

# Production, consumption and benefits of different herbal tea: A review

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## Abstract

Tea, brewed from leaves and twig of *Camellia sinensis*, is considered as most widely consumed beverage after water. Tea can be classified as raw or unfermented green tea; partially fermented Oolong (red and yellow) tea; totally fermented black tea. Tea possesses significant antioxidative, antiinflammatory, antimicrobial, anticarcinogenic, antihypertensive, neuroprotective, cholesterol lowering, and thermogenic properties. Green tea comprises of certain active components such as polyphenols, caffeine amino acids, flavonoids. Herbal tea or 'tisanes' is essentially an herbal mixture made from leaves, seeds and/ or roots of various plants. Herbal tea possesses certain medicinal properties such as anti-bacterial, anti-inflammatory properties. The objective of this review is to discuss various types of tea including herbal tea, summarizing their health benefits, preparations.

## Keywords

*Camellia Sinensis* • Herbal Tea • Moringa leaves • Green Tea

## Introduction

Tea, the most widely consumed ancient beverage is prepared from an evergreen shrub *Camellia sinensis*, a member of the Theaceae family. It is the oldest, most popular, non-alcoholic caffeine-containing beverage in the world which is originated from China and is the second most consumed beverage after water. It is prepared by brewing processed leaves of the tea plant (*C. sinensis*). In India, tea was cultivated in Assam in the 19th century. Chinese variety (*C. s. Sinensis*), and Assamese variety (*C. s. Assamica*) are the two basic varieties of tea from ancient times. There are about 45 species of *Camellia* out of which *Camellia sinensis* is considered to be native to India. The tea plant grows to a height of 35 feet in tropical and subtropical climates with a temperature range of 13°C-29°C, altitude 2460 m above sea level. It grows well in acidic conditions of soil having Ph 3.3-6.0, in the presence of iron and manganese. The plantations are cultivated at altitudes of 2460 m above sea level. Based on the method of production, tea can be classified mainly into three types black, green, and oolong which is all derived from the plant *Camellia sinensis*. Approximately 3.0 million metric tons of dried tea is produced annually out of which green tea occupies 20%, oolong tea, 2%, both of them are predominantly consumed in Asian countries, whereas the major portion is of black tea which is widely consumed in India and Western countries. These three differ in their manner of production, green tea is produced from freshly harvested

leaves which are subjected to a steaming process to inactivate polyphenols enzyme thereby preventing fermentation and producing a dry, stable product. Black tea undergoes complete fermentation which involves the activity of enzyme and oolong tea undergoes partial fermentation.

## Production and Consumption

Among 16 tea-growing states in India, four of them, Assam, West Bengal, Tamil Nadu, and Kerala account for about 96% of the total tea production of the country and the Northeast comprises 78% of the total area under tea cultivation. Tea was first cultivated in Assam after its discovery in 1823 in the same place, from there it spread to South India, Indonesia, and Sri Lanka. Assam is regarded as the major tea-producing region in the world but due to certain specific soil and climatic requirements, its cultivation was confined to only certain parts of the country. The other major tea-producing and exporting countries are China, Sri Lanka, Turkey, Kenya, and Indonesia.

In 2016, Turkey was the largest tea-consuming country in the world, with a per capita tea consumption of approximately 6.96 pounds per year. In 2018, China was the leading global tea producer, followed by India and Kenya. In 2020, global consumption of tea amounted to about 6.3 billion kilograms and is estimated to reach 7.4 billion kilograms by 2025.

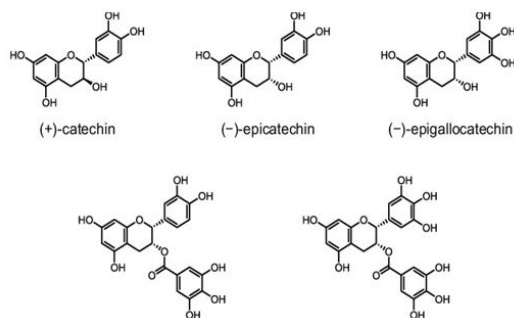
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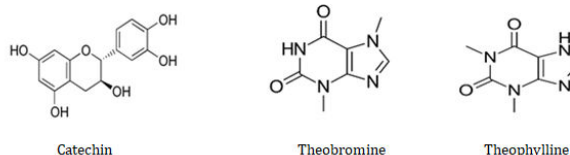
## Nutritive Value of Fresh Tea Leaves and Shoot

