

Research Article

Assessing the Therapeutic and Health Benefits of Commercialized Herbal Teas Sold in Supermarkets, Drugstores, and Entrepreneurs through Radios

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Abstract: An assessment of the therapeutic and health benefits of commercialized herbal teas available in various supermarkets, and drugstores, and advertised by entrepreneurs through radios in Iligan City was done. Sixty-five (65) herbal teas were found commercially sold and were found to contain ninety-eight (98) plant species as ingredients prepared individually or in groups. These teas have been claimed to be therapeutic. *Camellia sinensis*, *Rosa rubiginosa*, and *Jasminum sambac* Linn., were the most used plants in herbal teas, and argued to contain micronutrients like polyphenols. These are naturally active substances responsible for biological actions that treat human ailments. Diabetes, heart disease, and mental health were the most frequently listed health problems addressed by the tea products. Leaves were the most widely used plant part in the teas. Flavonoids, phenolic compounds, and alkaloids are the predominant bioactive constituents that were reported in the plants. Assessment of the individual properties of each of the plant species shows specific therapeutic functions, associated with the component bioactive compounds. While commercialized herbal teas sold have no approved therapeutic claims these were very popular with many users due to convincing marketing, especially through social media and radio. It was argued however that more investigations into the bioactive components found not only in each plant utilized as an ingredient but also when mixed to determine interactions of component compounds from each plant species and any potential toxicity or adverse reactions to users.

Keywords: Ethnopharmacological, Herbal teas, Medicinal plants, Therapeutic claims, Bioactive Compounds.

INTRODUCTION

Plants are known to have phytonutrients, which are bioactive compounds considered beneficial to human health. For many decades it remained the basis for the development of modern drugs to treat numerous forms of diseases all over the world [1]. As an efficient natural remedy for any ailment, commercialized plant-based products were developed such as tea, and became widespread when commercialized in the market.

Tea, caffeine-free, is currently the most popular beverage worldwide after water. They are known to be reliable, dependable, simple to use, affordable, and believed to be safer than synthetic drugs. These factors helped to expand the popularity of these teas and make them a crucial nutritional component. Teas are made from different plant parts, such as leaves, herbs, fruits, blooms, roots, etc. They are known for their abundant number of antioxidants such as polyphenols, polysaccharides, and amino acids, and have become popular as a healthy beverage for lowering obesity, cancer, liver, and cardiovascular problems [2].

However, a previous study described a patient who experienced acute liver failure after drinking an herbal detox tea that was marketed as being hepatoprotective. Six components of the aforementioned tea were linked to hepatotoxicity in one or more published studies [3]. Although tea polyphenols may have health benefits for people, they can cause fat to

accumulate by encouraging fat cell growth and extending fat cell sizes, which results in nutritional obesity [4]. In addition, excessive use of the laxative senna in pharmaceutical preparations causes finger clubbing. This was first described by Silk and colleagues in 1975, and the same case was again described by Rashiq and others in 1996 [5-6]. For these reasons, the level of heavy metal contamination in herbal products has raised serious concerns about their safety and quality. Thus, the study's objectives were to assess the commercialized herbal teas available in various stores, drugstores, and those advertised on radios in Iligan City, to record all plant species as ingredients present including their therapeutic claims. Data mining of reported ethnopharmacological and biochemical components and functions in the plants was also gathered to determine the possible safety and efficacy of the specified herbal teas.

METHODS:

2.1 Tea Samples and Data Collection

A total of 65 tea samples (local and imported tea products) were collected in various stores, and drugstores in Iligan City were documented. Plant species with their scientific names as an ingredient, plant parts used, and therapeutic claims of each tea product were noted. The plant's family and scientific names were also recorded.

2.2 Data Mining

A systematic literature review was conducted to identify and analyze research articles and publications from PubMed, Google Scholar, ScienceDirect, and ResearchGate databases pertinent to the medicinal plants used as an ingredient in herbal teas. In addition, a thorough literature review was conducted to identify the bioactive compounds of each medicinal plant and to assess their corresponding biological activities.

