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Review Article

Review on *Camellia sinensis* : Nature's Gift

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ABSTRACT

Green tea (***Camellia sinensis)*** always influenced human health benefits associated with this herbal drink. Green tea has possible benefits include promotion of cardio-vascular health, cancer prevention, skin protection, and antioxidant activity, to fight high cholesterol levels, infection, impaired immune system, diarrhoea, fatigue and much more. The credit for their useful antioxidant property exists with their huge collection of chemical substances called polyphenols and catechins make the major contribution to them. In addition, its content of certain minerals and vitamins increases the antioxidant potential of this type of tea The present paper reviews the geographical distribution, history, cultivation, uses, side effects, synonyms, botanical description, taxonomical classification, phytochemical constituents and pharmacological activities.

Keywords: Green tea, *Camellia sinensis,* Medicinal property.

INTRODUCTION

Camellia sinensis is a species of evergreen angiosperm dicot plant whose leaves and leaf buds are used to produce flourishing tea. It is of the genus *Camellia* of flowering plants in the family Theaceae. It is native to mainland China, South and Southeast Asia [2]. Tea is the most consumed drink in the world after water[1]. Green tea contains more catechins than black tea or oolong tea. Catechins are *in vitro* and *in vivo* strong antioxidants. In addition, its content minerals and vitamins increase the antioxidant potential of this type of tea. Presently, it is cultivated in at least 30 countries around the world. Tea beverage is an infusion of the dried leaves of *Camellia sinensis.* It is a widely used medicinal plant by the throughout India, China and popular in the various indigenous system of medicine like Ayurveda, Unani and Homoeopathy. Green tea has been consumed in all respects ages in India, China, Japan and Thailand.

History

This evergreen plant originated near the source of the Irrawaddy River (in Burma), then spread eastward into South-Eastern China, westward into upper Burma and Assam (North-Eastern India)[2]. Tea has been consumed as a beverage in China for 2000 to 3000 years. It was introduced to Japan around 600 A.D. and to Europe in the 1600s. Tea is grown mainly in the Subtropics and in the mountainous areas of the tropics between latitudes 41° N and 16° S. It is an intensively managed perennial monoculture crop cultivated on large- and small-scale plantations in a variety of countries including China, India, Sri Lanka, Kenya, Turkey, Vietnam, and Indonesia. Overall, tea is grown on over 2.71 million hectares in more than 34 countries across Asia, Africa, Latin America, and Oceania, with an annual yield of 3.22 million metric tons of processed tea.

Botanical description of green tea

Macroscopical description

- Shrubs, 1-5(-9) m tall. Young branches grayish yellow, current year branchlets purplish red and terminal buds silvery gray sericeous[3].
- The leaves are 4–15 cm (1.6–5.9 in) long and 2–5 cm (0.79–1.97 in) broad. Fresh leaves contain about 4% caffeine. The young light green leaves are first harvested for tea production and have short white hairs on the undersurface while older leaves are deeper green. Different leaf ages produce differing tea qualities, therefore, chemical compositions are different. Youngest leaves narrow, downy but slightly serrated.
- Petiole 4-7 mm.
- The flowers are axillary, yellow-white and 2.5–4 cm (0.98–1.57 in) in diameter.
- Sepals 5, persistent, 3-5mm, outside glabrous or white pubescent, inside white sericeous and margin ciliate.
- Petals 6-8, white, outer 1-3 petals sepaloid, inner petals obovate to broadly obovate, 1.5-2 × 1.2-2 cm, basally connate and apex rounded.
- Stamens numerous, 0.8-1.3 cm, glabrous; outer filament whorl basally connate for ca. 2 mm.
- Ovary globose, densely white pubescent, subglabrous and 3-loculed
- Capsule oblate, 2-coccal, or rarely globose, 1-1.5 × 1.5-3 cm, 1- or 2-loculed with 1 seed per locule, pericarp 1 mm thick.
- Seeds brown subglobose, 1-1.4 cm in diameter.

Microscopical Description

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Table 1: Possible Interaction.

S.NO.	Drugs	Interactions
1.	Adenosine	Green tea retards the action of adenosine drugs.
2.	Beta-lactam	Green tea increases the efficacy of these drugs.
3.	Blood thinning medication	Green tea increases blood thinning effects.
4.	Chemotherapy	Green tea increases the potency of these drugs.
5.	Clozapine	Green tea reduces the effect of these drugs.
6.	Ephedrine	Green tea with the drug may cause agitation, tremors, insomnia and weight loss.
7.	Lithium	Green tea reduces the blood levels of these drugs.
8.	MAOIS	Green tea with these drugs treats depression.
9.	Birth control pills	Green tea prolongs the action.
10.	Phenyl propanolamine	Green tea may a cause severe increase in blood pressure.
11.	Quinolone Antibiotics	Green tea may make these medications more effective and also increase the risk of side effects.