Tea leaves contain thousands of chemical compounds. When tea leaves are processed, the chemical compounds within them break down, form complexes with one another, and form new compounds. Fresh tea leaves are a good source of polyphenols, mainly, flavanols, flavanol gallate, catechins, and flavanol glycosides which contribute to the astringency of tea beverage. Among them catechins are predominant. Polyphenols comprise about 30-40% of the freshly plucked tea leaves and solids in tea liquor [7]. Caffeine and amino acids are also known as important components. The bud and first leaf of *C. sinensis* record the highest amount of polyphenols, the amount decreases with each leaf moving down the plant [8]. The major flavanols in tea are: catechin (C), epicatechin (EC), epicatechin gallate (ECG), gallocatechin (GC), epigallocatechin (EGC), and epigallocatechin gallate (EGCG). EGCG is the most active of the catechins, and this flavanol is often the subject of studies regarding tea antioxidants.



**Figure 1.** Aromatic structures of compounds.

The Umami taste of tea liquor is mainly due to its amino acid content which contributes to the sweetness and brothiness of the finished product. Tea plants that are shaded for 22 days contain 4 times more amino acids than non-shaded plants [9]. The main Methylxanthines compounds present in tea are caffeine, theobromine, and theophylline, which affect the color and flavor of tea [10]. Tea leaves consist of large no. of volatile substances such as alcohol, aldehyde, phenols, and some fatty acids, these makeup only about 0.01% of the weight of dry leaves [11]



Catechin Theobromine Theophylline

**Figure2:** Aromatic structure of compounds.

Constituent	Percentage (% of the dried leaf)
Polyphenols	37
Carbohydrates	25
Caffeine	15
Protein	4

Amino acids	6.5
Lignin	1.5
Organic acids	2
Lipids	5
Ash	0.5

**Table 1:** The main chemical constitutes of green tea leaves.

Crude fiber, cellulose, lignin, etc	22.00%
Protein	16.00%
Fats	8.00%
Chlorophyll and other pigments	1.50%
Pectin	4.00%
Starches	0.50%
(i) Insoluble in water (total)	52.00%
Fermentable polyphenols	20.00%
Other polyphenols	10.00%
Caffeine	4.00%
Sugar and gummy matter	3.00%
Amino acids	7.00%
Minerals (ash)	4.00%
(ii) Soluble in water (total)	48.00%

**Table 2:** Composition of Fresh Tea Shoots.

## Physical Characteristics and Chemical Quality of Tea

The processed black and green tea is sorted into different grades, leaf grade, broken, fannings, and dust, based on the appearance, size, and liquor qualities. Using a sorting machine fitted with meshes of different sizes. The quality of tea is decided by several chemical components present in it such as polyphenols (tannins); caffeine, pectic substances, pigments (theaflavins [TFs], and thearubigins [TRs]), noncaffeine nitrogenous compounds, sugars, minerals, and lipids. Tannin content is higher in green leaves, 18-20% than in processed black tea, 10%. In a good quality tea, the ratio of TF and TR should be 1:10 or 1:12 during the fermentation process. High-quality tea, with good color, strength, briskness, and flavor, has a low TR/TF ratio. Caffeine is the important component of the nonvolatile fraction that gives a modified pleasant taste to the infusion in the presence of polyphenols. Tea leaves contain 2.5% to 4.0% caffeine and traces of theophylline and theobromine. One cup of brewed tea contains (on average) 50mg caffeine. The refreshing property of tea is due to the presence of caffeine. The other nonvolatiles that contribute to taste include carbohydrates, proteins, and pectins. Caffeine determines the level of tangy astringency in black tea infusion.

