



Review

Medicinal and therapeutic potentialities of tea (*Camellia sinensis* L.) – A review

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ABSTRACT

The medicinal effects of tea have a history dating back almost 5000 years. The chemical components of green tea chiefly include polyphenols, caffeine and amino acids. Tea also contains flavonoids, compounds reported to have anti-oxidant properties having many beneficial effects. Tea flavonoids reduce inflammation, have antimicrobial effects and prevent tooth decay. Consumption of tea may have diuretic effects due to the caffeine. A related compound found in tea is theophylline, a licensed medicine for the treatment of respiratory diseases such as asthma. Today's computer-driven world can generate complicated lifestyle-related disorders and consumption of certain natural product like tea may very well replace the ill-effects of chemical drugs leading to a safer world with happier life. The paper is an overview of revealing all such ethno medicinal research efforts throughout the world over the times.

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1. Introduction

Tea is the second most commonly drank liquid on earth after water. It is being consumed socially and habitually by people since 3000 BC. The pleasing astringent taste and refreshing boost it provides is so deep-pervasive that its potential health benefits and medicinal properties are often overlooked. Ongoing scientific exploration points that the certain potential health benefits derived from tea have important implications on human health.

The American Medical Association shows that green tea can lower cholesterol levels, high blood pressure, and reduce the risk of strokes (especially in men). The National Cancer Institute reports that because of the highly effective anti-oxidants in green tea, it can ward off various types of cancer (<http://www.coffee-tea-pots-cups.net/tea/green>). There are many therapeutic values in green tea, including, aiding digestion, blood purification, ensuring regularity, lowering body temperature, strengthening teeth and bones, boost immune system, enhance heart function, suppress aging, deter food poisoning, fights virus, and lowers blood sugar levels.

From time immemorial, tea is regarded as a healthy beverage. 'Lost Property Of Medicinal Herbs', an ancient book in China's Chang Dynasty recorded that while various medicines are the cure of different diseases, 'green tea is the cure to all' (<http://www.gaia-research.co.za/greentea.html>). This review presents an overview of medicinal properties and therapeutic potentialities of tea.

2. Tea, the chemical constituents and activities of polyphenols

Tea (*Camellia sinensis* L.), a cultivated evergreen plant, is native to China, later spread to India and Japan, then to Europe and Russia, arriving in the New World in the late 17th century. Green, oolong and black tea are all made from the same plant species, *C. sinensis* L. but differing in their appearance, organoleptic taste, chemical content as well as flavour due to their respective fermentation process (Table 3).

The chemical components of tea leaves include polyphenols (catechins and flavonoides), alkaloids (caffeine, theobromine, theophylline, etc.), volatile oils, polysaccharides, amino acids, lipids, vitamins (e.g., vitamin C), inorganic elements (e.g., aluminium, fluorine and manganese), etc. However, the polyphenols are primarily responsible for the beneficial healthful properties of tea. The flavonoides have antioxidant, anti-inflammatory, antiallergic and anti microbial effects. Green tea contains six primary catechin compounds namely catechin, gallic catechin, epicatechin, epigallocatechin, epicatechin gallate and epigallocatechin gallate (EGCG), the later being the most active component. The polyphenols content of green tea and black tea varies from 30% to 40% and 3% to 10%, respectively.

There are active hydroxyl hydrogens in the molecular structure of green tea polyphenols that can end the chain reaction of excessive free radicals that (otherwise) result in pathological changes in the human body. Tea polyphenols can increase the activity of glutathione peroxidase and superoxide dismutase and the scavenging rate is much stronger than vitamins C and E. The anti-carcinogenic mechanism includes both cellular immune function and the inhibition of tumor growth (<http://www.gaia-research.co.za/greentea.html>).

3. Tea, various types with varying properties

3.1. Green tea

It is prepared from unfermented leaves compared to the leaves of oolong tea which are partially fermented and black tea which are fully fermented. Green tea is rich in varieties of beneficial chemicals with maximum positive effects on human beings. See Table 1.

Table 1

Differences among green and black teas. Source: <http://www.green-tea-benefit.com>.