Table 2: Botanical Classification Of Green Tea[12].

Kingdom	Plantae-plants
Subkingdom	Tracheobionta-vascular plants
Super division	Spermatophyte-seed plants
Division	Magnoliophyta-flowering plants
Class	Magnoliopsida-dicotyledons
Subclass	Dilleniidae
Order	Theales
Family	Theaceae-tea family
Genus	Camellia L.-camellia
Species	*Camellia sinensis* (L.) Kuntze-tea

Table 3: International Names Of Green Tea[13].

Names	Language	Country/Region
té verde	Spanish	Spain
thé vert	French	France
grüner Tee	German	Germany
grönt te	Swedish	Sweden
shay 'akhdar	Arabic	Northwestern Arabia
groene thee	Dutch	West Germanic
tè verde	Italian	Italy
chá verde	Portuguese	Portugal
Hariyō ciyā	Nepali	Nepal
Ryokucha	Japanese	Japan
Lǜchá	Chinese	China
zelenyy chay	Russian	Russia
green tee ग्रीन टी	Hindi	India
Green tea	English	England, USA, New Zealand
prásino tsái	Greek	Indo-European

Table 4: Indian Names Of Green Tea[13].

Names	Language	State/Region
green tee ग्रीन टी	Hindi	North India
Harī cāha ਹਰੀ ਚਾਹ	Punjabi	Punjab
Līlī cā □□□□ □□	Gujrati	Gujrat
Hasiru cahā ಹಸಿರು ಚಹಾ	Kannada	Karnataka
سبز چائے	Urdu	Jammu and Kashmir
grīn ṭī	Malayalam	Kerala
Hiravā cahā	Marathi	Maharashtra
Paccai tēyilai tēnīr	Tamil	Tamil Nadu
Grīn ṭī	Telugu	Telangana

Table 5: 2006 green tea production and export (in thousand of metric tons).

Country	Production	Export
China	782.4 (80.8%)	218.7 (83.0%)
Japan	91.8 9 (9.5%)	1.6 (0.6%)
Vietnam	66.0 (6.8%)	26.0 (9.9%)
Indonesia	20.0 (2.1%)	9.1 (3.5%)
World	968.1 (100%)	263.5 (100%)

The upper epidermis is composed of cells with undulating walls and covered with a rather thick cuticle. The lower epidermis consists of smaller cells and is alone provided with stomata; the latter are surrounded by three or four tangentially elongated cells.Simple hairs occur on both surfaces of the leaf, but they are more abundant on the lower; the number, however, varies with the variety of tea, and with the age of the leaf; hey are unicellular, tapering and rather thick walled, varying very much in length, but often attaining 500-700 microns. The mesophyll is heterogeneous and symmetrical. It is characterized by the presence of a large number of *sclerenchymatous idioblasts.* These are more or less branched and warty and often extend transversely from the upper to the lower epidermis. They vary much in shape and in the thickness of the walls. The cells of the spongy parenchyma contain cluster crystals of calcium oxalate. The midrib is biconvex. Under each epidermis there is a layer of collenchyma of varying thickness. The

Camellia sinensis plant

Leaves

Flower

Seeds

Table 6: Principle components of green tea[14].

Components	Green tea (% weight of extract solid)
Catechins	30-42
Flavonols	5-10
Other flavonoids	2-4
Theogallin	2-3
Other depsides	1
Ascorbic acid	1-2
Gallic acid	0.5
Quinic acid	2
Other organic acids	4-5
Theanine	4-6
Other amino acids	4-6
Methylxanthines	7-9
Carbohydrate	10-15
Minerals	6-8
volatiles	0.02

wood is arched and the bast contains crystals of calcium oxalate. The meristele is surrounded by a pericycle consisting of slightly lignified cells
arranged in circle. The cortical tissue contains idioblasts which are usually rather larger and more branched than those of the mesophyll. The little fragments of the stems, which are often to be found in ordinary tea, have a slightly different structure. The wood in them forms a circle within which there are pith containing branched idioblasts; these have comparatively thin, pitted walls[4].

