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THE ROLE OF HERBAL TEA IN FUNCTIONAL FOODS: A COMPREHENSIVE REVIEW OF HEALTH BENEFITS AND APPLICATIONS

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ABSTRACT: Herbal tea has emerged as a key component in the development of functional foods, offering a wide range of health benefits and applications. This comprehensive review explores the role of herbal teas in promoting health and wellness, focusing on their rich content of bioactive compounds such as polyphenols, flavonoids, and antioxidants. These compounds contribute to various health-promoting properties, including anti-inflammatory, antimicrobial, and immune-boosting effects. The incorporation of herbal teas in functional foods enhances their nutritional value and provides therapeutic potential in managing chronic conditions like cardiovascular disease, diabetes, and digestive disorders. Additionally, herbal teas are applied in diverse food products, such as beverages, baked goods, and dietary supplements, where their flavor, aroma, and health-promoting properties are utilized. This review highlights the growing interest in herbal teas as functional ingredients and their promising role in improving overall well-being through dietary innovation. The review also addresses key considerations such as safety measures, quality control, and regulatory frameworks to ensure the effective use of herbal teas in functional food products. Additionally, it highlights future opportunities for innovation, including the development of unique herbal tea blends and their combined impact on promoting health and wellness.

INTRODUCTION: The famous Cape flora includes nearly 9000 species of seed plants, with over 60% being native to the region. Numerous species are utilized in traditional medicine while some have already been transformed into commercial herbal teas and functional foods. Some examples are rooibos tea (*Aspalathus linearis*), honey bush tea (*Cyclopia genistoides*), buchu *Agathosma betulina* and *A. crenata*), hoodia (*Hoodia gordonii*), sutherlandia (*Lessertia frutescens*), and sceletium (*Mesembryanthemum tortuosum*) [1]. Herbal teas are made with herbal ingredients that are not *Camellia sinensis* (L.) and are brewed in water to create infusions/decoctions[2].

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Phytomedicine has been used for centuries in human history and continues to be popular. Advantages linked to herbal teas, or medicinal plants, consist of aiding in the prevention and treatment of specific inflammatory conditions in the urinary tract (like cystitis, urethritis), respiratory system, and gastrointestinal tract. Recently, there has been a rise in the popularity of herbal and natural medicinal products in developed countries due to the perception that they may be more potent and have fewer side effects than synthetic pharmaceuticals in the prevention and treatment of diseases [3].

Herbal teas have been utilized for their therapeutic properties in traditional Chinese, Indian, and other indigenous medical practices for a long time. Chamomile and peppermint are key ingredients in many popular herbal teas, known for their anti-inflammatory and anti-mutagenic properties in chamomile, and the calming effects of peppermint

oil on the digestive system. Nevertheless, more studies on the immediate and long-lasting advantages of drinking herbal tea are necessary, particularly looking into the impact of manufacturing processes such as tea fermentation on flavor and biological effects [4]. Kombucha is made from black tea and green tea that has been fermented without alcohol and sweetened with sugar. Although kombucha is typically made with black and green tea, new flavors can be made using different ingredients like oolong tea, jasmine tea, lemon balm tea, mulberry tea, peppermint, wheatgrass juice, coffee, coffee berry extract, traditional Tunisian plants, fresh, acid, and reconstituted sweet whey, coconut water, pear juice, banana peel, nettle leaves, oak, Coca-Cola, wine, vinegar, Jerusalem artichoke, Echinacea, milk, and more [5].

Every type of *Moringa sp.* plant. Moringaceae are indigenous to the sub-Himalayan regions and have been brought to numerous countries with a moderate climate. The most familiar and commonly found species is *Moringa oleifera*. *M. pterygosperma* is being referred to. The height of the tree varies between 5 and 10 meters and occasionally reaching a height of 15 meters. It is commonly referred to as a versatile tree or "miracle tree," for its various uses as a food source, in medicine, as a source of cosmetic oil, forage, and water coagulant [6].