	Green tea	Black tea
Process	Short, no fermentation	Longer fermentation
Color	Green or yellow	Red or black
Taste	Sweet after bitter	Distinct flavor, may add in sugar and/or milk
Antioxidants	In general, more Polyphenols	More Flavonoids
Caffeine	Less	Most
Quality	Better in fresh	Depend on produced locations
Health benefits	More in general; may irritate to empty stomach	Cardiovascular system

3.2. White tea

The buds and young tea leaves are collected shortly before the buds have fully opened. Then the leaves are steamed and dried with the minimum amount of processing. For this reason white tea retains the greatest levels of antioxidants and the lowest levels of caffeine than any other tea from the *C. sinensis* plant (green, black or oolong).

3.3. Black tea

It accounts for approximately 72% of the world's total tea production. While most of the EGCG antioxidants are oxidized during the fermenting process, black tea retains a high number of the antioxidants polyphenols such as flavonoids. These antioxidants help rid the body of harmful toxins.

3.4. Oolong tea

Oolong tea is a partially fermented tea and has the flavor and health characteristics of both green and black teas. It contains a high number of antioxidants, which protects healthy skin cells and the aging process slows down.

3.5. Pu'erh tea

This type of tea comes from a large leaf variety of tea plant and can be picked any time of the year. Its processing is similar to that of black tea. What makes this tea unique is that once it is picked, it is piled and aged for as long as 50–100 years.

3.6. Rooibos or "Red" tea

It comes from a shrub in South Africa. It is naturally caffeine free – making it a good choice for pregnant or breastfeeding women. Rooibos or Red tea has a high number of antioxidants.

Green and oolong tea are more commonly consumed in Asian countries like India, China, Japan and Thailand, while black tea is most popular in Western countries. The more the leaves are fermented, the lower the polyphenol content, and the higher the caffeine content. Yung, Yao, Jyh, and Jen (2003) compared caffeine and catechins in the same tea but manufactured by different fermentation processes to find that the level of caffeine in different manufactured teas was in the order black tea > oolong tea > green tea > fresh tea leaf, but the levels of EGCG and total catechins were in the order green tea > oolong tea > fresh tea leaf > black tea.

4. Health benefits of tea consumption on human beings

Tea in general and green tea in particular has long been valued by human beings throughout the world for its medicinal properties. A good number of animal and clinical studies suggest that chemical constituents in tea play an important role in contributing

overall human health. The health benefits derived through the consumption of tea is summarized below,

4.1. Acts as antioxidant

Green tea is believed to be as a potent source of beneficial antioxidants, like that found in fruits and vegetables. Tea is particularly rich in polyphenols, including catechins, theaflavins and thearubigins, which are thought to contribute to the health benefits of tea. Animal studies offer a unique opportunity to assess the contribution of the antioxidant properties of tea and tea polyphenols to the physiological effects of tea administration in different models of oxidative stress (Frei & Higdon, 2003). The leaf boasts the presence of a well-known antioxidant, among which EGCG (epigallocatechin-gallate) as well as other notable healing substances, including fluoride, catechins, and tannins.

Many studies have confirmed the free radicals scavenging activity of EGCG *in vitro* and *in vivo*. Tea catechins have been found to be better antioxidants than vitamins C and E, tocopherol and carotene. The antioxidant activity of tea polyphenols is not only due to their ability to scavenge superoxide but also due to increased activity of some detoxifying enzymes such as glutathione peroxidase, glutathione reductase, glutathione-S-transferase, catalase and quinine reductase in small intestine, liver and lungs. The antioxidant properties of tea may prevent atherosclerosis (i.e., hardening, thickening or loss of elasticity of arteries), particularly coronary artery disease (Miura, Chiba, & Tomita, 2001).

4.2. Fights against variable forms of cancer

The main hot drinks are tea (usually black tea but also green tea) containing various antioxidants and phenolic compounds, some of which have been shown to have anti-cancer properties in laboratory conditions (Kris-Etherton, Hecker, & Bonanome, 2002). Several population-based studies confirm about the cancer protective effects of tea (Vasisht et al., 2003). Polyphenols present in tea being powerful antioxidants, may play an important role in the prevention of cancer by reducing damage of DNA in the cell and activation of cancer leading to malignancy. Table 2a and b will present the effect of consumption of tea on combating different types of cancer based on different survey by different researchers.