## Different Types of Tea Based on the Method of Production

### Black tea

The tea which is manufactured by crushing the tea leaves to promote enzymatic oxidation followed by the fermentation process is known by the name, black tea. The fermentation process involves the condensation of tea polyphenols and results in the formation of two important compounds, the aflavins and thearubigins, the importance of both has been earlier discussed. The major steps involved in the manufacture of black tea are plucking, withering, leaf distortion, fermentation, firing, grading, packing, and storage. In today's world market, three manufactured forms of black tea exist, stick shaped black tea, granular black tea, and black tea bags. While the method of processing is the same for all three forms but differences occur in the appearance of the finished product. Stick-shaped black tea is made up of tender buds and leaves. Granular black tea comes from small bits, ground mechanically, while the tea bags are granular black tea enclosed in filter paper bags with or without added flavors.

### Green tea

Green tea is produced from a bud and two to three lead flushes of tea shrubs. The main objective of the production of green is to preserve the polyphenols present in the tea leaves by exploiting the fermentation step which results in the condensation of polyphenols. The first step in the manufacture of green tea is the steaming process which destroys the enzyme polyphenol oxidase, which is capable of oxidizing the tea catechins to oligomeric and polymeric derivatives, e.g., theaflavins and thearubigins. Different steps involve: Plucking, Steaming, Rolling, Drying, Grading, and Packing.

There are 18 different types of green tea which can be classified as pan fixed and steam fixed. Fresh tea leaves contain alkaloids 3-4%, mainly caffeine, theobromine, and theophylline. Minerals such as calcium, magnesium, chromium, manganese, iron, copper, zinc, molybdenum, selenium, sodium, phosphorus, cobalt, strontium, nickel, potassium, fluorine, and aluminum; and trace amounts of lipids (linoleic and  $\alpha$ -linolenic acids) are also present. Fresh leaves also contain phenolic compounds such as gallic acid and amino acids such as theanine.

### White tea

For making white tea, a young shoot of *Camellia sinensis* is taken which is not subjected to fermentation, instead, it is kept away from sunlight in order to protect its polyphenol content. White tea is considered one of the most expensive tea for consumers and more lucrative to the producers. As white tea is prepared from unfolded tea bud having pubescence, it gives a silvery appearance to the finished product, and hence the name white tea is suitable. The infusion of white tea is light orange yellow with a fresh aroma and plain taste.

### Yellow tea

Yellow tea serves as an intermediate between black tea and green tea but resembles closely to green tea. It is a pleasant, refreshing beverage with a bright color, mild taste, and strong aroma. It is prepared by utilizing a bud and two or three young leaves and tender shoots of the tea plant and possesses a high amount of catechin and vitamins. The main flavonoids present in yellow tea are kaempferol,

quercetine, isoquercetin, myricetin, water-soluble anthocyanins. The chemical transformation occurring in raw tea during withering, in essence, distinguishes yellow tea from green tea. Manufacturing steps include withering, roasting, rolling, sorting, and firing.

### Red tea

Red tea is of a fermented type that is prepared by a combination of enzymic and thermochemical processes in which the rate of the enzymic process is slower than that in black tea manufacture. It has a strong aroma and astringent taste. Manufacturing steps include withering, rolling, roasting, firing, sorting, and final firing.

### Oolong tea

Oolong tea which is regarded as semi-fermented or partially fermented tea is made from wilting fresh leaves by sun followed by slight bruising. The quality of oolong tea like other types of tea depend mainly on volatile fragrance, taste sensation of sweetness, umami, and intensity of astringency.

Compounds	Contents (mg/100 ml)
Catechin	1.65
Gallocatechin	6.68
Epigallocatechin	16.14
Epicatechin	5.08
Gallic acid	2.19
Caffeine	23.51
Total polyphenol	99.32

**Table 3:** Components of oolong tea.

### Herbal tea

Herbal teas or Tisanes do not originate from the *Camellia Sinensis* bush instead mixtures of several ingredients such as dried leaves, seeds, grasses, nuts, barks, fruits, flowers, or other botanical elements, and they are believed to possess certain health benefits. Herbal tea has a good taste and practically free from caffeine. Most of them comprise one main herbal ingredient or blend of herbal ingredients due to which they possess certain benefits such as relaxation, rejuvenation, relief from a specific condition, etc. Herbal tea is very popular and made of different herbs such as: **Chamomile:** Chamomile is the oldest, most widely used medicinal plant known to the world and possesses medicinal properties. It is believed to be anti-inflammatory and antispasmodic. Tea is prepared from two different plants, German chamomile (*Matricaria recutita*) and Roman chamomile (*Chamaemelum nobile*). Infusion is prepared by brewing 1.5 to 5 tsp dried flower heads in one cup for 5-10 minutes. Chamomile provides many health benefits, can soothe insect bites, chickenpox, wounds, burns, bruises, sunburns, rashes, and itchy or inflamed skin. There is no standard dose of chamomile. Studies have used between 400 milligrams to 1,600 milligrams daily in capsule form. Tea contains apigenin, which fights against cancer cells.