RESULTS AND DISCUSSION

Due to the public's increased interest in using herbal medicines, herbal teas are becoming more and more popular among consumers [12]. Of the total 64 herbal teas collected, 98 medicinal plant species were observed to be constituents either individually or mixed to treat different ailments/ diseases (Table I). These plant species belong to 47 different families namely: Actinidiaceae, Anacardiaceae, Annonaceae, Apiaceae, Apocynaceae, Arecaceae, Asteraceae, Bignoniaceae, Boraginaceae, Bromeliaceae, Cactaceae, Caprifoliaceae, Caricaceae, Caryophyllaceae, Costaceae, Clusiaceae, Cucurbitaceae, Ericaceae, Euphorbiaceae, Fabaceae, Ginkgoaceae, Grossulariaceae, Lamiaceae, Lauraceae, Lythraceae, Malvaceae, Moringaceae, Myrtaceae, Nelumbonaceae, Oleaceae, Paeoniaceae, Pandanaceae, Passifloraceae, Phyllantaceae, Poaceae, Polygonaceae, Punicaceae, Rosaceae, Rubiaceae, Rutaceae, Sapindaceae, Solanaceae, Theaceae, Urticaceae, Vitaceae, Vitaceae and Zingiberaceae.

Table 1. Commercialized Herbal Tea Plants Sold in Iligan City

N o.	Product's Name	Medicinal Plants	Plant Part Used	Therapeutic claims
1	TWININGS OF LONDON (GREEN TEA Earl Grey)	<i>Camellia sinensis</i> <i>Monarda didyma</i> L.	leaves	Support heart health and prevent serious cardiovascular diseases such as heart attacks and high blood pressure
2	TWININGS OF LONDON (GREEN TEA Jasmine)	<i>Camellia sinensis</i> <i>Jasminum sambac</i> Linn.	leaves, flowers	Lower your risk of heart disease, mental decline, and

				certain cancers
3	TWININGS OF LONDON (GREEN TEA & Lemon)	<i>Camellia sinensis</i> <i>Citrus limon</i>	leaves, fruit	Reduces your risk of stroke or heart attack
4	TWININGS OF LONDON (Pure Camomile)	<i>Matricaria recutita</i>	flower	Digestive upset, Wound healing, Generalized anxiety disorder (GAD), depression
5	ABS HERBS (Sambong Tea)	<i>Blumea balsamifera</i>	leaves	Treat wounds and cuts, rheumatism, anti-diarrhea, anti-spasms, colds and coughs
6	RITARRITZ (Lolo Jose's Banaba Tea)	<i>Lagerstroemia speciosa</i>	leaves	Diabetes, kidney failure, obesity, constipation, kidney inflammation, and urinary dysfunctions
7	RITARRITZ (Guyabano Fruit Tea)	<i>Annona muricata</i>	fruit and leaves	Cure for diabetes because it helps improve the body's tolerance for glucose and hyperlipidemia
8	RITARRITZ (Lagundi)	<i>Vitex negundo</i>	leaves	Asthma, coughs, and body

	Herbal Tea)			pain
9	THE GOOD HARVEST Dried Fruit and Tea Infusions (Crimson glory, Lemon, Jasmine)	<i>Vitis coignetiae</i> <i>Citrus limon</i> <i>Jasminum sambac</i> Linn.	fruit and flowers	Relaxation
10	THE GOOD HARVEST Dried Fruit and Tea Infusions (Hibiscus, Rose, White Dragon Fruit)	<i>Hibiscus</i> <i>Rosa</i> <i>Selenicereus undatus</i>	fruit and flowers	Relaxation
11	THE GOOD HARVEST Dried Fruit and Tea Infusions (Papaya, Grapefruit, Jasmine)	<i>Carica papaya</i> <i>Vitis vinifera</i> <i>Jasminum sambac</i> Linn	fruit and flowers	Relaxation
12	THE GOOD HARVEST Dried Fruit and Tea Infusions (Pineapple, Date, Rose)	<i>Ananas comosus</i> <i>Phoenix dactylifera</i> <i>Rosa</i>	fruit and flowers	Relaxation
13	THE GOOD HARVEST Dried Fruit and Tea Infusions (Pear, Melon,	<i>Pyrus communis</i> <i>Cucumis melo</i> <i>Lycium ruthenicum</i>	fruit	Relaxation