Drinking green tea is associated with decreased frequency of cancer development. Beltz, Bayer, Moss, and Simet (2006) outlined the wide range of mechanisms by which epigallocatechin gallate (EGCG) and other green and black tea polyphenols inhibit cancer cell survival. EGCG suppressed androgen receptor expression and

signalling via several growth factor receptors. Cell cycle arrest or apoptosis (i.e., programmed cell death) involved caspase activation and altered Bcl-2 family member expression. EGCG inhibited telomerase activity and led to telomere fragmentation. While at high concentrations polyphenols had pro-oxidative activities, at much lower levels, anti-oxidative effects occurred. Nitric oxide production was reduced by EGCG and black tea theaflavins by suppressing inducible nitric oxide synthase via blocking nuclear translocation of the transcription factor nuclear factor-kappaB as a result of decreased IkappaB kinase activity. Polyphenols up- or down-regulated activity of a number of key enzymes, including mitogen-activated protein kinases and protein kinase C, and increased or decreased protein/mRNA levels, including that of cyclins, oncogenes, and tumor suppressor genes. Metastasis was inhibited via effects on urokinase and matrix metalloproteinases. Polyphenols reduced angiogenesis, in part by decreasing vascular endothelial growth factor production and receptor phosphorylation. Recent work demonstrated that EGCG reduced dihydrofolate reductase activity, which would affect nucleic acid and protein synthesis. It also acted as an aryl hydrocarbon receptor antagonist by directly binding the receptor's molecular chaperone, heat shock protein 90. In conclusion, green and black tea polyphenols act at numerous points regulating cancer cell growth, survival, and metastasis, including effects at the DNA, RNA, and protein levels.

Population-based studies suggest that green tea consumption is associated with reduced risk of several human malignancies such as cancer and diabetes. Shankar, Ganapathy, and Srivastava (2007) studied on the molecular mechanisms of green tea polyphenols and their therapeutic implications in cancer. According to them epigallocatechin-3-gallate (EGCG), a major polyphenol found in green tea, is a widely studied chemopreventive agent with potential anti-cancer activity. Green tea polyphenols inhibit angiogenesis and metastasis, and induce growth arrest and apoptosis through regulation of multiple signaling pathways. Specifically, EGCG regulates expression of VEGF (vascular endothelial growth factor), matrix metalloproteinases, uPA, IGF-1, EGFR, cell cycle regulatory proteins and inhibits NFK B, PI3-K/Akt, Ras/Raf/MAPK and AP-1 signaling pathways, thereby causing strong cancer chemopreventive effects.

Green tea extracts contain a unique set of catechins that possess biologic activity in antioxidant, antiangiogenesis, and antiproliferative assays that are potentially relevant to the prevention and treatment of various forms of cancer (Cooper, Morre, & Morre, 2005). According to Leong, Mathur, and Greene (2008) green tea has its potential use as a breast cancer chemopreventive agent. Histological analysis of mammary glands showed that green tea slowed the progression of ductal lesions to advanced mammary

Table 2a

Effect of consumption of tea on combating different types of cancer.

Type of cancer	Effect of consumption of tea	References
Lung cancer	One population-based study found that Okinawan tea (similar to green tea but partially fermented) was associated with decreased lung cancer risk, particularly among women	Ohno, Wakai, and Genka (1995)
Pancreatic cancer	Major tea drinkers were less likely to develop pancreatic cancer compared to non-drinkers. Further studies are needed to recommend strongly	Ji et al. (1997) and Lyn-Cook et al. (1999)
Prostrate cancer	Laboratory studies have found that green tea extracts prevent the growth of prostrate cancer cells in test tubes. However, neither black nor green tea should be taken while receiving chemotherapy as both of them were less sensitive during that period	Lyn-Cook et al. (1999)
Breast cancer	Researchers found that women who consumed the most green tea experienced the least spread of cancer (particularly pre-menopausal women with early stages of breast cancer). However, women with late stages of breast cancer experienced little or no improvement from drinking green tea	Inoue, Tajima, and Mizutani (2001), Kaegi (1998), Leong et al. (2008), Low Dog, Riley, and Carter (2001), Nakachi et al. (1998), Pianetti, Guo, Kavanagh, and Sonenshein (2002)
Esophageal cancer	One large-scale population-based study found that green tea offered significant protection against the development of esophageal cancer (particularly among women). Another population-based study revealed just the opposite. In fact, the stronger and hotter the tea, the greater the risk. So, further research is needed before green tea can be recommended for the prevention of esophageal cancer	Hu, Nyren, Wolk, and Bergstrom (1994), Gao, McLaughlin, and Blot (1994)

Table 2b
Effect of consumption of tea on combating different types of cancer.

