



## HERBAL TEA : A COMPREHENSIVE REVIEW OF HEALTH BENEFITS AND THERAPEUTIC POTENTIAL

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### ABSTRACT:

Herbal teas are a widely enjoyed drink around the globe and are integral to many traditional medicinal systems. This study focuses on the health advantages of herbal tea among the Bangladeshi population, the key factors associated with potential negative effects on health, and the availability of components in ten selected herbal teas prevalent in Bangladesh concerning health concerns. The herbal teas examined include chamomile, peppermint, ginger, rosemary, hibiscus, lemon balm, giloy, dandelion, and turmeric. After applying exclusion criteria on numerous relevant publications from herbal medicinal databases, the research utilized plant species like matricaria, menthapiperita, zingiber officinale, aspalathus linearis, hibiscus, melissa officinalis, echinacea, taraxacum, salvia officinalis, and curcuma to analyze their effects on health, including aspects such as diabetes, cardiovascular health, weight loss, stress reduction, and relaxation. Herbal teas are created by combining the leaves, seeds, and/or roots of various plants, and contrary to common belief, they do not come from traditional tea plants but from tisanes. Many tisanes have been recognized for their medicinal benefits; some are consumed for their energizing properties, which can help alleviate stress, digestive issues, and enhance immune function. It is recommended to consult an expert knowledgeable about herbal tea and its potential effects before consumption. In cases of uncertainty, independent research is encouraged, while increasing the intake of low-calorie teas is advised.

**KEYWORDS:** Herbal tea, therapeutic potential, chemical composition, health benefits.

### INTRODUCTION:

Herbal teas are utilized as therapeutic agents in various traditional medicine practices and are widely enjoyed around the world. This review aimed to investigate the evidence concerning the clinical effectiveness and safety of herbal teas, as well as to highlight key research themes and knowledge gaps for future inquiries. Various studies focused on the use of herbal teas in women's health, diabetes, heart disease, and weight loss, examining plant species such as lavender, chamomile, fenugreek, stinging nettle, spearmint, hibiscus, yerba mate, echinacea, and various herb combinations<sup>1</sup>. Observational studies investigated the links between herbal tea consumption and cancer risk, liver health, and potential risks associated with environmental contaminants in the plants. Despite the prominence of plant materials in drug discovery and the popularity of herbal teas, there are few articles addressing their clinical efficacy and safety. This review discusses the potential benefits of herbal teas in certain areas of clinical and preventive health and outlines the additional research needed to determine whether regular consumption can promote overall healthy living<sup>2</sup>. In recent years, the number of deaths worldwide caused by non communicable diseases has surpassed those from infectious diseases, with ischemic heart disease being the most common. Dementia and diabetes have also emerged among the top 10 leading causes of death<sup>3</sup>. As life expectancy increases globally, research indicates that making dietary and lifestyle changes at any age can enhance vascular, metabolic, and cognitive health, thereby lessening the burden of non-communicable diseases<sup>4</sup>. Clinical evidence suggests that individuals should focus on consuming plant-based foods such as fruits, vegetables, grains, nuts, and oils while reducing their intake of red and processed meats as well as sugary beverages to maintain a healthy diet<sup>5</sup>. However, achieving these dietary goals is complicated by rising processed food consumption, decreasing availability of plant species, and broad socioeconomic and political challenges that limit access to nutritious food for many<sup>6</sup>. One potential solution to these challenges is incorporating valuable plant materials from various dietary sources. The Dutch government's dietary guidelines suggest drinking three cups of green or black tea daily, supported by evidence linking tea consumption to a lower risk of strokes and high blood pressure<sup>7</sup>. The traditional consumption of black and green tea, derived from the *Camellia sinensis* plant, has been practiced for thousands of years, and the health benefits of its primary polyphenolic compounds are well established<sup>8,9</sup>. In addition to the widely enjoyed green and black varieties, teas can also be made from infusions of the roots, leaves, flowers, and other parts of a wide array of plant species. These herbal teas are rich in beneficial compounds and may play a crucial role in providing nutrients and substances that can help offset the effects of poor-quality diets.

Research has shown a connection between tea consumption and a reduced risk of stroke and high blood pressure, leading the Bangladeshi Government to recommend three cups of herbal tea daily in their dietary guidelines. Herbal teas, especially those derived from the *Camellia sinensis* plant, have a long history of use, boasting significant pharmacological benefits from their primary polyphenolic catechins and flavonoids. Besides the well-known herbal and black teas<sup>10</sup>, tea can also be made from various plant parts, such as roots, leaves, and flowers. These "herbal teas" are rich in diverse

compounds and may offer essential nutrients, potentially addressing deficiencies in poor diets<sup>11</sup>. Various traditional medicine systems, including those in China and India, have used herbal teas for therapeutic purposes. Popular herbal teas include those made from blue, hibiscus, rose, tulsi (*Ocimum sanctum*), jasmine, ginseng, rosemary, peppermint, and ginger, noted for their anti-inflammatory and anti-mutagenic properties, with peppermint oil particularly known for its soothing effects on digestion. Due to the affordability of in vitro research, there is a substantial amount of preclinical data on these plant compounds and their pharmacological effects<sup>12</sup>.

Further human studies are necessary to explore both the short- and long-term benefits of herbal teas, as well as the effectiveness of production methods like fermentation, which can enhance flavor and biological activity. Tea is widely consumed worldwide, second only to water, and is cherished for its unique flavor and health benefits, along with its cultural significance. Herbal tea is available in many forms, including loose leaves, tea bags, and powders, and its popularity continues to rise globally. The unique cultivation method, where tea bushes are covered with bamboo mats to shield the leaves from excessive sunlight, results in a tea that is exceptionally high in antioxidants<sup>13</sup>. The World Health Organization's (WHO) 2014-2023 strategy emphasizes leveraging traditional medicines, such as herbal remedies, to promote health by providing effective, affordable options that align with cultural practices. As traditional medicines gain traction in global health policies, the need to address critical issues concerning their efficacy, safety, and quality assurance has grown, highlighting the importance of evidence-based approaches. There also safety concerns related to fluoride levels in black, herbal, and herbal teas, underscoring the necessity for rigorous quality standards<sup>14</sup>.

