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Tea (Camellia sinensis Linn.) – The Pharmacological Activities, Substitutes and Adulterants

Author: Das Sangram Keshari¹

Co Authors: Suryasmit Parwar² and Mohanty Bishnupriya³

^{1,2}Dept. of Dravyaguna vijnana, Gomantak Ayurveda Mahavidyalaya & Research Centre, At/Po- Shiroda, Dist- North Goa, Goa, India

³Dept. of Sanskrit – Samhita – Siddhanta, Gomantak Ayurveda Mahavidyalaya & Research Centre, At/Po- Shiroda, Dist- North Goa, Goa, India

ABSTRACT

Tea is an aromatic and the cheapest drink consumed by people around the world having high market demand. Tea plant *Camellia sinensis* belonging to family Theaceae has been grown around the world from past thousands of years. Tea was a monopoly with China, Britishers wanted to compete with them so they started its cultivation in Assam to get good revenue. According, to Tea board of India, around 80% of the total tea produced in India is consumed by Indian population. According to United Nation tea has got lots of medicinal and health benefits. Drinking tea within therapeutic limit prevent many diseases and maintain Cardiovascular, metabolic disorder, anti diabetic, anti ageing and other health benefits.

Besides so many benefits, tea has also some contraindications and side effects like insomnia, anxiety, heart burns etc. Because of the great demand in the world market it is often substituted and intentionally adulterated with other plants, plant parts, minerals adulterants, artificial colours, synthetic flavoring agents, ash, dry used tea, Persian blue, blue dye, graphite, gypsum, soap stone and colouring agents like L methyl lactate etc which creates health hazards. This paper presents overall review on Tea.

Key Words Tea, *Camellia sinensis*, Pharmacological activities, Substitutes, adulterants

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INTRODUCTION

After water tea is the 2nd most consume drinks in the world. In tea production, export and consumption India is the second largest in the world. The first tea produced from Assam was sent for public sale in England in 1823. In 1780 Robert KYD started experimental tea cultivation

in India with Chinese seed. Tea is made from processed leaves of tea plant i.e. *Camellia sinensis* belonging to theaceae family. Tea is mostly of two types, Green tea (*Thea viridis*) and Black tea (*Thea bohea*). Almost 80% of the tea produced in the world is black tea, 15% is green tea and the remaining is oolongs, yellow and the white tea. In addition to this Rose tea, Amla tea,

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Chamomile tea, English tea have also gained popularity around the world but it is important to know that all of these are infusions and not tea as it doesn't contain any traces of *Camellia sinensis*. The growth of the tea plant is best in a warm climate with good long sunlight days, cooler nights and a good amount of rainfall. After each winter season the tea leaves are hand plucked and harvesting is done. After air exposure the leaves start withering and when the leaves become palatable can be developed into different kind of tea. Anti cancerous effects and Cardiac effects of tea are gaining popularity around the globe. Besides lots of health benefits, tea also has disadvantages like it leads to insomnia, anxiety and heart burn etc more often. Increasing market demand leads to substitute and intentional adulterations with several plants plant parts, harmful chemicals, minerals, colours and flavors etc. To stop this adulteration practice, in 1976 Adulteration of tea act was passed by British parliament. Around 200 numbers of known substitutes for genuine tea are in use in the world. This paper discusses various aspects of tea.

MORPHOLOGY:

Camellia sinensis plant comes under theaceae family. It is an evergreen shrub of 0.6 and 1.5 m when it is cultivated. The leaves of the tea plants are light green in colour, short stalked, alternate lanceolate, serrated margin, glabrous varying in length of 5 to 30cm and around 4 cm in width. Mature leaves are bright green in color, smooth and leathery, while young leaves are pubescent. The flowers of the tea plant are white in colour

with a very good fragrance. These white flowers possess numerous stamens having yellow anther and brownish red capsules. Fruit is flat smooth, round with a three chambered capsule mentioned in Table No-1.

Table 1 Taxonomical Classification of *Camellia sinensis*

<i>Classification</i>	
Genus	camellia
Family	Theaceae
Order	Theales
Subclass	Dilleniidae
Class	Magnoliophyta Dicotyledone
Division	Magnoliophyta
Superdivision	Spermatophyta

CHEMICAL COMPOSITION:

Polyphenols-flavanoids comprises catechins. Tannins are second largest polyphenols present in tea responsible for astringency of tea. In addition to phenolic acids comprising of caffeic acid, chlorogenic acid, Gallic acid and Quinic acid. *Flavonols* -represents mainly Kaempferol, myricetin, Quercetin.

Proanthocyanidins. Xanthine bases/Purine – Caffeine, Theophylline, Theobromine. *Amino acids*-(1-4%)-Aspartic acid, Glutamic acid, glutaminic acid, *Minerals*-Al, Ca, Cr, Co, Cu, F, Fe, K, Mg, Mo, Mn, Na, Ni and Zn etc¹.