Geographical Description

World scenario

Camellia sinensis is home-grown from mainland china, south and Southeast Asia but it is at the present period of time cultivated across the world [Table 5][5].

Indian scenario

The roughly calculated production of green tea in India in the year 2013 was 11 million kgs only. West Bengal produces 8 million kgs, Assam 2 million kgs and the remaining 1 million was produced by South India[6].

Production process

Growing and harvesting

Green tea is processed and grows in a variety of ways, depending on the type of green tea desired. As a result of these methods, maximum amounts of polyphenols and volatile organic compounds are retained with affecting aroma and taste. The green tea plants are grown in rows that are trim to produce shoots in a regular manner and in general green tea plants are harvested three times per year. The first gathering takes place in late April to early May. The second harvesting usually takes place from June through July, and the third picking takes place in late July to early August. Sometimes, there can also be the fourth harvest. It is the first flush in the spring that brings the best-quality leaves with higher prices to match.

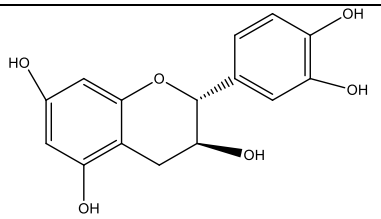
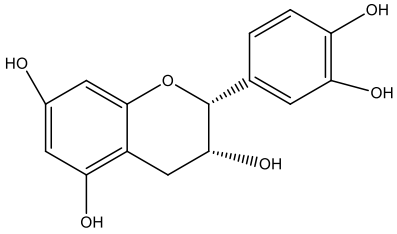
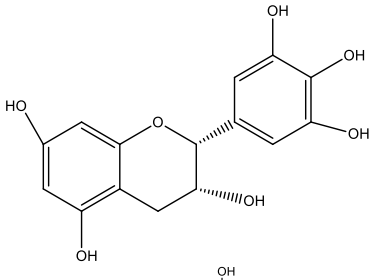
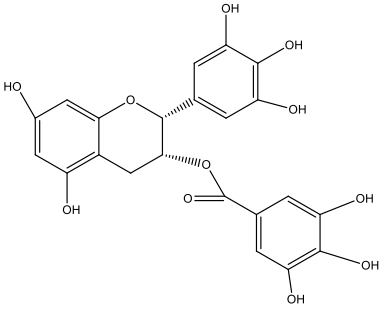
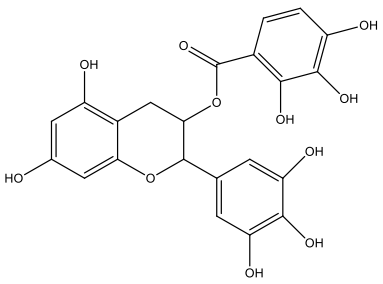
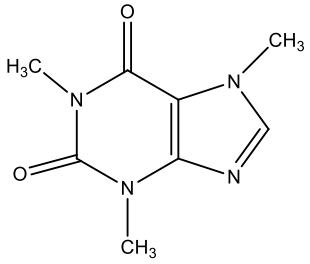
Processing

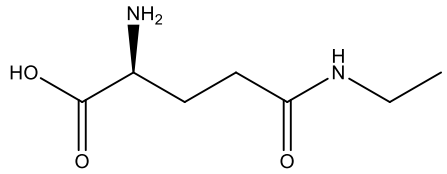
Green tea is processed using either:-

Artisanal method (Sun-drying, basket or charcoal firingor pan-firing)

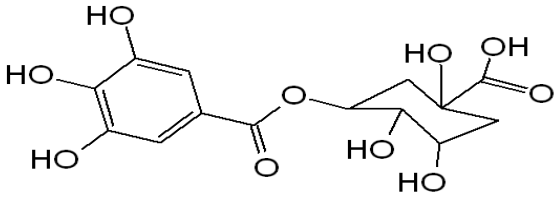
The Chinese style of green tea is characterized by pan-firing, where tea leaves are heated in a basket, pan or mechanized rotating drum to halt the oxidation process.

Table 7: Chemical Strucuters.