### Classification of herbal teas on different basis:

Herbal teas, also known as tisanes, are made by infusing various parts of plants in hot water. Unlike traditional teas derived from *Camellia sinensis*, herbal teas are naturally caffeine-free and come from a wide variety of botanical sources. They can be classified in several ways:

i) **Based on plant part used:** each part of plant offer unique flavor and health benefits.<sup>15</sup>

| Plant Part | Example Herb           | Common Uses                        |
|------------|------------------------|------------------------------------|
| Leaves     | Peppermint, Lemon balm | Digestive aid, relaxation          |
| Flowers    | Chamomile, Hibiscus    | Calming, heart health              |
| Roots      | Ginger, Licorice       | Anti-inflammatory, soothing throat |
| Seeds      | Fennel, Cardamom       | Carminative, anti-bloating         |
| Bark       | Cinnamon               | Warming, blood sugar regulation    |
| Fruits     | Rosehips, lemon        | Vitamin C source, immune boosting  |

**Table 1. Based on plant part used**

ii) **Based on Traditional Medicine system:** herbal teas have been used for centuries in traditional health system.<sup>15</sup>

| Tradition                    | Notable Herbs          | Focus Area                     |
|------------------------------|------------------------|--------------------------------|
| Ayurveda                     | Tulsi, Ashwagandha     | Adaptogens, immune support     |
| Traditional Chinese Medicine | Ginseng, Chrysanthemum | Energy balance, detoxification |
| Western Herbalism            | Echinacea, Peppermint  | Immunity, digestion            |
| Folk Medicines               | Nettle, Elderflower    | Seasonal wellness, cleansing   |

**Table 2. Traditional medicine system**

iii) **Based on functional use or Health Benefits:** herbs are often blended or consumed based on their intended effects.<sup>16</sup>

| Function            | Common Ingredients                       |
|---------------------|------------------------------------------|
| Digestive Aid       | Peppermint, ginger, fennel               |
| Relaxation & Sleep  | Chamomile, lavender, valerian            |
| Immune support      | Echinacea, elderberry                    |
| Detox/cleansing     | Dandelion root, milk thistle, lemongrass |
| Respiratory support | Thyme, mullein, eucalyptus               |

**Table 3. Based on health benefits**

iv) **Based on preparation/usage:** <sup>16</sup>

| Preparation       | Example                                   |
|-------------------|-------------------------------------------|
| Single herb teas  | Pure peppermint or ginger tea             |
| Blended herb teas | Detox blends, slimming teas, bedtime teas |

**Table 4. Based on usage**

## VARIOUS TYPES OF HERBAL TEAS

### 1. Chamomile tea:

It belongs to the family of *Asteraceae*, is a flower which is native to Asia and Europe, but grown all over the world because of its health benefits. Chamomile is used for medicinal purpose from years and is considered one of the most popular herbal medicine. It is commonly taken in the form of Chamomile tea but can also be taken in the form of capsules, pills, drops, or applied directly to skin (topically). Chamomile is mostly used for its relaxing properties and may help to enhance the sleep quality and also reduces anxiety<sup>19</sup>. Chamomile tea is also used to treat various mild disorders like gastrointestinal issues, runny nose, burning wounds, oral, topical or throat inflammation, anxiety, insomnia, and many more health issues. Chamomile comprises various pharmacological properties such as anti-inflammatory, antioxidant, anti-bacterial, anti-spasmodic, pain relief, anti-tussive, sedative, these all properties contribute to its pharmacological efficacy. Chamomile helps to increase appetite and reduces inflammation that occurs in the form of swelling or sweating<sup>20</sup>. Commonly the flower heads of the chamomile are used for medicinal purpose. Chamomile consists of various phytoconstituents such as Flavonoids, Coumarins, volatile oils, terpenes, organic acid, sterols, and polysaccharides and many more. Due to the presence of various compounds, chamomile exhibits various pharmacological activities such as anti-cancer, anti-inflammatory, anti-infective, antioxidant, hypoglycaemic, hypo-lipidaemic, anti-allergic, anti-depressant and neuroprotective effects<sup>21</sup>.



Image 1. Chamomile tea

### 2. Peppermint tea:

Peppermint also known as *Mentha piperita* is a hybrid plant, belongs to the mint family *Lamiaceae*. It is commonly used plant in modern society. It is a summer growing, perennial aromatic herb obtained by the cross between the *Mentha spicata* (spearmint) and *M. aquatic* (watermint). Peppermint is an aromatic herbaceous plant with smooth, square stems and lance-shaped, dark green leaves with reddish veins, the plant bears small purple flowers in terminal spikes and emits a characteristic minty odor<sup>22</sup>. The odor and flavor of this plant is due to the volatile components present in the leaves and stems of peppermint. The primary active component of peppermint consists of essential oils, flavonoids, tannins, phenolic acids. Peppermint is believed to help with digestion by relieving bloating, nausea, and other digestive symptoms as it relaxes gastrointestinal smooth muscles and helps alleviate symptoms of irritable bowel syndrome, menthol in peppermint has a relaxing effect on muscles of the gastrointestinal tract. This plant exhibits antimicrobial activity against various pathogens including bacteria, fungi, and viruses, making it useful in oral hygiene and skin care<sup>23</sup>. Menthol has a cooling and numbing effect that helps to reduce pain and inflammation, headache, muscle pain and joint conditions. Peppermint's menthol content helps to relieve nasal congestion, sinusitis and cold symptoms by acting as a natural decongestant and expectorant. Peppermint tea or oil also helps to reduce nausea especially during pregnancy and motion sickness. Flavonoids and phenolic content in peppermint help neutralize free radicals by protecting cells from oxidative stress. The main volatile oil includes menthol that is responsible for giving peppermint its characteristic cooling sensation<sup>24</sup>.