	Black Goji)			
14	THE GOOD HARVEST Dried Fruit and Tea Infusions (orange peel, red dragon fruit, pear slice)	<i>Citrus sinensis</i> <i>Selenicereus undatus</i> <i>Pyrus communis</i>	fruit	Relaxation
15	THE GOOD HARVEST Dried Fruit and Tea Infusions (Jasmine, White Dragon fruit, Kiwi)	<i>Jasminum sambac</i> Linn <i>Hylocereus undatus</i> <i>Actinidia deliciosa</i>	flower and fruit	Relaxation
16	THE GOOD HARVEST Flower FruitT Mix Tea (Roselle, Sugared Hawthorn , Apple, Melon, Pineapple , Lemon and Cherry)	<i>Hibiscus sabdariffa</i> <i>Crataegus monogyna</i> <i>Malus domestica</i> <i>Cucumis melo</i> <i>Ananas comosus</i> <i>Citrus limon</i> <i>Prunus avium</i>	flower and fruit	High in vitamin C, rich in antioxidants
17	THE GOOD HARVEST Blue Butterfly Pea Tea	<i>Clitoria ternatea</i>	flower	
18	THE GOOD HARVEST Lavender Flower Tea	<i>Lavandula angustifolia</i>	flower	Improve mood disorders, help with anxiety, depression , and fatigues,

				boost sleep, soothe menstrual cramping
19	THE GOOD HARVEST Genmaicha Tea	<i>Oryza sativa</i> <i>Camellia sinensis</i>	leaves and fruit	Good for the heart health
20	THE GOOD HARVEST Marigold Calendula Flower Tea	<i>Calendula officinalis</i>	flower	Antioxidants, have antifungal and antimicrobial properties, support oral health, regulate menstrual cycle, boost heart health
21	THE GOOD HARVEST Longan Tea	<i>Dimocarpus longan</i>	fruit	Anti-inflammatory, helps strengthen the liver, spleen, and kidneys, relaxing and calming to help ease anxiety
22	THE GOOD HARVEST Kumquat Fruit Tea	<i>Citrus japonica</i>	fruit	Aids in digestion helps balance blood sugar, rich in antioxidants, helps rid of free radicals that cause stress and aging to the body

23	RITA RITZ Pito-Pito Dried Herbal tea	<i>Lagerstroemia speciosa</i> <i>Psidium guajava</i> <i>Mangifera indica</i> <i>Pandanus amaryllifolius</i> <i>Centella asiatica</i> <i>Pimpinella</i> <i>anisum</i> <i>Premna odorata</i>	Leaves, seeds	Lowering blood sugar, healthy gums and aids the symptoms of loose bowels, antibacterial, pain reliever, healing of wounds, relax the muscles, produces gastric protection, aids the digestive system, cure tuberculosis
24	HERBAL SLIMMING TEA (Peach Apricot) with Senna leaves	<i>Prunus persica</i> <i>Prunus armeniaca</i> <i>Cassia angustifolia</i>	Fruit, leaves	Support cleansing and thermogenic activity within the body helping to promote the elimination and storage of excess calories
25	HERBAL SLIMMING TEA (Cranrasp berry) with Senna leaves	<i>Vaccinium macrocarpon</i> <i>Rubus idaeus</i> <i>Cassia angustifolia</i>	Fruit, leaves	Support cleansing and thermogenic activity within the body helping to promote the elimination and storage of excess calories
26	MY MARVE	<i>Tabebuia avellaneda</i>	inner	Promote strength