The term "functional foods" originated in Japan during the 1980s, Functional foods refer to either natural or processed foods that, when consumed regularly as part of a varied diet and in effective amounts, offer health benefits beyond basic nutrition. Importantly, before health claims can be made for such foods, rigorous studies, including randomized, double-blind, placebo-controlled clinical trials, are essential to confirm their effectiveness. This more precise definition emphasizes that without solid clinical evidence, including trials on safety and functionality, no food whether fresh, processed, or unprocessed can truly be labeled as functional [7]. A significant innovation in functional food has led to the development of a wide variety of health-boosting bioactive components, including probiotics, prebiotics, phytochemicals, natural antioxidants, bioactive peptides, and herbal extracts. These bioactive substances can occur naturally in food or be added through fortification, making the food functional for health purposes [8].

Epigallocatechin-3-gallate (EGCG), the main polyphenol found in green tea, is known for its potent antioxidant and free radical scavenging abilities. It consists of an ester formed between gallic acid and epigallocatechin, with two triphenolic groups defining its structure. Curcumin (CUR), a polyphenol derived from *Curcuma longa* (Zingiberaceae), is recognized for its potential anti-inflammatory, antioxidant, and cancer-preventive properties. Quercetin (QR), a flavonol present in foods like berries and tea, exhibits antioxidant effects due to three key structural features: the 4-oxo group paired with a 2,3-alkene, hydroxyl groups at the 3 and 5 positions, and additional hydroxyl groups on the B ring [9].

Classification of Herbal Tea: Herbal tea is an integral part of tea culture, offering both flavor and health benefits. Non-fermented teas, like green tea, are processed by heating and drying the leaves soon after harvesting to preserve their natural qualities. In contrast, semi-fermented teas like oolong and fully fermented teas like black tea undergo oxidation, during which catechins transform into theaflavins and thearubigins. These compounds influence the tea's color and flavor, with theaflavins contributing to its orange-red hue [10]. Chinese herbal tea originated during the Tang Dynasty and gained popularity in subsequent dynasties, with different types offering various health benefits. Teas for detoxification and clearing heat are ideal for spring, summer, and autumn, and include ingredients like honeysuckle and chrysanthemum. Jiegan tea, beneficial year-round for wind-cold, fever, and deficiencies, contains radix isatidis and dandelion. Other teas address autumn dryness, promoting hydration and lung health, while some are suited for heat and moisture elimination, especially in summer [11].

Benjamin Ginsberg, a merchant from Clanwilliam, was the first person to recognize the profit possibilities of rooibos as an herbal tea in 1904. Additionally, tea can be produced using small amounts of the closely related species A. pendula Dahlg. as well as various wild types of A. linearis. The wild-harvested grey, black, and red-brown

types were collected, processed, and distributed to the Rooibos Tea Control Board until 1966, when the marketing of the grey and black types was ceased because of their low quality. The black infusion was not commonly red-brown and the flavor was also not usual [12].

C. paliurus leaves, traditionally used in China to make herbal teas, are known for their pleasant flavor and have been approved by the US FDA. The tea's flavor comes from both its aroma, produced by volatile organic compounds (VOCs), and its taste, derived from non-VOCs. Typically, the leaves are soaked in hot water to brew the tea, and the dried leaves sold in the market often include stems. However, many prefer to remove the stems due to their irregular appearance [13]. In India, the leaves of several mangrove species like Ceriops decandra and Bruguiera cylindrica can be used as tea substitutes. Similarly, European researchers have crafted herbal teas using plants like Sorbus aucuparia and Rubus idaeus, known for their aromatic and healing properties. Herbal teas, common across Asia, are brewed from various plant leaves or flowers. One example is Gymnema sylvestre from India, which is valued for its medicinal benefits [14].

Health Benefits: Green, black, and white teas are rich in bioactive compounds like catechins, theaflavins, and L-theanine, which provide various health benefits, including anti-inflammatory, anti-diabetic, and anti-cancer properties. South African herbal teas like rooibos, honeybush, and bush tea also offer medicinal qualities, acting as antioxidants and supporting the management of chronic conditions such as type 2 diabetes, heart disease, obesity, high blood pressure, and dementia [15]. Tea contains beneficial compounds like polyphenols, flavonoids, and antioxidants that may support heart health, reduce the risk of chronic diseases, improve cognitive function, aid in weight management, boost immunity, and help with stress relief. However, the benefits vary by tea type, consumption levels, and individual factors. While tea can contribute to health, it should be part of a balanced diet and not relied on as a sole health remedy [16]. Further details are given on the **Table 1.**