**Chrysanthemum:** It is a transparent, yellow color tea made from an infusion of chrysanthemum flowers. Flowers are usually steeped in hot water in a teapot, cup, or glass. In most cases, cane sugar or

rock sugar is added. It is a sweet-tasting beverage and protects against liver damage and neutralizes toxins. Chrysanthemum flowers having yellow petals are used in tea making. Flowers comprises of flavonoids, lignans, and phenolic acid. 1g of chrysanthemum was brewed in 100ml of distilling water for 2-4 minutes to get the acceptable taste and flavor.

**Cinnamon:** Cinnamon tea has a calming impact and promotes healthy circulation and digestion. Infusion is prepared by brewing 0.5 to 3 tsp cinnamon bark in 1 cup water for 5 min. Cinnamon contains polyphenols and volatile phenols, mainly, vanillic, caffeic, gallic, protocatechuic, p-coumaric, and ferulic acids. Infusion comprising of 2g green tea and 2.5 grams cinnamon extract helps to improve TGL, LDL, and HDL cholesterol and also helps in weight loss.

**Ginger root:** It is regarded as the best herb for improving circulation and also helps in lung congestion, arthritis, prevent nausea and improve digestion. Infusion is prepared by brewing 1tsp of ginger root in one cup of water.

Phenols	Volatile oils	
Gingerols and shogaols	Sesquiterpenes	Others
	bisapylene, zingiberene, zingiberol, sesquiphellandrene, curcuminene	6-dehydrogingerdione, galanolactone, gingesulfonic acid, zingerone, geraniol, neral, monoacyldigalactosylglycerols, gingerglycolipids

**Table 4:** Active Chemical Constituents of ginger.

**Peppermint:** A tea made from blending peppermint is referred to as peppermint tea. Peppermint tea which is caffeine free is popular as a "Single ingredient tea" and is known for its refreshing taste and aroma. It prevents stomach and digestive problems and also good for stress relief. It is often used as a mouth freshener.

**Red clover:** It is more often used as a medicine than as a beverage. It helps cure menopausal symptoms, cancer, mastitis, joint disorders, asthma, bronchitis, psoriasis, and eczema.

## Utilization of Different Plants in Tea Preparation

Tea can be prepared from many underutilized plant species. Few of them have been discussed in this paper.

### Pirdot (*Saurauia bracteosa* DC)

It is regarded as one of the endemic plants which are native to Indonesia, mainly used as a medicine to reduce blood sugar levels, prevent high blood pressure, and reduce blood cholesterol levels. Pirdot tree belongs to open area, along rivers and in humid places, at altitudes of 600-1,200 meter above sea level. Procedure for tea preparation includes: Fresh pirdot leaves were collected and subjected to sorting followed by fermentation process in case of fermented tea. If fermentation is not required then sorted leaves were sliced 1-2 cm wide, then dried for 4 days at room temperature until the desired moisture content is reached which is 10-15%. Dried leaves were then mashed by coarse tendering. In the case of fermented tea, fresh leaves were subjected to the wilting process (1-2

days, depending on the room temperature and moisture content). Wilted leaves were then sorted by squeezing the leaves whether they have felt wilted or still break easily. Next, the leaves were twisted (rolled), kneaded, and/or sliced into a small size and then spread on fermentation (oxidation) slabs with 1-2cm thickness. The leaves were then incubated in the incubator room at controlled temperature, humidity for 6 hours. Fermented leaves were dried until reach 8-10% moisture content 8-10%. The last step is the filling of tea in tea bags which are ready to be tested.

Tea prepared by Pirdot leaves tends to have a good number of polyphenolic flavonoids due to which its antioxidant activity increases. It also contains a good number of secondary metabolites such as alkaloids, steroids, and tannins.