Image 2. Peppermint tea

### 3. Ginger tea:

Ginger (*Zingiber officinale*) is a member of the *Zingiberaceae* family. Turmeric, cardamom, and galangal are other members of the same family. Ginger is a perennial plant which grows approximately one to three feet in height with narrow, lanceolate leaves and greenish-yellow flowers. The rhizome is thick, irregular, branched and covered with a thin brownish skin. It produces a cluster of white and pink flower blooms which open into yellow flowers. Ginger grows horizontally in the form of a rhizome that gets compressed into branching segments<sup>25</sup>. It is a perennial herbaceous plant native to Southeast Asia.

widely cultivated for its aromatic and pungent rhizome, which is the main part used for culinary and medicinal purpose. Ginger is a natural anti-inflammatory herb, primarily due to gingerols and shogaols, making it effective in reducing pain and inflammation in condition like osteoarthritis and rheumatoid arthritis. Ginger stimulates digestion, relieves bloating and flatulence and enhances nutrient absorption<sup>26</sup>. It is commonly used to alleviate indigestion and gastro intestinal discomfort, ginger is well known for reducing nausea and vomiting, particularly during pregnancy, chemotherapy or motion sickness. Ginger contains antioxidants that helps control oxidative stress and reduce cellular damage, supporting overall health and disease prevention. Studies suggest ginger improves insulin sensitivity and lowers blood glucose levels, making it beneficial for managing type2 diabetes. Ginger has anti-microbial properties that can inhibit the growth of bacteria. Fungi and virus, contributing to the immune defense and oral health . ginger is traditionally used to treat cough, sore throat and congestion due to warming, expectorant properties and is often used to relieve nausea, improve digestion, and reduce inflammation<sup>27</sup>.



Image 3. Ginger tea

#### 4. Rosemary tea:

Rosemary (*Rosmarinus officinalis*) is a fragrant, evergreen herb native to the Mediterranean region, it belongs to the mint family *Lamiaceae* and is known for its needle like leaves, woody stems and distinctive, pine like aroma. Rosemary produces small flowers, typically blue or purple, and thrives in warm, sunny climates. Rosemary is a fragrant, evergreen shrub that grows up to 1-2 meters in height<sup>28</sup>. It is a powerhouse of various health benefits and therapeutic potential. It contains carnosic acid and antioxidants that helps to boost memory, enhance cognitive performance, alertness and improve concentration. Rosemary is rich in bioactive compounds like phenolic compounds, essential oils, flavonoids and triterpenes. Carnosic acid and rosmarinic acid act as powerful antioxidants, neutralizing free radicals and protecting cells from oxidative stress. Compounds like rosmarinic acid helps to reduce inflammation in body due to conditions like arthritis or chronic pain. Also known as “memory herb”, it may improve concentration, protect against neurodegenerative diseases like Alzheimer’s<sup>29</sup>. It is traditionally used to relieve indigestion, bloating, gas, also stimulates the production of bile and digestive enzymes. Aromatherapy with rosemary may reduce anxiety and mental fatigue as well as help to lower cortisol levels. It also shows antimicrobial and anti inflammatory properties which helps to boost the immune system. Antioxidants in rosemary supports cardiovascular health by reducing lipid oxidation, improving circulation, potentially lowering blood pressure. Carnosol and other polyphenols have shown anti-cancer effects in laboratory studies, including the ability to inhibit the growth of certain tumor cells. Rosemary is a versatile medicinal herb with a long history in traditional and modern herbal medicines. Its rich phytochemical profile gives it a wide range of health promoting properties for anti-inflammatory effects to cognitive enhancements<sup>30</sup>.



Image 4. Rosemary tea

#### 5. Hibiscus tea:

Hibiscus also known as *Hibiscus sabdariffa*, belongs to the family *Malvaceae*, it is a fast growing herbaceous shrub that typically reaches 2 to 2.5 meters in height. It has reddish-purple stems and lobed, alternate leaves with serrated edges<sup>31</sup>. The flowers are large, funnel shaped, and usually pale yellow with a deep red or maroon center. After blooming, the flower develops a thick, fleshy red calyx, which is the part harvested and dried for tea and other products. The calyces are rich in anthocyanins and used in herbal teas, jams, syrups and natural dyes<sup>32</sup>. The bioactive compounds in hibiscus calyces that contribute to its health effects includes anthocyanins, organic acids, flavonoids, phenolic acids, polysaccharides, vitamin C, Minerals, Essential fatty acids. Anthocyanins, hibiscus acid helps to relax blood vessels and reduce blood pressure by influencing the rennin-angiotensin system and improving endothelial function. Hibiscus is rich in vitamin C and antioxidants and may help lower blood pressure and support healthy cholesterol

levels. Compounds like flavonoids and phenolic acid improve insulin sensitivity, regulate glucose metabolism, and reduce postprandial blood sugar spikes. It helps to enhance liver enzyme activity, reduces fat accumulation and protect liver cells from oxidative damage<sup>33</sup>.



**Image 5. Hibiscus tea**

#### 6. Lemon balm tea:

Lemon balm (*Melissa officinalis*), belong to the *Lamiaceae* family, it is a perennial herb with a mild lemony scent, native to southern Europe and Mediterranean. It has oval, lightly serrated leaves, small white or pale yellow flowers, and typically grows up to 70-140 cm<sup>34</sup>. Lemon balm is rich in bioactive compounds such as essential oils, phenolic acids, flavonoids, triterpenes and tannins. It helps to reduce stress, anxiety and restlessness. Often used as a mild natural remedy for insomnia and nervous tension, act as a mild sedative as it improves sleep quality. It is found to be effective against Herpes simplex Virus -1<sup>35</sup>. Also helps to relieve indigestion, bloating, gas, calms irritable bowel syndrome because of its antispasmodic effect. May relieve PMS symptoms, protects brain, liver and heart tissues from oxidative stress. Lemon balm is believed to have calming properties and may help reduce anxiety and improve sleep quality<sup>36</sup>.



