skin cells. Cells that migrate to the skin's surface survive for approximately 28 days, and by day 20, they're sitting on the epidermis, waiting to die and peel off. EGCG seems to revive epidermal cells, according to recent study.

1.3.2. Anti-fungal activity:

Catechin's antifungal action is pH-dependent. At pH6.0, 2000mgL21, 500–1000mgL21 at pH6.5, and 156–250mgL21 at pH 7.0, the concentration of EGCG that caused 90 percent growth inhibition of C. albicans strains was found. Pyrogallol catechin outperformed catechol catechin in terms of antifungal efficacy against Candida albicans. When 6.25–25 or 3.12–12.5mgL21 EGCG was added to amphotericin B 0.125 or 0.25mgL21 (below MIC) at pH7.0, the antifungal action of amphotericin B was enhanced against amphotericin B-susceptible or -resistant C. albicans, respectively. The development of amphotericin B-resistant Candida albicans was significantly reduced when 3.12–12.5mgL21 EGCG was combined with 0.5mgL21 amphotericin B (below MIC). The growth of fluconazole-susceptible Candida albicans was reduced by 93–99.4% when it was treated with 25–50mgL21 EGCG and fluconazole 0.125–0.25mgL21 (below MIC) compared to fluconazole alone. Fluconazole-resistant Candida albicans were suppressed by 98.5–99.7% when 12.5 mgL21 EGCG and 10–50 mgL21 fluconazole (below MIC) were used together.

These findings suggest that EGCG boosts the antifungal activity of amphotericin B or fluconazole against antimycotic-susceptible and resistant Candida albicans. Combining anti-mycotics with catechin results in reduced anti-mycotic dosages and numerous anti-fungal effects. It is anticipated that this would assist to prevent anti-mycotic side effects.

1.3.3. Anti-viral effects:

In cell culture, EGCG and ECG were shown to be effective inhibitors of influenza virus multiplication. All influenza virus subtypes examined, including A/H1N1, A/H3N2, and B virus, showed this impact. Quantitative research showed that EGCG and ECG reduced viral RNA production in cells at high concentrations, while EGC failed to do so. EGCG and ECG, on the other hand, suppressed neuraminidase activity more efficiently than EGC. The antigenic glycoprotein enzyme neuraminidase is present on the surface of the influenza virus. Neuraminidase is a protein that aids in the efficient release of viruses from cells.

1.3.4. Cholesterol reduction:

Journal of The Gujarat Research Society

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Although the green tea diet has a reputation for improving health, empirical evidence of its advantages is still inconclusive. However, in a paper published in the Archives of Internal Medicine, American and Chinese experts cooperated to examine the cholesterol-lowering benefits of a green tea diet. The researchers advised 240 men and women (average age 55) with mild-to-moderately elevated LDL cholesterol levels to maintain their normal low-fat diet, green tea diet consumption, and exercise levels. Green tea diet extract was shown to reduce overall LDL cholesterol levels by more than 15% in individuals who took it with their normal meals after 12 weeks. Although the researchers never explained how the green tea diet affected cholesterol levels, prior research has indicated that specific chemicals in green tea diet reduce cholesterol absorption, increase cholesterol excretion, and therefore prevent cholesterol from being deposited in the liver. The results of the first set of researchers were put to the test in subsequent investigations. However, their findings were inconsistent, and they concluded that a green tea diet had no impact on the cholesterol profiles of their patients.

Green tea's antioxidant capabilities have been shown in population-based and clinical trials to help prevent atherosclerosis, especially coronary artery disease. Green tea, according to Japanese study, lowers LDL cholesterol levels, lowering the risk of coronary heart disease. Tea drinking has been linked to a reduced risk of heart disease in studies, with one finding that tea drinkers had a 36 percent lower risk.

1.3.5. Effects on HIV:

According to a new research published in the Journal of Allergy and Clinical Immunology, the antioxidant EGCG contained in green tea may help strengthen one's immune system, thereby preventing HIV. The EGCG stops HIV from attaching to human T-cells, which is the initial stage in HIV infection. The human immunodeficiency virus (HIV) binding to human CD4 (+) lymphocytes was reduced by EGCG in one research [26], which is a critical stage in HIV infection. In order for infection to progress, viruses must first enter CD4 (+) cells via a process that involves adhesion to the CD4 molecule and then intracellular viral multiplication. Epigallocatechin gallate has a high affinity for CD4 cells, and by attaching to them, it was able to successfully prevent the HIV envelope from binding to them (gp120). This information offers up new avenues for treating this life-threatening illness. For the clinical use of EGCG as an anti-HIV medication, further study is required.

'Our research shows that drinking green tea could reduce the risk of becoming infected with HIV, and could also slow down the spread of HIV,' said University of Sheffield Research Professor Mike Williamson, but added, 'It is not a cure, and it is not a safe way to avoid infection, but we suggest that it should be used in combination with conventional medicines to prevent infection.'