Type of cancer	Effect of consumption of tea	References
Colorectal cancer	Studies on the effects of green tea on colon or rectal cancer have produced conflicting results. Some studies show decreased risk in those who drink the tea, while others show increased risk. So, further research is needed before any recommendation	Ji et al. (1997)
Stomach cancer	In two studies that compared green tea drinkers with non-drinkers, researchers found that people who drank tea were about half as likely to develop stomach cancer and gastritis (inflammation of the stomach) as those who did not drink green tea. However, a recent study in Japan found no association between green tea consumption and stomach cancer risk. Further research in this line can only confirm whether green tea reduces the likelihood of developing this disease	Yu et al. (1995), Setiawan, Zhang, and Yu (2001) and Tsubono, Nishino, and Komatsu (2001)
Urinary bladder cancer	In one study that compared people with and without bladder cancer, researchers found that women who drank black tea and powdered green tea were less likely to develop the disease. A follow-up study by the same group of researchers revealed that bladder cancer patients (particularly men) who drank green tea had a substantially better five-year survival rate than those who did not	Ohno et al. (1985) and Wakai et al. (1993)
Skin cancer	Scientific studies suggest that epigallocatechin gallate (EGCG), the major tea polyphenol along with other polyphenols have anti-inflammatory and anti-cancer properties that may help prevent the onset and growth of skin tumours	Picard (1996) and Katiyar et al. (2000)
Cancer due to smoking	Cancer is usually caused by oxidative damage resulting from cigarette smoking. Researchers claim that tea polyphenols are powerful anti-oxidants and induce phase-2 detoxification enzymes, resulting in the body's ability to quench more oxidative DNA damage which in turn reduces the risk of cancer	Shim, Kang, Kim, Roberts, and Lee (1995)

Table 3
Content of caffeine (mg) in a seven cup in regular soft drinks. Source: <http://db.uwaterloo.ca/~alopez-o/Coffee/caffaq.html#HowMuchCaff>.

Regular soft drinks	Content of caffeine (mg)
Drip coffee	115–175
Mountain dew	55.0
Coca-cola	45.6
Pepsi cola	37.2
Tea	30–60

intraepithelial neoplasias and suppressed tumor invasiveness. Green tea inhibited the proliferation of ductal epithelial cells and tumors and, overall, disrupted post-pubertal ductal growth. Immunohistochemical analyses also demonstrated that green tea inhibited angiogenesis through a decrease in both ductal epithelial and stromal VEGF expression and a decrease in intratumoral microvascular density.

Green tea (GT) drinking showed chemopreventive effects on various cancers. In addition, inhibition of CYP1A activity by green tea components – polyphenols – has been suggested as a chemoprevention against carcinogens that were bioactivated by CYP1As. Therefore, any changes in hepatic CYP1As may be considered as a biomarker for GT chemoprevention and clarify whether whole GT is chemopreventive for the population who are exposed to CYP1A specifically-bioactivated carcinogens (Yang, Yoshikawa, Arashidani, & Kawamoto, 2003). Epidemiological and laboratory studies have identified epigallocatechin gallate (EGCG) in green tea polyphenols (GTP), as the most potent chemopreventive agent that can induce apoptosis, suppress the formation and growth of human cancers including colorectal cancers (Kumar, Shibata, Helm, Coppola, & Malafa, 2007).

Oral or local application of green tea extracts inhibit skin tumour formation induced by chemical carcinogens or UV-radiation. EGCG is the chief tea polyphenol responsible for the prevention of cancer. The research outcomes in this regard prompted many cosmetic and pharmaceutical companies to supplement their skin care products with green tea extracts (Katiyar & Elmets, 2001).

Nonmelanoma skin cancer is extremely common and is increasing in incidence. It would be very useful to have forms of therapy that would prevent precancerous changes from going on to form cancer, or to reverse the precancerous changes. Epidemiologic evidence in humans, in vitro studies on human cells and clinical

experiments in animals have identified polyphenol compounds found in tea to be possibly useful in reducing the incidence of various cancers, including skin cancer. To examine the potential for a polyphenol from green tea, epigallocatechin gallate, to act as a chemopreventive agent for nonmelanoma skin cancer, a randomized, double-blind, placebo-controlled phase II clinical trial of topical epigallocatechin gallate in the prevention of nonmelanoma skin cancer was performed (Linden et al., 2003).