	L Taheebo Herbal Tea		bark	and vitality, help boost immunity
2 7	Bignay Tea	<i>Antidesma buniis</i>	fruit	Antioxida nt, promotes colon health and weight loss, UTI, liver health, regulation of blood pressure, eye health, skin rejuvenati on, prevents anemia, helps flushing out uric acid, urea, toxin, and prevent stone formation in the kidney
2 8	Red Alingaton g Roots Herbal Tea	<i>Urtica Dioica</i>	root s	Kidney stone, uric acid, kidney disorders, lowers creatinine, UTI, gallstone, prostate enlargeme nt, high blood pressure, rheumatoi d arthritis, diabetes, gout, insomnia, prostate enlargeme nt
2 9	ALOKO ZAY Rooibos	<i>Aspalathus linearis</i>	leav es	Antioxida nts

	Tea			
30	ALOKO ZAY Thyme Tea	<i>Thymus vulgaris</i>	leaves	Increase memory, prepare the body for sleep and even bring luck
31	ALOKO ZAY Pomegranate Tea	<i>Punica granatum</i>	fruit	Promote heart health, reduce inflammation, slow down osteoarthritis and lessen joint pains
32	ALOKO ZAY Fennel Tea	<i>Foeniculum vulgare</i>	flower	Improve digestive health
33	ALOKO ZAY Black Currant Tea	<i>Ribes nigrum</i>	fruit	Rich in antioxidants, iron and potassium, regulating blood pressure, increasing fat oxidation, and promoting skin health
34	MVPM Insulin Plant Herbal tea	<i>Chamaecostus cuspidatus</i>	leaves	Prevents diabetes, regulates blood sugar level, promotes healthy liver, antioxidant, immunity booster, anti-cancer, regulates blood pressure

3 5	Pure Paragis Tea	<i>Eleusine indica</i>	leaves	PCOS, myoma, cyst, UTI, irregular menstruation, sperm count, diabetes, high blood, kidney, arthritis, parasites
3 6	Sapang Red Tea	<i>Caesalpinia sappan L.</i>	wood	Tuberculosis, binat, anemia, liver cancer, hypertension/high blood, hepatitis, diarrhea, diabetes, tumor, irregular menstruation, breast cancer, stomach cancer, ovarian cancer and etc.
3 7	Damong Maria Tea	<i>Artemisia vulgaris Linn</i>	leaves	Good for irregular menstruation, adenomyosis, women with endometriosis, PCOS help dissolves cyst, clear UTI and bad vaginal smell or discharge
3 8	Pure Serpentin	<i>Rauvolfia serpentina (L.)</i>	leaves	Cancer fighter,

	a Tea			diabetes, antibacterial, antiviral, analgesic, anti-inflammatory, high blood pressure, expectorant, immunity enhancer
39	Pure Ginger Salabat Tea	<i>Zingiber officinale</i>	roots	Aids in digestion, fights respiratory problems, relieves stress, reduces acne, increases sperm count
40	TWININGS OF LONDON (Passionfruit, Mango and Orange) TEA	<i>Passiflora edulis</i> <i>Mangifera indica</i> <i>Citrus sinensis</i>	fruit	Not specified
41	TWININGS OF LONDON FOUR RED FRUITS TEA (Strawberry, Raspberry, Cherry and Redcurrants)	<i>Fragaria ananassa</i> <i>Rubus idaeus</i> <i>Prunus avium</i> <i>Ribes rubrum</i>	fruit	Not specified
42	CRAFTED NUTTY (Dried Stevia)	<i>Stevia rebaudiana</i>	leaves	Aids in managing diabetes and weight control,