TABLE 1: HEALTH BENEFITS OF DIFFERENT HERBS USED IN TEA

Herbs Used	Health Benefits	Reference
Chamomile tea (*Matricaria recutita* L.)	Chamomile provides several health benefits, including treating peptic ulcers by steeping it in boiling water. It can help with viral diarrhea, eliminate stomach and bowel parasites, and promote milk production in nursing mothers. Additionally, chamomile may aid in the elimination of bladder stones and help manage urinary incontinence. Chewing chamomile can assist in healing mouth wounds, while drinking chamomile tea before bedtime is recommended for a restful night's sleep. It may also be beneficial for issues like anemia, anorexia, and menstrual cramps. It is rich in flavonoids, specifically apigenin, quercetin, patuletin, and luteolin, which offer various health benefits. These polyphenolic compounds possess antioxidant, anti-inflammatory, and antispasmodic properties. Apigenin is particularly noted for its potential to induce apoptosis in cancer cells and its anxiolytic effects. Meanwhile, quercetin and luteolin enhance chamomile's ability to combat oxidative stress and inflammation, making the tea beneficial for related health issues.	17, 18
Peppermint tea (*Mentha piperita* L.)	Peppermint has been shown to soothe the smooth muscles of the gastrointestinal tract by reducing calcium entry in the colon and small intestine. It is considered a safe and effective short-term treatment for irritable bowel syndrome (IBS), primarily by inhibiting calcium channel activity in the intestine. Moreover, peppermint may also influence histamine, serotonin, and cholinergic receptors in the digestive system, contributing to its antiemetic effects. It is enriched with menthol and flavonoids, may enhance its bioactivity, boosting antioxidant and anti-inflammatory effects through sensory receptor modulation. Menthol also relaxes smooth muscles in the digestive system, alleviating symptoms such as cramps and discomfort. Additionally, it influences neurotransmitter activity in the central nervous system, supporting neural communication and overall brain function.	19, 20
Ginger tea (*Zingiber officinale)*	Ginger has antimicrobial properties that can help treat bacterial infections and is used in Traditional Chinese Medicine to address colic and atonic dyspepsia while acting as a stimulant. Additionally, ginger extract is a strong antioxidant that combats oxidative stress. Studies show that compounds like gingerols and shogaols provide neuroprotective benefits, including pain relief and improved memory and	21, 22