**Image 6. Lemon balm tea**

#### 7. Giloy tea:

Giloy, scientifically known as *Tinospora cordifolia*, is a climbing shrub native to tropical regions of India. It belongs to the family *Menispermaceae*. The plant is characterized by its heart-shaped leaves and succulent, twining stems with papery bark<sup>37</sup>. It often grows on trees, with preference for neem and mango trees, which are believed to enhance its medicinal qualities. Giloy contains a wide range of bioactive compounds such as alkaloids, diterpenoids, lactones, glycosides, steroids, polysaccharides, flavonoids. It shows various therapeutic health benefits like boosts immune function by enhancing macrophages activity and stimulating the production of immune cells, makes them effective against infection<sup>38</sup>. Traditionally used to treat chronic fevers, Giloy helps regulate body temperature and fight microbial infections. The plant exhibits strong anti-inflammatory properties, beneficial in treating conditions like arthritis and gout. Giloy is rich in antioxidants, helps to neutralize free radicals by reducing oxidative stress and cellular damage. Giloy has hypoglycemic effects, which help in managing blood sugar levels, making it useful for diabetic patients. It supports liver health and is used for treatment of jaundice and liver dysfunction. Traditionally, used for treating asthma, cough, bronchitis due to its anti-allergic and anti-inflammatory effect<sup>39</sup>.



**Image 7. Giloy tea**

### 8. Dandelion tea:

Dandelions are also called as *Taraxacum officinale* belongs to the family of *Asteraceae*. Native to Europe and Asia; now widely naturalized across the world. Dandelion is a hardy, low-growing perennial with a rosette of deeply toothed leaves. It produces bright yellow composite flowers that later turn into spherical seed heads ("puffballs"). The plant has a thick taproot that exudes a milky latex when cut. It thrives in a wide range of environments, including lawns, fields, and roadsides. Dandelions comprises various bioactive constituents like Sesquiterpene lactones, Triterpenoids, flavonoids, and phenolic acids, Inulin (a prebiotic fiber), Vitamins and minerals: Vitamins A, C, K, and potassium, calcium, magnesium, iron. Dandelion root is known to stimulate liver function, aid bile production, and support detoxification, making it useful for treating jaundice, hepatitis, and liver congestion. The leaves have natural diuretic effects, helping eliminate excess water and toxins through urine without causing potassium loss. Stimulates appetite and aids digestion by enhancing bile and gastric secretions. It's also used to relieve bloating and indigestion<sup>40</sup>. Rich in antioxidants that combat oxidative stress and reduce inflammation, potentially supporting chronic disease prevention. Inulin and other compounds may help regulate blood sugar levels and improve insulin sensitivity. Dandelion may help lower LDL cholesterol and triglycerides while promoting cardiovascular health through its antioxidant and anti-inflammatory actions. Dandelion extracts are used for treating acne, eczema, and other skin conditions due to their antibacterial and anti-inflammatory properties. High levels of calcium and vitamin K support bone strength and mineral density. Dandelion (*Taraxacum officinale*) is a powerful yet gentle herbal remedy with a long history in traditional medicine. From detoxification and digestion to skin health and immunity, it offers diverse therapeutic benefits. Often used as tea, tincture, or supplement, it serves as both a nutritive tonic and a functional herbal medicine<sup>41</sup>.

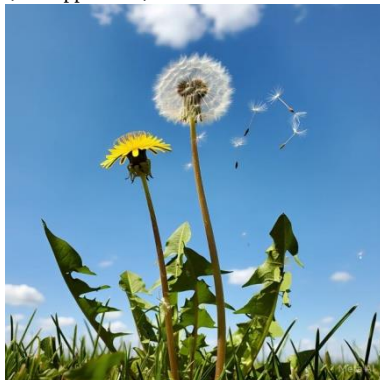


Image 8. Dandelion tea

### 9. Tulsi Tea:

Tulsi also known as *Ocimum sanctum* or *Ocimum tenuiflorum*, and Holy Basil, is a sacred medicinal plant in Ayurveda, often referred to as the "Queen of Herbs." It belongs to the *Lamiaceae* family and is native to the Indian subcontinent. It is a small shrub with: Aromatic green or purple leaves, tiny purple or white flowers, A strong, clove-like fragrance due to its essential oils. It contains various bioactive constituents like Essential oils (eugenol, camphene, cineole, and carvacrol), phenolic compounds and flavonoids, Tannins, saponins, and alkaloids. Vitamins(A, C, and K) and minerals (calcium, iron, zinc). This herb helps the body adapt to physical and emotional stress<sup>42</sup>. It reduces cortisol levels and balances neurotransmitters, improving mood and reducing anxiety also Stimulates immune function and enhances resistance to infections. Tulsi Acts as an antimicrobial agent against bacteria, viruses, and fungi. Effective in treating coughs, asthma, bronchitis, and sinusitis. It acts as an expectorant and decongestant, clearing mucus from the lungs and nasal passages. Anti-Inflammatory and Antioxidants. Helps to reduce inflammation and oxidative stress, which helps prevent chronic diseases<sup>43</sup>. Its flavonoids protect against cellular damage. Tulsi helps lower blood glucose levels and improve insulin sensitivity, aiding in diabetes management. Tulsi is known for its activity for lowering cholesterol and triglycerides levels. Reduces high blood pressure and protects against heart disease by improving lipid profile and reducing oxidative damage. Its antimicrobial and anti-inflammatory properties make it useful for acne, eczema, and wounds. Promotes scalp health and reduces hair fall. Relieves indigestion, bloating, and gas. Protects the stomach lining and helps manage ulcers. Therapeutic Uses: Widely used in Ayurvedic and Unani medicine for detoxification, rejuvenation, and enhancing longevity. Employed in herbal teas, tinctures, powders, and essential oil form. Acts as a natural remedy for fever, headaches, sore throat, and colds<sup>44</sup>.