### Withania somnifera stems, Terminalia arjuna bark, Cinnamon bark, and Tinospora cordifolia stems

Withania somnifera, also known as "Ashwagandha" is widely used as a medicinal plant to cure many clinical conditions in India. The leaves contain a large number of steroidal alkaloids like anferine, somnine and withanolides, iron, fatty acids. Antioxidants like glyco-withanolides and potassium nitrate are also present. The roots of ashwagandha also contain some active compounds which are useful in several health diseases.

Cinnamon bark, due to its fragrance finds application in aroma and essence industries. Due to the presence of some chemical components such as cinnamaldehyde, cinnamate, cinnamic acid, and essential oil, cinnamon is used as an anti-inflammatory, antiseptic, nematocidal, insecticidal agent. Tinospora cordifolia, commonly known as 'Giloy,' Amrita' or 'Guduchi', possesses great medicinal value and is also used as a drug. The herb contains many active components such as alkaloids, glycosides, steroids, phenolics, aliphatic compounds, polysaccharides, flavonoids, saponins, and several amounts of phytosterols.

Terminalia arjuna acts as a cardi tonic and helps to lower down the blood pressure and pulse rate. It possesses anti-oxidant, antibacterial antimutagenic activity. Tea is prepared by blending these herbs with green tea. Different formulations of Green tea (GT), Withania foraminifera stems (WS), Terminalia arjuna bark (TA), Cinnamon bark(C), and Tinospora cordifolia stems (TC) were made and subjected to sensory analysis. The result of sensory evaluation revealed that formation which comprises of GT:30%; WA:15%; TC: 15%; C:5%; TA:15%, is highly acceptable.

### Stems and Leaves of Moringa oleifera L.

Moringa oleifera Lam., commonly known as drumstick tree, horseradish tree, ben oil tree, benzoin tree is a perennial herb tree belonging to the Moringaceae family, mainly grows in Southeast Asia and the southern part of Japan. Leaves of moringa are utilized in tea preparation on account of its being regarded as a healthy food. Phytochemical analysis of moringa showed the presence of active compounds due to which it acts as an antihyperglycemic and anti-dyslipidemic antioxidant, tissueprotective, analgesic, antiulcer, antihypertensive agent. 2g each of dried moringa leaf tea and stem tea from tea bags were soaked in 100 mL of MilliQ water at 95°C for 20 min, followed by centrifugation and filtration, and residue left is

extracted two times. The final product undergoes sensory and phytochemical analysis. It was shown that the polyphenol extracted from 1 mg of leaf tea was 1.24-fold higher than that extracted from stem tea; flavonoid content from leaf tea extract was 4.51-fold higher than that of stem tea extract.

**Agglomerated: lemon balm (*Mellisa Officinalis* L. *Lamiaceae*), chamomile (*Matricaria chamomilla* L. *Astraceae*) and sage (*Salvia officinalis* L. *Lamiaceae*)**

Tea is prepared from the agglomeration of three herbs namely, lemon balm, chamomile, and sage, and subjected to phytochemical analysis. 2g each of these herbs was agglomerated using a disk pelleting machine with a 40% aqueous starch solution as the moisturizing liquid after drying the product was divided into three size-determined fractions: <1 mm; 1-2 mm and 2-3.15 mm.

For the preparation of herbal tea, 2 g portions of pellets were weighed and sealed in tea bags, and brewed for 2-3 minutes using demineralized water. When compared with commercially available teas, the infusion prepared from herbal granules consists of a slightly lower value of anti-oxidant and a higher value of polyphenols. Tea prepared from sage granules of the smallest size was the darkest while those prepared from the chamomile were brightest.

## Conclusion

There are lot of good things about consuming tea, caffeine and catechins, a type of polyphenol, in tea may help with weight loss. Consuming green tea or black tea regularly reduces the risk of heart disease. Catechins in green tea may help to keep blood sugar in check, reducing the risk for developing Type 2 diabetes. Both caffeinated and herbal teas may provide very small amounts of

minerals such as potassium, phosphorous, magnesium, sodium, copper and zinc. Overdosing can cause health risk. Large amounts of caffeine may lead to nervousness, restlessness and may disturb your sleep. Herbal tea is becoming more and more in use due to its health promoting properties. These herbs when mixed with black tea result in increase in antioxidant properties which promotes good heart health.

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