There are millions of cases of skin cancer diagnosed annually throughout the globe. The majority of these is nonmelanoma (NMSCs) and is associated with chronic exposure to ultraviolet light (UV). Cancer chemoprevention can prevent or delay the occurrence of cancer in high-risk populations using dietary or chemical interventions. UV light induces molecular signaling pathways and results in specific genetic alterations that are likely critical to skin cancer development. UVB-induced changes serve as a basis for the development of novel agents. Targets include inhibition of polyamine or prostaglandin synthesis, specific retinoid receptors, and components of the Ras and MAP kinase signaling pathways. Agents under study include, epigallocatechin gallate (EGCG), a green tea catechin with antioxidant and sunscreen activity, as well as UVB signal transduction blocking activity; perillyl alcohol, a monoterpene derived from citrus peel that inhibits Ras farnesylation; difluoromethylornithine (DFMO), an inhibitor of ornithine decarboxylase and polyamines; retinoids that target retinoid X receptors and AP-1 activity; and nonsteroidal anti-inflammatory agents that inhibit cyclooxygenase and prostaglandin synthesis (Einspahr, Bowden, & Alberts, 2003).

4.3. Reduces risk of cardiovascular diseases

High cholesterol level, also called hypercholesterolemia, is an excessive amount of cholesterol circulating in the blood and it is defined when total cholesterol concentration is above 200 mg/dL, or levels of high-density cholesterol is below 35 mg/dL. High levels of cholesterol have been associated with increased risk of cardiovascular disease. Causative factors include stress, a high refined sugar or oil intake, or regular consumption of animal fats. One of the major dietary changes that is being taking place throughout the world is the replacement of animal fats with industrially processed vegetable oils. Green tea, too, is beneficial for the cardiovascular system, lowering cholesterol and preventing platelet clumping.

Increased oxidative stress and dysfunction of endothelium (cells lining the heart, blood and lymphatic vessels and various other cavities) result in coronary artery disease. Black tea antioxidants are known to reverse endothelial dysfunction (Duffy et al., 2001). A recent clinical trial showed that five servings of black tea per day reduced Low Density Lipoprotein (LDL) by 11.1% and total cholesterol by 6.5% in mildly hypercholesterolemic adults (Davies et al., 2003). The effect of tea on blood lipids were examined keeping all other components of the diet constant. The reason for this is believed to be tea's potential ability to limit cholesterol absorption in the intestines.

A study published in the Archives of Internal Medicine found that among persons consuming tea regularly for at least one year, the risk of developing high blood pressure was 46% lower among those who drank ½ cup to 2½ cups per day, and 65% less among those consuming more than 2½ cups per day (Yang, Lu, Wu, Wu, & Chang, 2004). The continuous ingestion of a green tea extract high in catechins led to a reduction in body fat, SBP, and LDL cholesterol, suggesting that the ingestion of such an extract contributes to a decrease in obesity and cardiovascular disease risks of human beings (Nagao, Hase, & Tokimitsu, 2007).

Matsuyama, Tanaka, Kamimaki, Nagao, and Tokimitsu (2008) evaluated the effects of a catechin-rich beverage on body fat and cardiovascular disease risk factors in obese children and verified the safety of its use. The findings suggest that ingestion of a catechin-rich beverage ameliorates serious obesity and cardiovascular disease risk factors without raising any safety concerns in Japanese children.

4.4. Treat respiratory diseases

Theophylline in tea is used to prevent respiratory diseases like wheezing, shortness of breath, and difficulty breathing caused by asthma, chronic bronchitis, emphysema, and other lung diseases. It relaxes and opens air passages in the lungs, making it easier to breathe. Huerta, Lanes, and García Rodríguez (2005) conducted a case-control study in the UK to evaluate the association between respiratory drugs and the occurrence of rhythm disorders among patients with asthma and those with chronic obstructive pulmonary disease.

4.5. Corrects skin disorder

Tea is used as an age-old home remedy for burns, wounds and swelling. A poultice of green tea eases itching and inflammation of insect bites, while a compress stems bleeding. Tannins and flavonoids of tea are having with the antiseptic properties. The former also have anti-inflammatory effects.

Green tea also has some benefits for the body if used externally. It can be used to stop or slow bleeding, and can relieve itchy rashes and bug bites. Also, many hair and skin care products make use of tea tree oil to add shine and replenish. Researchers are also looking into green tea as a natural sun block.