				relieves upset stomach, indigestion and heartburn, helps reduce formation of bacteria in the mouth preventing cavities and gingivitis, boost bone health and reduce the risk of osteoporosis
43	CRAFTE A NUTTY Blueberry Balm (Butterfly pea, Rosehip, Blueberry and Lemon)	<i>Clitoria ternatea</i> <i>Rosa</i> <i>Vaccinium meridionale</i> <i>Citrus limon</i>	flower, fruit	Enhances mood, boosts collagen production, lowers blood pressure, and flushes out water weight
44	CRAFTE A NUTTY Mighty Green Warrior (Green Tea, Wolfberry and Orange)	<i>Camellia sinensis</i> <i>Lycium barbarum</i> <i>Citrus sinensis</i>	Leaves, fruit	Colds and flu slayer, improves digestion, weight loss and fats flush-out, heart disease prevention
45	CRAFTE A NUTTY Heavenly Green Tea (Green Tea, Bamboo, Mint)	<i>Camellia sinensis</i> <i>Mentha</i> <i>Bambusoideae</i>	leaves	Mental clarity, detoxifies blood, promotes heart and gut health, fights inflammation and infections

46	CRAFTE A NUTTY A Spiced Life (Assam, Cinnamon, Cardamom, Ginger)	<i>Camellia sinensis</i> <i>Cinnamomum verum</i> <i>Elettaria cardamomum</i> <i>Zingiber officinale</i>	leaves	Boosts alertness, sustained energy non-crashing feeling, improves digestion and metabolism, boosts immunity
47	CRAFTE A NUTTY Brainy and Savvy (Jasmine green tea, Ginkgo Biloba, Rosemary)	<i>Jasminum sambac</i> Linn <i>Camellia sinensis</i> <i>Ginkgo biloba</i> <i>Salvia rosmarinus</i>	leaves	Improves memory and focus, stimulates creative thinking, elevates mood and pacifies anxiety, headache and migraine relief
48	TWININGS OF LONDON Defence (citrus, ginger with green tea, echinacea)	<i>Citrus</i> <i>Zingiber officinale</i> <i>Camellia sinensis</i> <i>Echinacea</i>	leaves, root and fruit	Supports the normal function of the immune system
49	TWININGS OF LONDON Sleep Blue (Blood Orange flavored herbal infusion with orange blossom, chamomile, passionflower, lavender, and	<i>Citrus sinensis</i> <i>Matricaria chamomilla</i> <i>Passiflora incarnata</i> <i>Lavandula</i> <i>Valeriana officinalis</i>	root	Contributes to normal sleep

	valerian)			
50	FLOWER TEA (Peach Flower)	<i>Prunus persica</i>	flower	Promotes weight loss, serves as a mild laxative that removes excess fats and toxins, reduces skin pigmentation, and boosts skin hydration
51	FLOWER TEA (Peony Flower)	<i>Paeonia</i>	flower	Improves blood flow, treats pain, muscle cramps, and inflammation, treats PCOS, and promotes healthy and balanced estrogen
52	FLOWER TEA (Carnation Flower)	<i>Dianthus caryophyllus</i>	flower	Treats pimples and acne, promotes clearer skin, promotes healthy digestion, anti-aging
53	LIPTON (Peppermint and Spearmint Tea)	<i>Camellia sinensis</i> <i>Mentha piperita</i> <i>Mentha spicata</i>	leaves	Can help support a healthy heart
54	AHMAD TEA (Lemon, Mate,	<i>Citrus limon</i> <i>Ilex paraguariensis</i> <i>Camellia sinensis</i>	Leaves, fruit	Weight loss

	Matcha green tea)			
55	AHMAD TEA (Mango and Lychee)	<i>Mangifera indica</i> <i>Litchi chinensis</i>	fruit	Not specified
56	Oregano Powder Tea	<i>Origanum vulgare</i>	leaves	For sore throat, cough, nausea, digestive problems and irritable bowel syndrome
57	NATURE'S APOTHECARY Tulsi Traditional Herbal Tea	<i>Ocimum tenuiflorum</i>	leaves	Nourishes the skin, rich in vitamin C, promotes restful sleep, reduces high blood pressure, promotes relaxation, decongests sinuses, relieves headaches
58	NATURE'S APOTHECARY Namaste Signature Tea Blend (dried honeysuckle, white grass root, gardenia, tangerine peel, licorice, white tea, monk fruit)	<i>Lonicera periclymenum</i> <i>Leersia virginica</i> <i>Gardenia jasminoides</i> <i>Citrus reticulata</i> <i>Glycyrrhiza glabra</i> <i>Camellia sinensis</i> <i>Siraitia grosvenorii</i>	Leaves, roots, peel, fruit	Supports the respiratory system, supports liver health, supports the digestive system, helps reduce inflammation, helps lower cholesterol levels, rich in antioxidants
5	AHMAD	<i>Urtica dioica</i>	Lea	Proper