	learning, particularly in aging individuals. According to various research studies, it is possible to conclude that ginger has the potential to help regulate obesity by boosting thermogenesis and lipolysis while also inhibiting lipogenesis, managing intestinal absorption, and reducing appetite. Therefore, incorporating ginger into one's diet may be a beneficial additional treatment to help fight the progression of obesity and its associated complications.	
Rooibos tea (*Aspalathus linearis*)	Health parameters, including liver and kidney functions, iron levels, inflammatory markers (such as CRP), and physiological measures (like blood pressure and resting heart rate), were evaluated in diagnosed and at-risk individuals, as well as healthy populations. The assessment also targeted those with chronic conditions, focusing on factors like IgE levels, oxidative status, urinary and plasma biomarkers, bone markers, melatonin, and psychological well-being. Rooibos tea is rich in phenolic compounds, particularly flavonoids, tyrosols, and phenolic acids, with aspalathin and nothofagin being unique dihydrochalcones predominantly found in this tea. Key flavonoids include isoorientin, orientin, quercetin-3-O-robinobioside, and phenyl pyruvic acid glucoside. It also contains significant levels of phenolic acids such as 4-hydroxybenzoic acid, protocatechuic acid, and vanillic acid, which contribute to its distinct flavor and possess strong antioxidant properties. Drinking Rooibos tea positively impacts blood lipid profiles, leading to a notable reduction in serum LDL-cholesterol and triglyceride levels, while also increasing HDL-cholesterol. Additionally, Rooibos may indirectly protect heart health through its calming effects, which have been recognized for some time.	23, 24, 25
Hibiscus tea(*Hibiscus sabdariffa*)	Decoction, infusion, or maceration of *Hibiscus sabdariffa* (HS) leaves and calyxes are known for their various health benefits, including antimicrobial, antioxidant, diuretic, and anti-inflammatory properties. A survey at the University of Ibadan in Nigeria with 1,238 participants revealed that 96.9% consumed HS beverages primarily for relaxation (29.2%), blood pressure regulation (24.3%), and weight loss (10.7%). The health effects of HS are largely attributed to its bioactive compounds, such as phenolic acids, flavonoids, and anthocyanins, which are effectively digested and transformed during gut fermentation. *Hibiscus sabdariffa* is rich in anthocyanins and phenolic compounds, primarily featuring Delphinidin-3-sambubioside and Cyanidin-3-sambubioside. It contains significant amounts of citric and malic acids, which play a crucial role in reducing metal poisoning. Additionally, ascorbic acid is present at 140.13 mg/100g, known for its antioxidative benefits. The main flavonoids found in Hibiscus include quercetin, luteolin, and gossypetin, along with various glycosides. Fiber primarily consists of 85.6% insoluble fiber and 14.4% soluble fiber, contributing to its significant presence in flowers, with a total of 0.66 g/L of dietary fiber in the drink. HS calyces are rich in carbohydrates (68.7%), crude fiber (14.6%), and ash content (12.2%), along with protein (7.51%) and fat (0.46%). Additionally, studies have identified various chemical compounds in dried calyces, including organic acids (like citric and ascorbic acid), phytosterols, polyphenols, anthocyanins, and other water-soluble antioxidants.	26, 27, 28
Lemon Balm tea (*Melissa officinalis*)	*Melissa officinalis L* essential oils show significant antioxidant potential, particularly in lipid-containing foods, thanks to their high phenolic compound content. These oils exhibit antioxidant activity comparable to synthetic options like BHA and BHT, largely attributed to phenolic compounds such as citronellal and neral. Additionally, lemon balm leaves contain 0.5% flavonoids by dry weight, including quercitrin, ramnocitrin, and several luteolin derivatives, such as luteolin 7-o-β-D-glucuronopyranoside. Adding lemon balm to drinks or yogurt can boost wellness and cognitive function. A study found that consuming a beverage containing 0.3 g of lemon balm leaf extract (with over 6% rosmarinic acid) and a natural sweetener reduced anxiety and improved memory for up to three hours. Additionally, patients with chronic stable angina experienced enhancements in ejection fraction, nitric oxide levels, and lactate dehydrogenase levels, along with reductions in systolic and diastolic blood pressure. Lemon balm is frequently used in traditional Asian medicine to address mental health issues such as depression, anxiety, insomnia, and stress-related symptoms. Clinical research has demonstrated its benefits for the central nervous system, showing properties that alleviate anxiety, enhance mood, improve cognitive performance, and protect neurofunction. Its	29, 30, 31