1.3.6. Antioxidant properties:

Experimental results revealed that EGCG inhibited soybean lipoxygenase (IC50510– 20 mmolL21), which was the first indication of EGCG's antioxidant effects. Later research found that EGCG inhibited TPA-induced oxidative DNA base modification in HeLa cells, reduced tert-butyl hydroperoxide-induced lipid peroxidation, and blocked the production of reactive oxygen species derived from NADPH-cytochrome P450-mediated oxidation of the cooked meat carcinogen, 2-amino-3methylimidazo[4,5- f] Green tea was shown to have more

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antioxidant activity than brussel sprouts, garlic, kale, and spinach as measured by oxygen radical absorption capacity.

2. DISCUSSION

Green tea extract has been demonstrated in studies to have anti-inflammatory properties owing to the polyphenolic components present. Green tea has virtually become associated with weight reduction and diet due to the popularity of recent discoveries. Green tea's use in diet pills and weight reduction supplements may have been prompted by reports of severe side effects from other medicines such as ephedra. Green tea diet has been utilized as a health and therapeutic beverage in Asia for over 4000 years. Green tea differs from other tea diets in that the liquid is produced by steaming the Camellia sinensis plant's leaves rather than complete oxidation. Green tea diet preserves a lot more antioxidants and keeps them intact for the body to utilize in this manner. Polycatechin polyphenols, a type of antioxidants that fight free radicals, are abundant in a green tea diet. Because free radicals are the primary cause of illnesses and aging, they have negative effects on the body. A person who consumes polycatechin polyphenols from green tea has a higher chance of preventing illnesses and being well for a longer length of time. Green tea may even aid dieters, according to new research. The findings of a research conducted at the University of Geneva in Switzerland were published in the American Journal of Clinical Nutrition in November 1999. Men who were given a mix of caffeine and green tea extract burnt more calories than those who were given just caffeine or a placebo, according to the study.

The chemical caffeine interacts with EGCG in the green tea diet (a small amount of this is found in green tea). Green tea diet promotes thermogenesis in the body due to the interplay of these two substances. According to a research published in the American Journal of Clinical Nutrition, the body's total 24-hour energy expenditure increases by up to 4% when it consumes a green tea diet. This translates to a monthly weight loss of more than 10 pounds. The green tea diet boosts the body's metabolic rate. With its thermogenic characteristics, it's only logical that a green tea diet would speed up fat and sugar metabolism. The hormone insulin converts excess glucose in the body into fats. Because green tea inhibits insulin, it prevents sugar from being stored as fat and instead delivers it straight to the muscles for immediate utilization. Green tea may even aid in the prevention of tooth decay. Its germ-killing properties may aid in the prevention of food poisoning, and it can also eliminate the bacteria that form dental plaque. Meanwhile, green tea-based skin care products, ranging from deodorants to lotions, are beginning to emerge on the market.

2.1.Side Effects:

The only known negative side effect of consuming green tea is ‘insomnia,' which is related to the caffeine content. Green tea, on the other hand, has less caffeine than coffee: 30–60mg in 6–8 ounces of tea, compared to over 100mg in 8 ounces of coffee. Green tea includes vitamin K, which has been shown to interact with warfarin [38]. That, however, was predicated on one person drinking a gallon of green tea per day while taking the medicine. According to current research, regular green tea intake does not seem to have any major adverse effects or toxicity. Caffeine-free green tea or a caffeine-free extract should be used by caffeine-sensitive patients.

In general, the amount of fluoride in tea is inversely proportional to the amount of EGCG. The less fluoride, the more natural EGCG in the tea leaves. When compared to their caffeinated

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counterparts, decaffeinated teas contain a greater fluoride level. Fluoride, he claims, may potentially decrease tea's anti-cancer effects or even induce cancer, since fluoride is a cancer promoter. For example, he cites a 1998 research that showed a link between colon cancer and tea use. In the presence of aluminum, the high fluoride concentration may potentially induce neurological and renal harm. Furthermore, excessive fluoride levels may contribute to osteoporosis, arthritis, and other bone diseases.

3. CONCLUSION

Green tea is eaten in different ways all around the globe. Years of safe use of this beverage, as well as many research demonstrating its health advantages, justify a general advice to drink it on a daily basis. Green tea's anti-inflammatory and antioxidant properties are highlighted in this article. It has been used to treat cardiovascular illnesses, oral cavity diseases, cardiovascular applications, and Parkinson's disease. Green tea has a broad variety of applications in diabetes, fitness improvement, inflammatory bowel disease, and skin problems, to name a few. The well-controlled epidemiologic research aiming at changing the brain ageing process, which may act as neuroprotective agents, are the most remarkable. Although there is currently a lack of human clinical evidence, this paper demonstrates that green tea has a role in both mainstream and alternative medicine.

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