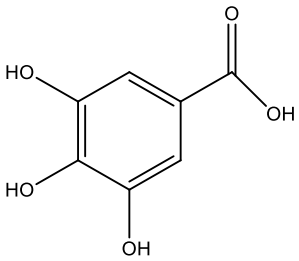
Structure	Name	Formula
	Catechin, C, (+)-Catechin	$C_{15}H_{14}O_6$
	Epicatechin, EC, (-)-Epicatechin (cis)	$C_{15}H_{14}O_6$
	Epigallocatechin, EGC	$C_{15}H_{14}O_7$
	Epicatechin gallate, ECG	$C_{22}H_{18}O_{10}$
	Epigallocatechin gallate, EGCG, (-)-Epigallocatechin gallate	$C_{22}H_{18}O_{11}$
	Caffiene	$C_8H_{10}N_4O_2$



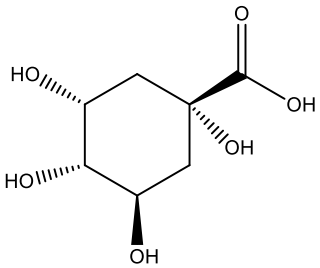
Theanine $C_7H_{14}N_2O_3$



Theogallin $C_{14}H_{16}O_{10}$



Gallic acid $C_7H_6O_5$



Quinic acid $C_7H_{12}O_6$

Table 8: Nutritional Value[15,16] Nutritional value per 100 g (3.5 oz).

Principle	Nutrient value	% of RDA
Energy	4 kJ (0.96 kcal)	--
Carbohydrates	0 g	--
Fat	0 g	--
Protein	0.2 g	--
Vitamins		
Thiamine (B1)	0.007 mg	(1%)
Riboflavin (B2)	0.06 mg	(5%)
Niacin (B3)	0.03 mg	(0%)
Vitamin B6	0.005 mg	(0%)
Vitamin C	0.3 mg	(0%)
Minerals		
Calcium	0 mg	(0%)
Iron	0.02 mg	(0%)
Magnesium	1 mg	(0%)
Manganese	0.18 mg	(9%)
Potassium	8 mg	(0%)
Sodium	1 mg	(0%)
Other constituents		
water	99.9 mg	--
caffeine	12 mg	--

The flavor can be altered greatly depending on the number and type of firings but generally, a pan firing Chinese green tea takes on a yellowish-green or dark green color and imparts a grassy, earthy and roasted flavor.

Some popular pan fired Chinese green teas include Dragonwell and Gunpowder.

Modern methods (Oven-drying, tumbling, or steaming)[7]

The Japanese style of green tea is characterized by steaming, where tea leaves are treated briefly with steam heat within hours of plucking to both halts the oxidation process and bring out the rich green color of both the tea leaves and the final brewed tea.

The steaming process creates a unique flavor profile that can be described as sweet, vegetal or seaweed-like. Some Japanese green tea may also be shade grown during cultivation or roasted during processing, both to create additional flavor characteristics.

Some popular Japanese green teas include Sencha, Hojicha, Genmaicha, Gyokoro and Matcha.

Processed green teas, known as *aracha* are stored under low humidity refrigeration in 30- or 60-kg paper bags at 0–5 °C (32–41 °F). This aracha has to be refined before at stage of selection and packaging take place as they are needed giving the green teas a longer shelf-life and better flavor. The first flush tea of May readily stored in this fashion until the next year's harvest. After this re-drying process, each crude tea will be shifted and graded according to size. Finally, each lot will be blended according to the blending order by the tasters and packed for sale[8].

Preparing Green Tea

Depending on the type of green tea you're planning to brew each type may have different brewing temperature

Table 9: Pharmacological activities.

S.no.	Pharmacology Activity	action	Components
1.	Anti-Alzheimer activity [17,18]	By preventing formation of neurotoxin beta-amyloid.	EGCG & Catechins
2.	Anti-oxidant [19]	By scavenge reactive oxygen species (ROS), which are known as "free radicals," and nitrogen species	EGCG
3.	Anti-Parkinson activity [20, 21]	By preventing loss of dopaminergic neurons & preserving the level of dopamine	EGCG
4.	Anti-stroke activity [22, 23]	By protecting against neurological deficit & infarction due to the focal ischemia.	EGCG
5.	Cardiovascular disease [24, 25]	Increase in resistance of plasma LDL to oxidation, an effect that may lower the risk of atherogenesis.	Flavonoids & catechins
6.	Anti-cancer activity [26-29]	By inhibiting tumor cell proliferation as well as promoting the destruction of leukemia cell.	Catechins & EGCG
7.	Anti-diabetic activity [30-31]	By decreasing glucose level in the blood streams.	Catechins
8.	Anti-caries activity [33]	Tea leaves rich in fluoride which is known to enhance dental health & prevent dental caries.	ECG, EGCG & GCG
9.	Anti-obesity activity [34]	By stimulating brown adipose tissue.	Caffeine, catechins & EGCG
10.	Skin [35]	Green tea extract, taken orally or applied to skin, inhibit skin tumour formation.	EGCG
11.	Anti-ageing activity [36]	By protection against ethanol induced oxidative stress.	EGCG & catechins
12.	Eye Disease [37]	Increase the cell count and the cell activity after UV irradiation in cultured human retinal pigment epithelial cells.	EGCG & catechins
13.	Anti-bacterial [38]	Suppress the growth of pathogenic bacteria in the gut, but not the growth of friendly bacteria.	EGCG
14.	Renal failure [39]	Prevents glycogen accumulation in the renal tubules and probably by lowering blood level of glucose.	EGCG
15.	Anti-allergic [40]	It suppresses the B cells productions of IgE without inducing apoptosis.	EGCG
16.	Anti-hair fall [41]	By inhibition of apoptosis, radioprotection of follicle cells, profound anti-oxidant activity and potential follicular inhibition of TGF-beta.	EGCG
17.	Anti-inflammatory [42]	By protecting human chondrocytes from IL-Iβ induced inflammatory responses.	EGCG