	effects extend to better memory function and overall mental well-being.	
Echinacea tea (*Echinacea purpurea* L.)	*Echinacea purpurea (L.)* primarily contains caffeic acid, while chicoric acid is the main phenolic component found in both the root and petiole of this species. These antioxidant and antibacterial compounds can enhance immune system functionality. Additionally, the discovery of echinacoside, a derivative of caffeic acid present in the flower at a concentration of 1.45%, highlights its potential benefits for nervous and heart health. Echinacea supplements may help alleviate symptoms of acute respiratory infections and the common cold if taken at the onset of symptoms, though there is no evidence regarding their effectiveness against COVID-19. Some naturopathic physicians advocate for Echinacea to enhance immune function, citing its immune-modulating properties, such as activating macrophages and influencing cytokine expression. Echinacea is well-known for its immune-boosting properties, supported by studies indicating its enhancement of both innate and specific immunity. It also exhibits anti-inflammatory, antiviral, and antimicrobial effects, reinforcing its traditional medicinal use. For preventive purposes, standardized Echinacea extracts containing specific phytochemicals like PolinaceaTM polysaccharide and echinacoside are recommended as a self-help approach to fend off the common cold and improve the immune response to vaccinations.	32, 33, 34
Dandelion tea (*Taraxacum officinale* L.)	Consuming dandelion leaves during pregnancy may help prevent preeclampsia, a condition marked by high blood pressure and swelling, while their nutrient content can also reduce the risk of anemia. Additionally, dandelion has the potential to be a nutraceutical, offering both nutritional benefits and healing properties. It acts as a dietary antioxidant, which may help mitigate oxidative stress-related conditions such as cardiovascular diseases, cancer, and inflammation. The entire dandelion plant, including its flowers, leaves, stems, and roots, is edible and rich in bioactive compounds. Various secondary metabolites, such as sesquiterpenes, triterpenes, phenolic compounds, and phytosterols, have been extracted from it. Dandelion has also been found to inhibit digestive enzymes like pancreatic lipase, α-glucosidase, angiotensin-converting enzyme, and xanthine oxidase. Dandelion is known for its ability to support kidney health, aid digestion, and alleviate acid reflux. It acts as a gentle laxative, helps cleanse the blood, and is effective for managing arthritis, rheumatism, eczema, and other skin conditions. Additionally, its antimicrobial properties make it useful in preventing dental cavities and treating endodontic infections.	35, 36, 37
Sage tea (*Salvia officinalis* L.)	Research has demonstrated that *S. officinalis* offers various biological benefits, including cancer prevention, inflammation reduction, antioxidant protection, and antibacterial properties. It may also help improve memory, lower blood sugar, and reduce cholesterol levels. However, it's recommended to use clary sage only after 37 weeks of pregnancy, as it may stimulate labor if the body is ready by triggering the release of oxytocin. It is advised to utilize clary sage during labor to assist in strengthening contractions and aiding in the dilation of the cervix by stimulating the horizontal uterine muscles, helping the baby descend into the pelvis and birth canal.	38, 39
Turmeric tea (*Curcuma longa*)	Curcumin, a natural compound gaining attention for its medicinal potential, is known for its diverse biological effects, including antibacterial, anti-inflammatory, antimicrobial, and anti-cancer properties. Recognized for its strong antioxidant and hypoglycemic abilities, it also serves as a colorant, antiseptic, and wound healer. This compound is responsible for the vibrant yellow-orange hue in Indian curries. Turmeric has anti-inflammatory properties that can benefit mucous membranes and may help with conditions like colitis, Crohn's disease, diarrhea, and recovery after salmonella. However, its use during pregnancy is discouraged due to the potential for increasing bleeding risks and stimulating the uterus. Saponins in turmeric may contribute to the plant's antifungal, hypoglycemic, anti-inflammatory, and cytotoxic properties. Curcumin, turmeric's main active compound, plays a key role in its anti-inflammatory effects. Additionally, saponins may help regulate blood sugar by improving insulin sensitivity, raising plasma insulin levels, and promoting insulin secretion from the pancreas.	40, 41, 42
Oolong tea (*Camellia sinensis*)	Initial studies suggest that the caffeine in oolong tea may promote fat breakdown by targeting lipid droplets rather than hormone-sensitive lipase (HSL), indicating its potential as a treatment for fatty liver and obesity related to high-fat diets. Additionally, oolong tea contains GABA (gamma-aminobutyric acid), a naturally	43, 44

occurring amino acid in Camellia sinensis, which may help reduce stress and anxiety, making it a possible natural aid for better sleep. Food allergies are classified as immediate hypersensitivity reactions (type I), where mast cells release chemical mediators. Research has shown that tea catechins can effectively inhibit histamine release from these mast cells when activated by specific allergens and IgE. Additionally, the buildup of reactive oxygen species (ROS) and reactive nitrogen species (RNS) in tissues can contribute to oxidative stress, which is linked to various health issues like carcinogenesis, arthritis, and metabolic syndrome. Consuming oolong tea has been found to improve plasma antioxidant defenses in healthy individuals.

Nutritional and Bioactive Compounds: Phenolic compounds, widespread in plant parts, are secondary metabolites with an aromatic ring and varying hydroxylation levels. Derived from biosynthetic pathways like the pentose phosphate, shikimate, and phenylpropanoid pathways, they are synthesized from precursors such as pyruvate, acetate, and aromatic amino acids. Found in herbal drinks, these compounds include phenolic acids, coumarins, flavonoids, tannins, lignans, and lignins. Flavonoids are further divided into subclasses like flavones, flavonols, flavanones, anthocyanidins, and isoflavones, with key compounds such as quercetin, luteolin, catechin, and genistein commonly found in human diets [45].

Tea contains essential minerals like copper, manganese, iron, zinc, magnesium, calcium, sodium, and potassium, which are vital for various biological functions. These minerals must be consumed in balanced amounts, as deficiencies or excesses can lead to disorders or increase the risk of diseases like osteoporosis, hypertension, and diabetes. Tea's health benefits primarily stem from its rich antioxidants, such as catechins and tannins. During tea fermentation, especially in oolong and black teas, catechins are partially or fully converted into polyphenols like theaflavins and thearubigins, which contribute to its antioxidant properties [46].