Image 9. Tulsi tea

### 10. Green tea:

Green tea is derived from the leaves of the plant *Camellia sinensis*, the same plant used to make black and oolong teas. The key difference lies in the processing: green tea leaves are quickly steamed or pan-fired after harvesting to prevent oxidation, preserving their green color and many natural compounds. Green tea is rich in: Polyphenols, especially catechins (like epigallocatechin gallate, EGCG), Alkaloids (such as caffeine, theobromine, and theophylline), Amino acids (notably L-theanine), Vitamins (B2, C, E), Minerals (potassium, manganese, fluoride). Catechins, particularly EGCG, act as powerful antioxidants, neutralizing free radicals and reducing oxidative stress, which is linked to aging and chronic diseases.<sup>45</sup> Regular consumption of green tea has been associated with reduced LDL cholesterol, improved artery function, and lower risk of heart disease and stroke. Green tea may enhance metabolic rate and fat oxidation, especially when combined with exercise. EGCG and caffeine synergistically aid in weight loss efforts. Caffeine and L-theanine in green tea can improve brain function, increasing alertness, memory, and mood. Long-term intake may reduce the risk of neurodegenerative diseases like Alzheimer's and Parkinson's<sup>46</sup>. Studies suggest that the antioxidants in green tea may help inhibit the growth of certain cancers, including breast, prostate, and colorectal cancer, though more research is needed. Green tea may help improve insulin sensitivity and lower blood sugar levels, supporting type 2 diabetes management. Its antioxidant properties can protect the liver from damage and reduce inflammation, especially in conditions like non-alcoholic fatty liver disease. Green tea polyphenols can protect against UV damage, improve skin hydration, and reduce signs of aging and acne. Anti-inflammatory and antimicrobial properties make green tea useful in managing conditions like arthritis, periodontal disease, and even some infections. L-theanine promotes relaxation without drowsiness, potentially helping with anxiety and stress. In cancer treatments, green tea compounds are being researched for their potential to enhance the effectiveness of chemotherapy and reduce side effects<sup>47</sup>.



Image 10. Green tea

### 11. Cinnamon tea:

Cinnamon is a spice obtained from the inner bark of trees from the genus *Cinnamomum*, belonging to the Lauraceae family. It is native to South Asia and widely cultivated in Sri Lanka, India, Indonesia, and China. There are two main types: Ceylon cinnamon (*Cinnamomum verum*): Known as "true cinnamon," milder and preferred for medicinal use. Cassia cinnamon (*Cinnamomum cassia*): More common, stronger flavor, but contains more coumarin (a compound that can be toxic in high doses)<sup>49</sup>. Cinnamon contains: Essential oils (mainly cinnamaldehyde, the compound responsible for its aroma and most of its health effects), Eugenol, linalool, and camphor, Polyphenols and flavonoids, tannins and mucilage, rich in polyphenols, cinnamon helps neutralize free radicals and reduce oxidative stress, slowing aging and cellular damage. Helps lower inflammation throughout the body, which can aid in managing chronic diseases like arthritis, heart disease, and neurodegenerative disorders. Enhances insulin sensitivity and lowers blood glucose levels. Slows down carbohydrate digestion by inhibiting certain digestive enzymes, may help reduce cholesterol, triglycerides, and blood pressure, supporting cardiovascular health<sup>50</sup>. Cinnamaldehyde and eugenol give cinnamon strong antimicrobial effects. Effective against candida fungi and various bacteria, including *E. coli* and *Salmonella*. May protect neurons, improve cognitive function, and reduce the risk of Alzheimer's and Parkinson's diseases through its antioxidant and anti-inflammatory activity. Traditionally used to treat indigestion, nausea, bloating, and flatulence. Stimulates appetite and improves digestion. Can help reduce menstrual pain and regulate cycles due to its anti-inflammatory and circulation-boosting effects. Traditionally used in herbal formulas for fertility support. Cinnamon is used in Ayurveda, Traditional Chinese Medicine, and Unani systems to treat colds, digestive issues, and improve circulation. Commonly included in herbal teas, tinctures, powders, and essential oil preparations. Also used externally for pain relief in conditions like arthritis or muscle soreness (as an oil or poultice).

Caution: High doses of Cassia cinnamon can be harmful due to its coumarin content, which may affect the liver. Ceylon cinnamon is safer for long-term or therapeutic use<sup>51</sup>.



Image 11. Cinnamon tea

## 12. Clove tea:

Clove is the dried flower bud of the tree *Syzygium aromaticum*, a member of the *Myrtaceae* family. Cloves are native to the Maluku Islands (also known as the Spice Islands) in Indonesia, clove is now cultivated in several tropical regions, including India, Sri Lanka, and Madagascar. Clove buds are Aromatic, reddish-brown in color. Clove are rich in essential oils, especially eugenol, which gives cloves their strong aroma and medicinal properties. Key constituents of clove comprises: Eugenol (major active component), Tannins, Flavonoids, Terpenoids, Vitamins (C, K) and minerals (manganese, calcium, magnesium). Health Benefits and Therapeutic Potential: Clove has one of the highest antioxidant capacities among spices, protecting cells from oxidative stress and free radical damage. Eugenol and flavonoids reduce inflammation, which is beneficial for conditions like arthritis, sore throat, and inflammatory bowel diseases<sup>52</sup>. Traditionally used for toothaches and oral infections due to its numbing and antiseptic properties. Found in many toothpaste and mouthwash formulas. Effective against various bacteria, fungi, and viruses. Can help treat respiratory infections, skin infections, and digestive pathogens. Promotes enzyme secretion, improving digestion and reducing gas, bloating, and nausea. Used traditionally to treat indigestion and stomach ulcers. May improve insulin sensitivity and help regulate blood glucose levels. Eugenol exhibits hepatoprotective properties, supporting liver detoxification and reducing liver inflammation. Clove acts as an expectorant and decongestant, helping with coughs, bronchitis, and asthma. Therapeutic Uses: Widely used in Ayurvedic, Unani, and Traditional Chinese Medicine for treating colds, digestive issues, and pain. Common in essential oils, herbal teas, poultices, and infusions. Used in aromatherapy to relieve stress, fatigue, and mental exhaustion<sup>53</sup>.