9	TEA BEAUTY (nettle leaves, lemon verbena leaves, lemon balm, lemongra ss, chicory root, linden flowers, carob, rose, aloe vera, peach)	<i>Aloysia citrodora</i> <i>Citrus limon</i> <i>Cymbopogon citratus</i> <i>Cichorium intybus</i> <i>Tilia</i> <i>Ceratonia siliqua</i> <i>Rosa rubiginosa</i> <i>Aloe barbadensis miller</i> <i>Prunus persica</i>	ves, fruit , root, flow ers	sleep
6 0	NATURE 'S APOTHE CARY Sampa- sampiluk an Tradition al Herbal Tea	<i>Phyllanthus niruri</i> Linn.	leav es	Protects liver from toxins, dissolutio n of kidney stones, cholester ol-lowering effects, lowers blood sugar levels, prevents gout attacks
6 1	NATURE 'S APOTHE CARY Forget- me-Nots Tradition al Herbal Tea	<i>Euphorbia hirta</i>	leav es	Natural bronchodil ator, anti- inflammat ory, anthelmint ic, treat digestive problems, analgesic
6 2	NATURE 'S APOTHE CARY Salabat Plus Tradition al Herbal Tea (Ginger,	<i>Zingiber officinale</i> <i>Curcuma longa</i> <i>Garcinia mangostana</i> <i>Moringa oleifera</i> <i>Annona muricata</i> <i>Origanum vulgare</i> <i>Persea americana</i> <i>Cymbopogon citratus</i> <i>Momordica charantia</i> <i>Mentha piperita</i>	Lea ves, fruit s	Not specified

	Turmeric, Mangosteen, Moringa, Guyabano, Oregano, Avocado, Lemongrass, Ampalaya and Peppermint)			
63	NATURE'S APOTHECARY Forget-me-Nots Traditional Herbal Tea	<i>Myosotis scorpioides</i>	flower	Nourishes the skin, rich in Vitamin C, promotes restful sleep, reduces high blood pressure, promotes relaxation
64	PURE TEA 14 Day Skinny Tea (senna leaf, lotus leaf, chamomile, dark pu'erh leaf, sencha green tea, lemongrass, Garcinia Cambogia extract, rhubarb root, fennel, marshmallow leaf, holy thistle leaf, and malva leaf)	<i>Senna</i> <i>Nelumbo nucifera</i> <i>Matricaria chamomilla</i> <i>Garcinia cambogia</i> <i>Althaea officinalis</i> <i>Cnicus benedictus</i> <i>Malva</i>	Leaves, root	To support weight loss with traditional organic herbs that aid in detoxification and eliminate toxins released from fat cells when you lose weight. Helps burn fat and increase metabolism resulting in healthy weight loss.

Species within the Lamiaceae, Rosaceae, and Asteraceae plant families have been scientifically validated for their positive impact on human health (Table 2). Notably, the Lamiaceae family, commonly known as the mint family, boosts a considerable number of medicinal species. Ethnobotanical to pharmacological studies reveal that some of these species have a longstanding history in folk medicine, with approximately 80% of the family's species being utilized for medicinal purposes. Plants within the Lamiaceae family are recognized for their abundance of polyphenolic components and terpenoids, contributing to their effectiveness in addressing digestive system issues, particularly flatulence and dyspepsia. Additionally, they are employed as constituents and treatments for infections [7]. The Rosaceae family, exemplified as a group of flowering plants, represents a promising reservoir of natural antioxidants. The utilization of total phenolics and flavonoids derived from these plants has been explored for the treatment of various diseases and ailments [8]. Similarly, the Asteraceae family, one of the largest groups of flowering plants, has been part of our diet and used for healing for a long time. The beneficial effects of these plants come from their natural compounds, like alkaloids, which are commonly used in medicine. Studies show that this plant family is rich in chlorogenic acids, which act as antioxidants and help prevent diseases [9].