Green tea contains around 90% polyphenols, 7% amino acids, and small amounts of caffeine, with catechins being its key beneficial compounds. It also contains flavonols like quercetin, kaempferol, and myricetin. The concentration of theanine, caffeine, and catechins in green tea varies with leaf age and harvest timing. Oolong tea, which is partially oxidized and shares similarities with both black and green tea, also has a mix of polyphenols typical of both types [47]. *Moringa oleifera* dried leaves contain all essential amino acids, with over half of their amino acid content contributing to high protein quality. Factors like weather, fertilization, tree age, and leaf maturity can influence the amino acid concentration. Around 100 grams of dehydrated leaves can fulfill a significant portion of daily amino acid requirements, including histidine, methionine, and tryptophan, making it a valuable source of protein and essential nutrients [48].

CONCLUSION: Herbal tea is important in the advancement of functional foods, providing therapeutic and nutritional advantages that meet the increasing consumer desire for natural health products. These teas, made from different plants, possess a wide range of bioactive substances like polyphenols, flavonoids, antioxidants, and essential oils, resulting in numerous health benefits. Frequent intake of herbal teas is linked to many physical advantages such as better digestion, increased immune system function, reduction of inflammation, stress reduction, and support for heart health. Herbal teas can be successfully incorporated into a wide range of food and drink recipes, including smoothies, soups, baked goods, sauces, dressings, and frozen desserts, as functional ingredients. These formulas bring distinctive tastes and organic hues to the food while also enhancing products with health benefits, all without using artificial ingredients. Their ability to adapt and change allows for the development of creative and user-friendly food choices that serve those looking for both health and well-being. Moreover, incorporating herbal teas into functional foods supports sustainability trends, since a majority of these herbs are cultivated using organic methods, rendering them an environmentally conscious option. The increasing research on the health advantages of herbal teas is expected to increase their importance in functional foods, promoting both preventive healthcare and overall well-being.

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REFERENCES:

1. Van Wyk, BE & Gorelik B: The history and ethnobotany of Cape herbal teas. South African Journal of Botany 2017; 110: 18-38.
2. Fu Y, Yang JC, Cunningham AB, Towns, AM, Zhang Y, Yang HY & Yang XF: A billion cups: The diversity, traditional uses, safety issues and potential of Chinese herbal teas. Journal of Ethnopharmacology 2018; 222: 217-228.
3. Martín-Domingo MC, Pla A, Hernánde AF, Olmedo P, Navas-Acien A, Lozano-Paniagua D & Gil F: Determination of metalloid, metallic and mineral elements in herbal teas. Risk assessment for the consumers. Journal of Food Composition and Analysis 2017; 60: 81-89.
4. Poswal FS, Russell G, Mackonochie M, MacLennan E, Adukwu EC & Rolfe V: Herbal teas and their health benefits: a scoping review. Plant Foods for Human Nutrition 2019; 74: 266-276.
5. Zhang J, Van Mullem J, Dias DR & Schwan RF: The chemistry and sensory characteristics of new herbal tea-based kombuchas. Journal of Food Science 2021; 86(3): 740-748.
6. Lalas S, Athanasiadis V, Karageorgou I, Batra G, Nanos GD & Makris DP: Nutritional characterization of leaves and herbal tea of *Moringa oleifera* cultivated in Greece. Journal of Herbs, Spices & Medicinal Plants 2017; 23(4): 320-333.
7. Granato D, Barba FJ, Bursać Kovačević D, Lorenzo JM, Cruz AG & Putnik P: Functional foods: Product development, technological trends, efficacy testing, and safety. Annual Review of Food Science and Technology 2020; 11(1): 93-118.
8. Nataraj BH, Ali SA, Behare PV & Yadav H: Postbiotics-parabiotics: The new horizons in microbial biotherapy and functional foods. Microbial cell factories 2020; 19: 1-22.
9. Konstantinidi M & Koutelidakis AE: Functional foods and bioactive compounds: A review of its possible role on weight management and obesity's metabolic consequences. Medicines 2019; 6(3): 94.
10. Liu Y, Guo C, Zang E, Shi R, Liu Q, Zhang M & Li M: Review on herbal tea as a functional food: classification, active compounds, biological activity, and industrial status. Journal of Future Foods 2023; 3(3): 206-219.
11. Lin X, Li H & Huang B: Chemical constituents, health-promoting effects, potential risks and future prospective of Chinese herbal tea: A review. Journal of Functional Foods 2024; 121: 106438.
12. Joubert E & de Beer D: Rooibos (*Aspalathus linearis*) beyond the farm gate: From herbal tea to potential phytopharmaceutical. South African Journal of Botany 2011; 77(4): 869–886.
13. Liang L, Liu Y, Liu Y, Gan S, Mao X & Wang Y: Untargeted metabolomics analysis based on HS-SPME-GC-MS and UPLC-Q-TOF/MS reveals the contribution of stem to the flavor of *Cyclocarya paliurus* herbal extract. Lwt 2022; 167: 113819.
14. Huda HSA, Majid NBA, Chen Y, Adnan M, Ashraf SA, Roszko M and Sasidharan S: Exploring the ancient roots and modern global brews of tea and herbal beverages: A comprehensive review of origins, types, health benefits, market dynamics, and future trends. Food Science & Nutrition.
15. Malongane F, McGAW LJ & Mudau FN: The synergistic potential of various teas, herbs and therapeutic drugs in health improvement: a review. Journal of the Science of Food and Agriculture 2017; 97(14): 4679-4689.
16. Hosen MS & Madhu B: Health Benefits of Herbal Tea: A Review 2023.
17. Chauhan ES & Jaya A: Chamomile an ancient aromatic plant-A review. Journal of Ayurveda Medical Sciences 2017; 2(4).
18. Wang X & Zhang, L: Chamomile Tea: An In-Depth Analysis of Its Bioactive Compounds, Therapeutic Applications, and Historical Usage. Medicinal Plant Research 2024; 14.
19. Loolaie M, Moasefi N, Rasouli H & Adibi H: Peppermint and its functionality: A review. Arch Clin Microbiol 2017; 8(4): 54.
20. Wang Y & Xu G: Peppermint Tea: Evaluating Its Digestive Benefits, Neuroprotective Effects, and Role in Modern Herbal Medicine. Medicinal Plant Research 2024; 14.
21. Shahrajabian MH, Sun W & Cheng Q: Clinical aspects and health benefits of ginger (*Zingiber officinale*) in both traditional Chinese medicine and modern industry. Acta Agriculturae Scandinavica, Section b—Soil & Plant Science 2019; 69(6): 546-556.
22. Ma RH, Ni ZJ, Zhu YY, Thakur K, Zhang F, Zhang YY, & Wei ZJ: A recent update on the multifaceted health benefits associated with ginger and its bioactive components. Food & Function 2021; 12(2): 519-542.
23. Afrifa D, Engelbrecht L, Eijnde BOT & Terblanche E: The health benefits of rooibos tea in humans (*Aspalathus linearis*)-a scoping review. Journal of Public Health in Africa 2023; 14(12).
24. Nyu A: Rooibos Tea: A systematic review of its antioxidant properties, health implications, and economic impact in the global market. Journal of Tea Science Research 2024; 14.
25. Smith C & Swart A: *Aspalathus linearis* (Rooibos)–a functional food targeting cardiovascular disease. Food & Function 2018; 9(10): 5041-5058.
26. Montalvo-González E, Villagrán Z, González-Torres S, Iñiguez-Muñoz LE, Isiordia-Espinoza MA, Ruvalcaba-Gómez JM & Anaya-Esparza LM: Physiological effects and human health benefits of Hibiscus sabdariffa: a review of clinical trials. Pharmaceuticals 2022; 15(4): 464.
27. Amos A & Khiatah B: Mechanisms of action of nutritionally rich *Hibiscus sabdariffa's* therapeutic uses in major common chronic diseases: a literature review. Journal of the American Nutrition Association 2022; 41(1): 116-124.
28. Riaz G & Chopra R: A review on phytochemistry and therapeutic uses of Hibiscus sabdariffa L. Biomedicine & Pharmacotherapy 2018; 102: 575-586.
29. Ullah MA & Hassan A: Medicinal benefits of lemon balm (*Melissa officinalis*) for human health. World Journal of Chemical and Pharmaceutical Sciences 2022; 1(1): 028-033.
30. Świąder K, Startek K & Wijaya CH: The therapeutic properties of Lemon balm (*Melissa officinalis* L.): Reviewing novel findings and medical indications. Journal of Applied Botany & Food Quality 2019; 92.
31. Ghazizadeh J, Sadigh-Eteghad S, Marx W, Fakhari A, Hamedeyazdan S, Torbati M & Mirghafourvand M: The effects of lemon balm (*Melissa officinalis* L.) on depression and anxiety in clinical trials: A systematic review and meta-analysis. Phytotherapy Research 2021; 35(12): 6690-6705.