PHARMACOLOGICAL ACTIVITIES:

Antioxidant and Hepatoprotective activity

Tea having Epi-gallocatechingallate & epi-gallocatechin are potent Hepatoprotective agents².

Anticancer & antimutagenic activity

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Green tea polyphenolics GTP's are considered to be dietary chemopreventive compounds due to their potent effect on apoptosis and cell cycle progression inhibition^{3,4}.

Antibacterial and antiviral activity

Green tea is effective against *Staphylococcus aureus* and *Vibrio Cholerae*⁵.

Anti Schistosomiasis activity

Green tea could protect liver cells in mice after being infected with *Schistosomamansoni* and thus decreases cellular necrosis and regenerates Total protein and glycogen leads partially⁶.

Cardioprotective action

Green tea could improve the risk factors for heart disease as it significantly reduces total cholesterol, low density lipoprotein (LDL) Cholesterol, and blood pressure⁷.

Antidiabetic and antiobesity activity

Green tea is used for diabetes and its complications like diabetic retinopathy⁸.

Gastrointestinal action

Green tea having anti-inflammatory effect, so useful abdominal aortic aneurysm⁹.

Neuroprotective activity

Green tea extract having beneficial effect on brain injury induced by ischemia¹⁰.

Anti-inflammatory, Antipyretic and Analgesic activity.

Green tea is considered to be a potent anti-inflammatory and Antipyretic agent¹¹.

Skeletomuscular system relieving activity

EGCG has direct vasodilator action in skeletal muscle and recover the muscle mass and function¹².

Miscellaneous activity

Besides so many benefits ,tea has some contraindications also like-

Reduced Iron absorption, Increased anxiety, stress and restlessness, Hampers the sleep pattern, Nausea, Heartburn and Caffeine dependency¹³.

Adulterants

History of tea adulteration was significantly seen in 19th century.

Law was passed by British parliament, Adulteration of Tea Act 1776.

Adulteration never stopped yet.

Substitutes and Adulterants

Adulterants-Rose , Ash, Rhododendrons and other plants.

Given scented with flower of olive, *Chloranthus encenspicus*, species of *Gardena Florida*, Species of *Jasmine* mentioned in Table No 2.

Mineral adulterants are also employed to give weight and color. Sometimes dried tea is also used.

Many other substances like artificial color are also used like Persian blue and Indigo.

Graphite and Gypsum are also used.

Table 2 Plant/Plants parts used as Tea Substitutes and Adulterants

Sr no	Botanical name	Family	Habita t	Eng/Hindi/Sans krit name	Useful part	Substitute or Adulterant
1	Acacia nilotica(Linn) Delile Subsp.A.indica(Benth)Brenan	Mimosaceae	Tree	- Babul Kikar	Powder ed bark	Adulterant ¹⁴

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Syn.A.arabicaauct non (Lam).Willd						
2	Acer negundo Linn	Aceraceae	Tree	Box elder	Leaves	Adulterant ¹⁵
3	Adiantum capillus_veneris Linn	Adiantaceae; Pteridaceae	Fern	Maiden hair fern Hansraj	Leaves	Adulterant ¹⁶
4	Agapetesaligne (Hook.f.)	Ericaceae,Vaccin iaceae	Shrub	-	Leaves	Substitute ¹⁷
5	Albizia smara(Roxb)Boiv	Mimosaceae	Tree	-	Leaves	Adulterant ¹⁸
6	Andropogon schoenanthus Linn.	Poaceae	Grass	Geranium Grass Lemon grass	Fresh Young leaves	Substitute ¹⁸
7	Basella alba Linn var.rubra(Linn).Stewart	Basellaceae	Creeper	Upodika,Poi, Malabar Night Shade,	Leaves	Substitute ¹⁹
8	Berberis lyceum Royle	Berberidaceae	Shrub	Indian barberry	Leaves	Substitute ²⁰
9	Bertula alba Linn.	Cupuliferae	Tree	Bhurjapatra, Paper or white birch	Leaves	Substitute ²¹
10	Bursera gummifera Linn.	Burseraceae	Tree	American gum tree, Indian birch	leaves	Substitute ²¹
11	Ceanothus americanus Linn.	Rhamnaceae	Shrub	New jersey tea	Leaves	Substitute ²²
12	Chenopodium ambrosioides Linn.	Chenopodiaceae	Herb	Mexican tea	Leaves	Substitute for Chinese tea ²³
13	Cinnamomum verum J.S Presl Syn- C.zeylanicum Blume	Lauraceae	Tree	Twak, Dalchini,Cinnam on	Leaves and bark	Substitute and Adulterant ²⁴
14	Desmodium triquetrum DC.	Fabaceae	Shrub	-	Leaves	Substitute ²⁵
15	Epilobium angustifolium Linn.	Onagraceae	Herb	Fire weed Roselay Willow Herb	Leaves	Adulterant ²⁶
16	Eurya japonica Thumb.	Theaceae	Tree	Wild tea H- Baunra	Leaves	Substitute ²⁷
17	Ficus arnotiana (Miq) Miq	Moraceae	Tree	H- Ban pipal	Leaves	Substitute ²⁸
18	Fragaria vesca Linn.	Rosaceae	Climber	The Strawberry	Leaves	Adulterant ²⁹
19	Fraxinus spp	Oleaceae	Tree	-	Leaves	Adulterant ³⁰
20	Galium aparine Linn	Rubiaceae	Herb	Bed straw, Burweed, Catchweed	Dried plant	Substitute ³⁰
21	Gaultheria procumbens Linn	Ericaceae	Shrub	Tea Berry	Leaves decoction	Substitute for Chinese tea ³⁰
22	Glycyrrhiza glabra Linn.	Fabaceae	Herb	Yastimadhu, Mulethi, Liquorice	Leaves	Substitute ³¹
23	Gordonia obtusa Wall ex Wight&Arn.	Theaceae	Trees	-	Leaves	Adulterant ³²
24	Hibiscus syriacus Linn.	Malvaceae	Shrub	Shrubby Athaea	Leaves	Substitute ³³
25	Llexparaguensis St.Hill	Aquifoliaceae	Shrub	Paraguay tea	Leaves	Substitute ³⁴
26	Ledumpalustre Linn.	Ericaceae	Shrub	Marsh tea	Leaves	Substitute or