C. sinensis, *C. limon*, and *J. sambac* Linn are highly favored medicinal plants commonly used as ingredients in teas due to their several health benefits. In particular, Twinings of London herbal teas, featuring *C. sinensis*, claim to support heart health, lower the risk of certain cancers, and help prevent mental decline. This valuable plant which is known as the “tea plant” was studied in numerous laboratory research indicating that the bioactive compounds present in this plant have various physiological benefits against cardiovascular diseases, cancer progression, inflammatory response, and lower the risk of mental decline. It was reported that the anti-cancer effects of *C. sinensis* were due to its polyphenols (except (-)-epicatechin) that exhibit the property of cell growth inhibition, and flavonoids that may be involved in the induction of apoptosis [10-11]. Reports suggested that consuming this tea decreased the 50% risk of gastric cancer in the Chinese population, and similarly, black tea exhibited strong protective actions against gastric cancer in the Indian population [12-13]. Another study confirmed that the consumption of green tea decreased the risk of colorectal cancer which was done by catechins that inhibit the activity of cancer-inducing nitrosamine compounds and heterocyclic amines [14]. The application of catechin nanohybrids in WM266 human melanoma significantly increased the rate of apoptosis of tumor cells [15]. Furthermore, several studies have been conducted on the tea polyphenols, flavan-3-ol, which were associated with antioxidant functions [16]. Also, studies suggest that green tea is the richest source of epigallocatechin-3-gallate (EGCG) which has reactive oxygen species (ROS) scavenging properties, and theaflavins which are more effective than epigallocatechin-3-gallate (EGCG) which has a strong free radical activity. These bioactive compounds present in teas might be the basis for the herbal teas' therapeutic claims that they can lower the risk of heart disease. Moreover, tea consists of a particular amino acid, L-theanine which has a significant role in the central nervous system that alters the synthesis of dopamine and serotonin in the brain, which helps in improving cognitive functions and reduces stress, mood, anxiety, and depression [17-18].

Table 2. Plants Used in Herbal Teas

Family/Scientific Name	Biological Activities	Bioactive Compounds	Reference/s
Actinidiaceae			
<i>Actinidia deliciosa</i>	Antimicrobial activity	syringic, chrysin and quercetin, catechin, quercetin, and epigallocatechin	[19-20]
	Antioxidant activity		
Anacardiaceae			
<i>Mangifera indica</i> Linn	Anticancer activity, Antioxidant activity	quercetin 3-o-galactoside, polyphenols, carotenoids and anthocyanins	[21-22]
	Gastroprotective Effect	mangiferin	[23]
Anonaceae			
<i>Annona muricata</i>	Antidepressive	anonaine, asimilobine, nor nuciferine	[24-25]
	Antioxidant	vitamin c, vitamin e, superoxide dismutase and catalase	[26]
	Antimicrobial activity	flavonoids, tannins, alkaloids, saponins and cardiac glycosides	[27]
	Anticarcinogenic	acetogenins (ace)	[28]
	Antimalarial activity	isoboldine	[29]
Apiaceae			
<i>Centella asiatica</i>	Anticancer activity, Anti-inflammatory activity/	asiatic acid	[30-34]