Green tea constituents may be useful topically for promoting skin regeneration, wound healing, or treatment of certain epithelial conditions such as aphthous ulcers, psoriasis, rosacea, and actinic keratosis. At certain concentrations, EGCG or a mixture of the major green tea polyphenols stimulated aged keratinocytes to generate biological energy and to synthesize DNA, possibly for renewed cell division (Hsu et al., 2003).

4.6. Aids in indigestion

Because green tea contains astringent tannin compounds, it can ease indigestion, diarrhea, and other forms of gastrointestinal

dysfunction (http://www.crescentlife.com/dietnutrition/green_tea.htm). Moreover, green, black and oolong tea, all having antibacterial, antioxidant, antiseptic and detoxifying properties are very much effective in treating infectious dysentery as well as easing inflammatory bowel disease. This makes tea useful as a traditional home remedy for various digestive problems.

4.7. Prevents diabetes

Animal studies revealed that green tea may have properties to prevent development of Type 1 diabetes and slow the progression once it has developed. Insulin causes most of the body cells to take up glucose from the blood, storing it as glycogen in the liver and muscle, and stops use of fat as an energy source. When insulin is absent or low, glucose is not taken up by most body cells and the body begins to use fat as an energy source. People with Type 1 diabetes produce little or no insulin, a hormone that converts glucose (sugar), starches and other foods into energy needed for daily life. Tea polyphenols lower the serum glucose by inhibiting the activity of the starch digesting enzyme, amylase. Tea inhibits both salivary and intestinal amylase. As a result, the starch is broken down more slowly and the sudden rise in serum glucose is minimized. The inhibition of α -amylase from human saliva by polyphenolic components of tea and its specificity was investigated *in vitro* by Hara and Honda (1990). Four kinds of green tea catechins, and their isomers and four kinds of their dimeric compounds (theaflavins) produced oxidatively during black tea production were isolated. They were (–)-epicatechin (EC), (–)-epigallocatechin (EGC), (–)-epicatechin gallate (ECg), (–)-epigallocatechin gallate (EGCG), (–)-catechin (C), (–)-gallocatechin (GC), (–)-catechin gallate (CG), (–)-gallocatechin gallate (CGG), theaflavin (TF1), theaflavin monogallates (TF2A and TF2B), and theaflavin digallate (TF3). Among the samples tested, EC, EGC, and their isomers did not have significant effects on the activity of α -amylase. All the other samples were potent inhibitors and the inhibitory effects were in the order of TF3 > TF2A > TF2B > TF1 > Cg > GCg > ECg > EGCG. The inhibitory patterns were noncompetitive except for TF3. However, more research in this area is needed.

Type 2 diabetes mellitus is a common disease that interferes with the body's ability to store energy from food. Risk factors for type 2 diabetes mellitus include being overweight, lack of exercise, and family history of the disease. Iso, Date, Wakai, Fukui, and Tamakoshi (2006) opined from a study that people who were frequent drinkers of green tea (>6 cups per day) were less likely to develop this diabetes than those who drank less than one cup of these beverages per week.

Caffeine is a mild stimulant consisting of a xanthine molecule with three methyl groups attached to it is predominantly found in the leaves of tea. It enters the body and forces the working muscles to utilize as much fat as possible. This delays the immediate depletion of glycogen. When this happens, the saved glycogen can be used for the remainder of the workout where normally it would be entirely depleted (<http://www.rice.edu/~jenky/sports/caffeine.html>). Caffeine consumption causes major changes occurring to the kidneys known as the diuretic effect. The kidney blood flow is increased by caffeine and at the same time this can inhibit the reabsorption of sodium and water. Caffeine has also been known to weaken the detrusor muscles in the bladder, which provokes the need to urinate (<http://www.cosic.org/caffeine/diuretic.html>).

With the carbohydrate-containing meal, the tea extract resulted in a highly significant increase in breath-hydrogen concentrations, which indicated appreciable carbohydrate malabsorption. A comparison of hydrogen excretion after the carbohydrate-containing meal with that after the nonabsorbable disaccharide lactulose suggested that the tea extract induced malabsorption of 25% of the carbohydrate (Zhong, Furne, & Levitt, 2006).

4.8. Improves oral health

The tea plants extract fluoride from the soil which in turn is accumulated in its leaves. Therefore, tea is a very rich source of fluoride and one cup of tea may contain between 0.3 mg and 0.5 mg of fluoride. This has strong binding ability to enamel particles on the tooth surface that prevents dental decay. Human *ex vivo* clinical trials suggested that regular tea drinking may decrease the incidence and severity of caries (Hamilton-Miller, 2001).