Note: Clove oil is highly concentrated—should be used in diluted form, especially in topical or internal applications. Excessive intake may irritate the stomach or affect the liver.

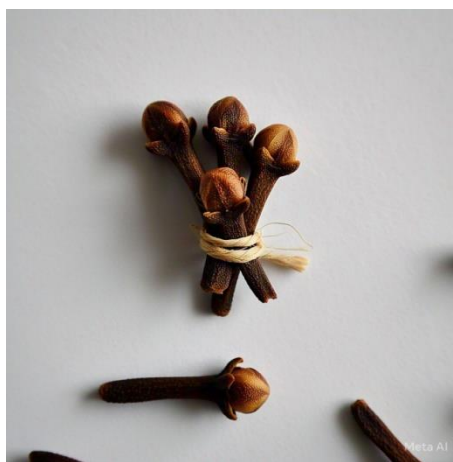


Image 12. Clove tea

## 13. Turmeric tea:

Turmeric is also known as *Curcuma longa* is a perennial herb belonging to the ginger family *Zingiberaceae*. It is native to South Asia and is widely cultivated in tropical and subtropical regions. The rhizome (underground stem) is the part most commonly used in cooking and medicine, typically dried and ground into a bright yellow-orange powder. Turmeric contains bioactive components like: Curcuminoids (active compounds, especially curcumin), Essential oils (like turmerone, atlantone, and zingiberene). Polysaccharides, proteins, fibers, vitamins (C, E, and K), and minerals (iron, potassium, manganese). Curcumin is the most studied and bioactive compound in turmeric, responsible for most of its therapeutic properties. Health Benefits and Therapeutic Potential: Curcumin inhibits inflammatory pathways (e.g., NF- $\kappa$ B), making it effective in treating chronic inflammatory conditions such as arthritis, inflammatory bowel disease, and metabolic syndrome<sup>54</sup>. Curcumin neutralizes free radicals and boosts the body's own antioxidant enzymes, helping to combat oxidative stress and cellular aging. Its anti-inflammatory effects can relieve joint pain, stiffness, and swelling in conditions like osteoarthritis and rheumatoid arthritis. Curcumin may increase brain-derived neurotrophic factor (BDNF), supporting neurogenesis and reducing risk of neurodegenerative diseases like Alzheimer's. May help improve mood and cognitive function. Helps improve endothelial function (lining of blood vessels), reduce cholesterol levels, and prevent blood clot formation, reducing the risk of heart disease. Curcumin has been shown to inhibit the growth of cancer cells, block tumor development, and enhance the efficacy of chemotherapy in certain types of cancers (e.g., breast, colon, prostate)<sup>55</sup>. It works through multiple mechanisms: apoptosis induction, angiogenesis inhibition, and modulation of cancer-related genes. Turmeric stimulates bile production, improving digestion and relieving bloating and gas. Supports liver detoxification and protects against liver damage from toxins and alcohol. Effective against a range of bacteria, fungi, and viruses, making it beneficial in wound healing and skin infections. Curcumin may improve insulin sensitivity, lower blood glucose levels, and reduce diabetes-related complications. Therapeutic Potential: Used in Ayurvedic and Traditional Chinese Medicine for centuries for treating skin conditions, respiratory issues, liver disorders, and wounds. Being studied as an adjunct therapy in modern medicine, especially for inflammatory and cancer-related conditions. Curcumin supplements are often combined with piperine (from black pepper) to enhance bioavailability by up to 2000%.<sup>56</sup>



Image 13. Turmeric tea

## CHEMICAL COMPOSITION

Herbal teas comprise a diverse range of bioactive phytochemicals, derived from different parts of medicinal plants. These compounds are majorly responsible for the flavor, aroma and therapeutic properties attributed to herbal infusions. The composition varies depending on the plant species, part used, preparation method and infusion time<sup>57</sup>. The bioactive compounds

**1. Polyphenols:** Polyphenols are the most abundant group in herbal teas and exhibits strong antioxidant activity. It includes:

- Flavonoids (e.g., apigenin in chamomile, quercetin in nettle)
- Phenolic acids (e.g., rosmarinic acid in lemon balm, chlorogenic acid in dandelion)
- Tannins (e.g., in rooibos and raspberry leaf)

Health benefits: antioxidants, anti inflammatory, cardioprotective, neuroprotective<sup>58</sup>.

### 2. Terpenes and Terpenoids:

These are derived from isoprene units and responsible for the aroma and essential oil content of many herbs. It includes:

- Menthol (in peppermint)
- Cineole (in eucalyptus)
- Gingerol and shogaol (in ginger)
- Linalool (in lavender)

Health benefits: Antimicrobial, analgesic, decongestant, calming effects<sup>59</sup>.

### 3. Alkaloids:

These nitrogen-containing compounds are potent and often pharmacologically active. While less common in herbal teas (more in true tea), some herbs like *yerba mate* and *guayusa* contain caffeine or theobromine. Health benefits: Stimulant effects, cognitive enhancement (use cautiously).