and steeping time instructions. Ask your tea vendor for brewing tips if the tea package does not have specific instructions.

Here are a few general steps

- Take one teaspoon of green tea leaves. Even if you decide to make it for the whole family, keep in mind that you take a teaspoon of tea leaves for each cup.
- Now take the tea leaves in a strainer/sieve and keep aside.
- Now take a stainless steel pot/pan and boil adequate water. If you wants to use a glass bowl instead. The ideal temperature for green tea is 80°c to 85°c so keep an eye on the water to make sure it's not boiling. We need to take water near to the boiling point but not boiling. If accidentally it starts boiling, just switch off the gas/heat and let it cool a bit (for say 30 to 45 seconds) and then it should be ready for use.
- Now place the cup/mug in which you want to make the tea. Take the sieve/ strainer and place it over the cup or mug.
- Now we need to pour the hot water into the cup and let the tea steep for 3 minutes max. This is the step where we need to be very careful. Not everyone likes their drink strong and to see whether the tea is just right, keep a spoon handy and drink a spoonful of tea every 30/45 seconds to find out if the flavor is right.
- Now take out the sieve once you are sure of the taste (or it's passed 3 minutes) and keep it aside. Add some sugar (½ teaspoon) or if you want a healthy choice, add some honey (1 teaspoon).
- Stir the sugar/honey in and let the drink cool a few seconds and enjoy your cup of green tea.

Traditional Uses

- According to tradition, green tea could cure headaches, body aches, and pains to constipation and depression.
- Green tea is said to increase the blood flow throughout the body due to it contains a little caffeine, also stimulates the heart and allows the blood to flow more freely through the blood vessels. For the same reason

that green tea stimulates blood flow, it also stimulates mental clarity[9].

- Green tea detoxifies the body. The presence of polyphenols, a naturally occurring antioxidant in green tea that keeps the body free from diseases. Antioxidants in green tea can improve immunity, preserve young-looking skin and brighten the eyes.
- Green tea aids in digestion and banishes fatigue. Chinese green tea is also said to prolong the lifespan.

Toxicity

Green tea has not any toxicity after consumption in both human and experimental animals. Single doses of decaffeinated green tea solids up to 4.5 g/day (45 cups of tea) have been well tolerated by humans[10].

Adverse Side Effect of Green Tea

These side effects can range from mild to serious and include a headache, nervousness, sleep problems, vomiting, diarrhea, irritability, irregular heartbeat, tremor, heartburn, dizziness, ringing in the ears, convulsions, and confusion. Green tea seems to reduce the absorption of iron from food[11].

Green Tea Dosing

A daily intake of 3 to 5 cups/day (1,200 mL) of green tea will provide at least 250 mg/day of catechins. Green tea extract should not be taken on an empty stomach due to the potential for hepatotoxicity from excessive levels of epigallocatechin gallate.

CONCLUSION

Green tea is an herbal gift of nature to the mankind. Green tea has been found to possess various pharmacological activities such as anti-alzheimer, anti-oxidant, anti-parkinson, anti-stroke, anti-cardiovascular disease, anti-cancer, anti-diabetic, anti-caries, anti-obesity, anti-ageing, eye disease, anti-bacterial, anti-allergic, anti-hair fall, anti-inflammatory due to the presence of various chemical constituents called polyphenols, catechins and others. Because of wide health benefits of the tea it attracted the interest of people in research about green tea.

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