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27	<i>Lindera benzoin</i> Blume	Lauraceae	Shrub	Spice wood Shrub of twigs	Twigs	Adulterant ³⁴ Substitute ³⁵
28	<i>Lippia alba</i> (Mill).N.E.Br. ex Britton and Wilson	Verbenaceae	Shrub	-	Leaves	Substitute ³⁶
29	<i>Menyanthestrifoliata</i> Linn	Menyanthaceae	Rhizome	Bog bean	Leaves	Substitute or Adulterant
30	<i>Morus alba</i> Linn	Moraceae	Tree	The white mulberry	Leaves	Adulterant ³⁷
31	<i>Origanum vulgare</i> Linn.	Lamiaceae	Shrub	Organy, Wild Marjoram, H-Sathera	Leaves	Substitute or Adulterant
32	<i>Osyrisarborea</i> Wall.	Santalaceae	Shrub	-	Leaves	Substitute
33	<i>Pentapetes phoenicea</i> Linn.	Sterculiaceae	Shrub	H-Dopharia	Leaves	Substitute
34	<i>Polygala vulgaris</i> Linn.	Polygalaceae	Grass	Milk wort	Whole plant	Adulterant
35	<i>Primulaveris</i> Linn.	Primulaceae	Shrub	Cowslip	Leaves	Substitute ³⁸
36	<i>Pseudotsugamenziesii</i> Franco Syn- <i>P.taxifolia</i> Britton	Pinaceae	Tree	Douglas fir	Leaves	Substitute
37	<i>Rinorea bengalensis</i> (Wall)kuntze. syn. <i>Alsodeia bengalensis</i> Wall.	Violaceae	Tree	-	Leaves	Substitute or Adulterant
38	<i>Salix alba</i> Linn.	Salicaceae	Tree	White Willow, H- Bis	Leaves	Substitute ³⁹
39	<i>Sida rhombifolia</i> Linn.	Malvaceae	Herb	-	Leaves	Substitute
40	<i>Streblus asper</i> Lour.	Moraceae	Tree	S- Shakhotaka, H-Siora	Leaves	Substitute
41	<i>Ulmus campestris</i> Linn.	Ulmaceae	Tree	English Elm	Leaves	Substitute
42	<i>Vacciniummyallus</i> Linn.	Ericaceae	Shrub	Kutai tea	Leaves	Substitute or Adulterant ⁴⁰
43	<i>Wedelia biflora</i> (Linn)DC.	Asteraceae	Herb	-	Whole plant	Substitute and Adulterant ⁴¹

CONCLUSION

Tea is the most consumed beverage in the world, next to water. There is a misconception in the market that herbal tea is also a tea; however herbal tea is not made from *Camellia sinensis*. The benefits of tea as it contains polyphenols and other components are wonderful. It is known to reduce the risk of consistency of chronic diseases such as cancer, cardiovascular diseases, diabetes and arthritis. However it is much needed to check the quality of tea as it is often adulterated with other leaves as its demand is increasing day by day and is widely consumed.

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