### 4. Saponins:

Amphipathic glycosides with surfactant properties. Some sources of saponins are Ginseng, licorice root, fenugreek. It performs various functions like Boost immune response, Anti-inflammatory and expectorant (loosen mucus), Lower blood cholesterol (by binding bile acids<sup>61</sup>).

### 5. Essential Oils (Volatile Oils):

These are complex mixtures of volatile terpenoids and aromatic compounds. It consists of various Key constituents like:

- Linalool (Lavender): Sedative, anxiolytic.
- Eugenol (Clove, Basil): Antiseptic, analgesic.
- Citral (Lemongrass): Antibacterial, flavoring agent.
- 1,8-Cineole (Eucalyptus): Expectorant, decongestant.

### 6. Glycosides:

Glycosides are molecules consisting of a sugar moiety (glycon) bound to a non-sugar moiety (aglycone).

- Anthraquinone glycosides (Senna, Aloe): Strong laxatives – should be used with caution.
- Steviol glycosides (Stevia): Natural sweeteners with zero calories.
- Salicin (Willow bark): Precursor of aspirin – analgesic and anti-inflammatory.

### 7. Lignans:

Phenolic compounds found in seeds and some herbs. Some sources of lignans are Flaxseed, Schisandra, Milk thistle.

- Functions: Antioxidant, phytoestrogenic activity, hormone balancing<sup>62</sup>.

### 8. Coumarins:

Aromatic compounds with benzopyrone structure. Some sources of coumarins are Sweet clover, chamomile, celery seed.

-Functions: Mild blood-thinning, anti-inflammatory, and photo-reactive<sup>63</sup>.

➤ **Factors That Influence Phytochemical Content:**

- Plant species and variety
- Harvesting season and plant age
- Drying and processing techniques
- Infusion time and water temperature
- Storage conditions (light, air, humidity)<sup>64</sup>.

**Safety and Side Effects of Herbal Teas:**

While herbal teas are often perceived as natural and safe, they can produce adverse effects, particularly when consumed in large quantities, over prolonged periods, or in sensitive populations. Safety largely depends on the type of herb, dose, duration of use, and individual factors such as age, pregnancy, allergies, and concurrent medications.

**1. General Considerations:**

Herbal teas are not regulated as strictly as pharmaceutical drugs in many countries, leading to variability in quality, purity, and dosage. Contaminants such as pesticides, heavy metals, or microbial pathogens can be present if the herbs are not properly sourced or processed. Herbal teas may interact with conventional medications, sometimes enhancing or inhibiting their effects.

**2. Herb-Drug Interactions:**

Some herbs influence cytochrome P450 enzymes and P-glycoprotein transporters, affecting drug metabolism and bioavailability. St. John's Wort: Induces CYP3A4 – reduces effectiveness of many drugs (antidepressants, oral contraceptives, antiviral). Licorice: Inhibits CYP3A4 – can increase toxicity of certain medications. Ginger & Ginkgo: May increase bleeding risk when combined with anticoagulants like warfarin or aspirin.

**3. Special Populations:**

a.) Pregnant and Lactating Women: Some herbs can stimulate uterine contractions or alter hormone levels<sup>67</sup>.

Avoid: Pennyroyal, senna, dong quai, black cohosh.

Use with caution: Peppermint, ginger, raspberry leaf (only in late pregnancy).

b.) Children: Children are more sensitive to herbs due to body size and metabolism. Always require lower doses and pediatric guidance.

c.) Elderly: Greater risk of interactions due to polypharmacy and slower metabolism. Avoid sedative herbs or those with strong cardiovascular effects unless supervised.

**4. Allergies and Hypersensitivity:**

Herbs from the Asteraceae family (e.g., chamomile, echinacea) may cause reactions in those allergic to ragweed, daisies, or marigolds. Symptoms include rash, itching, swelling, and even anaphylaxis in rare cases<sup>68</sup>.

**5. Quality Control Issues:**

Adulteration with non-declared herbs or synthetic drugs has been reported in some commercial products. Use products that are: Standardized extracts or certified organic, Tested for heavy metals, microbial contamination, and authenticity

**6. Recommendations for Safe Use:**

Start with small doses to assess tolerance. Avoid chronic use without professional supervision.

Consult healthcare providers if you: Take prescription drugs, are pregnant or breastfeeding, have chronic health conditions.

**Modern Applications of Herbal Teas**

In contemporary society, herbal teas have evolved beyond traditional remedies to become an integral part of the wellness, nutraceutical, and functional food industries. They are widely consumed not only for their pleasant taste and aroma but also for their perceived health-promoting properties.

Advances in phytochemistry, pharmacology, and food technology have expanded the scope of herbal teas in modern health applications.

**1. Functional Beverages:**

Herbal teas are marketed as functional beverages, designed to provide health benefits beyond basic nutrition.

- Digestive health: Teas containing peppermint, fennel, and ginger are used to relieve bloating, nausea, and indigestion.
- Stress relief & sleep support: Chamomile, valerian root, lemon balm, and lavender teas are promoted as natural anxiolytics and mild sedatives.
- Immune enhancement: Herbal blends with echinacea, elderberry, and licorice are used for seasonal immune support.
- Detox and cleansing: Dandelion, nettle, and milk thistle teas are included in detox regimens for liver and kidney health<sup>69</sup>.

**2. Nutraceutical & Therapeutic Use:**

Modern research supports the incorporation of herbal teas as nutraceuticals—products that provide medical or health benefits, including the prevention and treatment of disease.

- Antioxidant-rich teas (e.g., rooibos, hibiscus, moringa) are promoted for reducing oxidative stress and supporting cardiovascular health.
- Anti-diabetic teas (e.g., cinnamon, fenugreek, gymnema) help regulate blood glucose levels.
- Weight management teas often include green tea extract, yerba mate, and garcinia for their thermogenic effects<sup>70</sup>.