32. Burlou-Nagy C, Bănică F, Jurca T, Vicaș LG, Marian E, Muresan ME & Pallag A: *Echinacea purpurea* (L.) Moench: Biological and pharmacological properties. A review. Plants 2022; 11(9): 1244.
33. Aucoin M, Cooley K, Saunders PR, Carè J, Anheyer D, Medina DN & Garber A: The effect of Echinacea spp. on the prevention or treatment of COVID-19 and other respiratory tract infections in humans: A rapid review. Advances in Integrative Medicine 2020; 7(4): 203.
34. Catanzaro M, Corsini E, Rosini M, Racchi M & Lanni C: Immunomodulators inspired by nature: a review on curcumin and echinacea. Molecules 2018; 23(11): 2778.
35. Lis B & Olas B: Pro-health activity of dandelion (*Taraxacum officinale* L.) and its food products–history and present. Journal of Functional Foods 2019; 59: 40-48.
36. Li Y, Chen Y & Sun-Waterhouse D: The potential of dandelion in the fight against gastrointestinal diseases: A review. Journal of ethnopharmacology 2022; 293: 115272.
37. Jalili C, Taghadosi M, Pazhouhi M, Bahrehmand F, Miraghaee SS, Pourmand D & Rashidi I: An overview of therapeutic potentials of Taraxacum officinale (dandelion): A traditionally valuable herb with a reach historical background. WCRJ World Cancer Res J 2020; 7: 1679.
38. Poulios E, Giaginis C & Vasios GK: Current state of the art on the antioxidant activity of sage (Salvia spp.) and its bioactive components. Planta Medica 2020; 86(04): 224-238.
39. Laelago T: Herbal medicine use during pregnancy: benefits and untoward effects. Herbal Medicine 2018; 103-119.
40. Hay E, Lucariello A, Contieri M, Esposito T, De Luca A, Guerra G & Perna A: Therapeutic effects of turmeric in several diseases: An overview. Chemico-biological Interactions 2019; 310: 108729.
41. Timba PP, Giri SG & Panchal RV: Health benefits and possible risks of turmeric, garlic and ginger: a short. Health 2019; 6(4): 4656-4659.
42. Anyaoku I, Igwilo IO & Ezekwesili CN: Nutritional Profile and Health Promoting Properties of Curcuma Longa (Linn) (Tumeric). International Journal of Research Publication and Reviews 2023; 4(11): 2731-2740.
43. Ng KW, Cao ZJ, Chen HB, Zhao ZZ, Zhu L & Yi T: Oolong tea: A critical review of processing methods, chemical composition, health effects, and risk. Critical Reviews in Food Science and Nut 2018; 58(17): 2957-80.
44. Wang S, Zeng T, Zhao S, Zhu Y, Feng C, Zhan J & Gosslau A: Multifunctional health-promoting effects of oolong tea and its products. Food Science and Human Wellness 2022; 11(3): 512-523.
45. Chandrasekara A & Shahidi F: Herbal beverages: Bioactive compounds and their role in disease risk reduction-A review. Journal of Traditional and Complementary Medicine 2018; 8(4): 451-458.
46. Klepacka J, Tońska E, Rafałowski R, Czarnowska-Kujawska M & Opara B: Tea as a source of biologically active compounds in the human diet. Molecules 2021; 26(5): 1487.
47. Samanta S: Potential bioactive components and health promotional benefits of tea (*Camellia sinensis*). Journal of the American Nutrition Association 2022; 41(1): 65-93.
48. Lalas S, Athanasiadis V, Karageorgou I, Batra G, Nanos GD & Makris DP: Nutritional characterization of leaves and herbal tea of *Moringa oleifera* cultivated in Greece. J of Herbs, Spices & Medicinal Plants 2017; 23(4): 320-333.

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