This extends to antiviral activities, where many pronounced activities were reported for enveloped viruses (Song & Seong, 2007).

4.9. Keeps away from liver disease

Green tea protects the liver from alcohol and other harmful chemicals. Alcohol metabolism results in the production of damaging free radicals that can overwhelm the liver's supply of antioxidants, resulting in liver injury. In a study published in the January 2004 issue of *Alcohol* in which rats were chronically intoxicated with alcohol for four weeks, green tea prevented damage to their livers (Ostrowska, Luczaj, Kasacka, Rozanski, & Skrzydlewska, 2004).

4.10. Gives a boost to immunity

Green tea carry micronutrients that feed the human immune system and strengthen body cells. When the immune system becomes stronger, tissue and cell repair is enhanced in a way that the body retains the ability to heal itself. This is due to the free radical capturing (antioxidant), invigorating (caffeine), detoxifying, antibacterial properties of tea, as well as the vitamins and mineral products therein. Moreover, the content of caffeine is low (Table 3). Tea extract has been shown to have viricidal activity against polio, influenza and herpes simplex virus. Green tea catechins exert antimicrobial and antiviral activities against a variety of infectious agents. Although the detailed mechanism of the antimicrobial activity of tea catechins remains to be explored, the broad-spectrum activity of catechins may involve common target(s), such as the cell membrane, in addition to specific targets for each pathogen.

4.11. Treats arthritis

Antioxidants in green tea may prevent and reduce the severity of osteoarthritis. Studies have shown that consumption of approximately four cups of green tea a day may be able to protect from developing arthritis, and in case of having arthritis already, consumption of green tea can help to diminish the inflammation it causes. The compound EGCG inhibits the production of several molecules in the immune system that contribute to inflammation and joint damage in people with rheumatoid arthritis ([http://www.nerve.in/news, 25350069280](http://www.nerve.in/news,25350069280)).

4.12. Burns fat

Obesity is a metabolic disorder resulting from imbalance between energy intake and energy expenditure. It is known to be a strong risk factor for lifestyle-related diseases. Murase, Haramizu, Shimotoyodome, and Tokimitsu (2006) investigated the effects of long-term intake of tea catechins in combination with regular exercise on the development of obesity in C57BL/6 mice. These results indicate that intake of tea catechin, together with regular exercise helps to reduce diet-induced obesity. This effect might be attributed to the activation of whole-body energy metabolism.

5. Cognitive functions with tea consumption

Green tea is currently considered a source of dietary constituents endowed with biological and pharmacological activities relevant to human health. As per human epidemiological and new animal data it can be suggested that the pharmacological benefits of tea drinking may help to protect the brain corresponding to the ageing process. It is now certain that tea consumption is inversely correlated with the incidence of dementia and Alzheimer's and Parkinson's diseases. In particular, its main catechin polyphenol constituent, EGCG, has been shown to exert neuroprotective/neurorescue activities in a wide array of cellular and animal models of neurological disorders (Mandel, Amit, Kalfon, Reznichenko, & Youdim, 2008). Higher consumption of green tea is associated with a lower prevalence of cognitive impairment. However, considerable experimental and animal evidence shows that green tea may possess potent activities of neuroprotection, neurorescue, and amyloid precursor protein processing that may lead to cognitive enhancement, no human data are available (Kuriyama et al., 2006). In a cross-sectional study, Nurk et al. (2009) examined the relation between intake of three common foodstuffs that contain flavonoids (chocolate, wine, and tea) and cognitive performance between several participants (70–74 y, 55% women) recruited from the population-based Hordaland Health Study in Norway underwent cognitive testing and found that in the elderly, a diet high in some flavonoid-rich foods is associated with better performance in several cognitive abilities in a dose-dependent manner.

6. Conclusions

Tea is a pleasant, popular, socially accepted, economical and safe drink that is initially as medicine, later as beverage and now proven well as future potential of becoming an important industrial and pharmaceutical raw material. Since green tea had little caffeine and is one of the mildest of the teas; there are no adverse side effects. Now that we have rediscovered this ancient wonder, we need to grab hold of it and use it to our advantage. The scientists should take serious concern to propagate the message of medicinal properties and therapeutic values of tea to the consumers. The industry will flourish if the consumption increases.

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