### 3. Herbal Teas in Integrative Medicine:

Many integrative and complementary medicine practitioners incorporate herbal teas into treatment protocols for chronic conditions.

- Cancer care support: Mild herbal infusions (e.g., ginger or chamomile) are used to manage nausea, anxiety, and fatigue during chemotherapy.
- Women's health: Raspberry leaf tea is commonly used to tone the uterus during late pregnancy; sage and black cohosh teas are used to manage menopausal symptoms.
- Respiratory health: Thyme, licorice, and mullein teas are recommended for cough, sore throat, and bronchial conditions<sup>71</sup>.

### 4. Personalization & Wellness Trends:

Modern consumers are seeking customized herbal blends based on individual health goals, genetic predispositions, and even gut microbiome analysis. Tea subscription services offer personalized herbal blends. AI-driven wellness apps suggest herbal teas based on stress levels, sleep patterns, or dietary habits. Ayurvedic and TCM-based personalization tailors tea consumption according to dosha or qi imbalances<sup>72</sup>.

**5. Cosmetic and Dermatological Use:** Herbal teas are increasingly used for internal beauty or “beauty from within” products.

- Skin health: Teas with calendula, rose, and burdock are claimed to improve skin tone and reduce acne.
- Hair health: Nettle and horsetail teas are marketed to support hair strength and growth.
- Anti-aging blends: Rooibos and hibiscus are promoted for their antioxidant and anti-glycation properties<sup>73</sup>.

### 6. Food and Beverage Industry Innovations:

Ready-to-drink (RTD) herbal tea beverages are now a major market category. Cold-brewed herbal teas are gaining popularity for convenience and smoother taste profiles. Herbal tea-infused culinary products: Herbal infusions are now used in smoothies, desserts, cocktails, and cooking sauces.

### 7. Sustainability and Ethical Sourcing:

Modern herbal tea companies emphasize: Organic cultivation, Fair trade practices, Eco-friendly packaging. This aligns with increasing consumer demand for ethical and sustainable products.

Despite the growing popularity and traditional use of herbal teas, several research gaps persist, limiting their full integration into evidence-based health care. Addressing these gaps through systematic research can enhance the safety, efficacy, and standardization of herbal tea products<sup>73</sup>.

### Research gap and future direction:

#### 1. Lack of Standardization and Quality Control:

Gap: Herbal teas often vary in phytochemical content due to differences in plant species, growing conditions, harvest time, and preparation methods.

Future Direction: Development of standardized protocols for cultivation, processing, and infusion preparation. Use of marker compounds and chemical fingerprinting (e.g., HPLC, NMR) for quality assurance<sup>74</sup>.

#### 2. Limited Clinical Evidence

Gap: Most claims regarding the health benefits of herbal teas are based on in vitro or animal studies, with few high-quality human clinical trials.

Future Direction: Conduct randomized controlled trials (RCTs) to assess the efficacy and safety of specific herbal teas for defined health outcomes (e.g., stress reduction, glycemic control, blood pressure regulation).<sup>75</sup>

#### 3. Herb-Herb and Herb-Drug Interactions

Gap: Interactions between herbal teas and pharmaceuticals are understudied, posing risks in polypharmacy contexts.

Future Direction: Perform pharmacokinetic and pharmacodynamic studies to explore potential synergistic or antagonistic interactions with common medications.<sup>76</sup>

#### 4. Dosage and Consumption Guidelines:

Gap: There is a lack of evidence-based guidelines on safe dosage, frequency, and duration of use for most herbal teas.

Future Direction: Define therapeutic windows and establish Recommended Daily Intakes (RDIs) where applicable, especially for vulnerable populations like pregnant women, children, and the elderly.<sup>77</sup>

#### 5. Toxicological Assessment and Long-Term Safety:

Gap: Long-term toxicity studies are scarce, particularly for chronic or high-dose consumption of herbal teas.

Future Direction: Conduct sub-chronic and chronic toxicity studies and assess potential carcinogenicity, genotoxicity, and reproductive toxicity of frequently consumed herbs.

#### 6. Omics-Based Research Approaches:

Gap: The molecular mechanisms of action for many herbal tea phytochemicals remain unclear.

Future Direction: Utilize metabolomics, transcriptomics, and proteomics to understand the bioactivity pathways and individual variability in response to

herbal tea consumption.

### 7. Sustainable and Ethical Sourcing:

Gap: Ethical and environmental implications of large-scale herb harvesting are not well addressed.

Future Direction: Promote research into sustainable agriculture practices, climate-resilient herb varieties, and fair trade models to support ethical sourcing.

### 8. Consumer Behavior and Public Health Impact:

Gap: There is limited research on consumer perceptions, usage patterns, and the role of herbal teas in preventive health strategies.

Future Direction: Conduct behavioral and epidemiological studies to evaluate how herbal tea consumption influences population health over time<sup>79</sup>.

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## Conclusion

Herbal teas have long been valued for their cultural significance, sensory appeal, and diverse therapeutic properties. Rich in bioactive phytochemicals such as flavonoids, phenolic acids, terpenes, and essential oils, they offer a wide range of health benefits, including antioxidant, anti-inflammatory, digestive, and immune-supportive effects. Modern applications extend into functional beverages, integrative medicine, and personalized wellness trends, reflecting their growing relevance in contemporary health and nutrition. However, despite their widespread use, significant research gaps remain, particularly in the areas of standardization, clinical validation, long-term safety, and herb-drug interactions. Moving forward, multidisciplinary studies involving pharmacology, toxicology, clinical trials, and omics-based approaches are essential to unlock the full potential of herbal teas. Establishing evidence-based guidelines and promoting sustainable sourcing will be critical to ensure both consumer safety and environmental responsibility.

In conclusion, herbal teas represent a promising avenue for natural health support, but their integration into evidence-based practice requires a stronger scientific foundation and a more holistic understanding of their benefits and limitation.

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