	Wound Healing, Antidepressant activity, Antioxidant property, Neuroprotective activity		
<i>Foeniculum vulgare</i>	Anti-bacterial activity	<i>trans</i> -anethole, fenchone, and limonene	[35]
	Anti-fungal activity		
	Anti-anxiety activity	quercetin-3 β -d- glucoside, <u>rutin</u> , <u>hyperoside</u> , <u>quercetin</u> , <u>miquelianin</u> , trifolin, <u>isorhamnetin</u> and <u>kaempferol</u>	[36]
<i>Pimpinella anisum</i>	Muscle Relaxant	pyridoxine, niacin, riboflavin, and thiamin	[37]
	Anticonvulsant and antimicrobial	phenylpropanoids, monoterpenes (hydrocarbons and phenolics), and <i>trans</i> -anethole, <i>cis</i> - anethole, <u>estragole</u> , <u>linalool</u> , α -terpineol, and <u>methyl eugenol</u>	[38]
	Wound healing and Anti- Inflammatory	<u>galactose</u> , β -D-glucose, α -D-mannose, β -D- galactose, D-fructose, α -D-glucose, α -L-galactose and <u>arabinose</u>	[39]
	Antioxidant Activity	palmitic, petroselinic, <i>trans</i> -anethole, naringin, gallic, rosmarinic, allergic and syringic acids	[40]
	Antidiabetic,hypolipidemic,	apigenin and luteolin	[41]
Apocynaceae			
<i>Rauvolfia serpentina</i> (L.)	Antibacterial, antioxidant, and antineoplastic	ajmalicine, ajmaline, yohimbine, and reserpine, kaempferol, vincamine	[42-44]
Arecaceae			
<i>Phoenix dactylifera</i>	Antioxidant activity	gallic acid, chlorogenic acid, vanillic acid, caffeic acid, syringic acid, tyrosol, ferulic acid, o-coumaric acid, vanillin, catechin and <u>rutin</u>	[45]
	Antiviral activity	protein and some derived polyphenolic compounds such as polysaccharides, lignans and bioflavonoids	[46]
	Antifungal activity	flavonoids, tannins, alkaloids and coumarins	[47]
	Nephroprotective activity	melatonin, vitamin e, and ascorbic acid	[48]
Asteraceae			
<i>Artemisia vulgaris</i> Linn	Antifertility activity	steroids, flavonoids and saponins	[49]
	Antioxidant activity	Not mentioned	[50]
<i>Blumea balsamifera</i>	Antitumor	dihydroflavonol bb-1	[51]
	Antimicrobial	flavonoids and sesquiterpenoids	[52]
	Anti-tyrosinase and anti- cancer	luteolin-7-methyl ether	[53]
	Antifungal	ichthyothereol acetate and cryptomeridiol	[54]
	Antioxidant activity	<u>quercetin</u> , <u>rhamnetin</u> , <u>luteolin</u> , luteolin-7-methyl ether , L-ascorbic acid, blumeatin, <u>butylated</u> <u>hydroxyanisole</u> , 5,7,3',5'-tetrahydroxyflavone, <u>tamarixetin</u> , butylated <u>hydroxytoluene</u> , α - tocopherol, dihydroquercetin-4'-methyl ether , dihydroquercetin-7,4'-diethyl ether	[55]
<i>Calendula officinalis</i>	Anti-bacterial and antifungal	t-muurolol and palustron	[56]
<i>Cichorium intybus</i>	Anti-inflammatory effect	carrageenan	[57]
	Wound healing effect	β -sitosterol	[58]
	Gastroprotective	alkaloids, phenols, flavonoids, saponins, carbohydrates and glycosides	[59]
	Anticancer effect	flavonoids	[60]
	Hepatocyte Protective and anti- hepatitis-B	cichoric acid	[61]

<i>Cnicus benedictus</i>	Antioxidant activity, anti-inflammatory	vanillic, silibinin b, ferulic acid and rutin	[62]
	Antibacterial activity	alkaloids, flavonoids, phenols, tannins and terpenes.	[63]
Echinacea	Antioxidant	caftaric acid, <u>chlorogenic acid</u> , caffeic acid, <u>cynarin</u> , <u>echinacoside</u> and <u>cichoric acid</u>	[64]
<i>Matricaria recutita</i>	Antimicrobial activity	α -bisabolol oxide, followed by camphene, sabinene, limonene, 1,8-cineole, camphor, and α -pinene	[65]
	Antifungal activities	<u>chamazulene</u> , isopropyl hexadecanoate, trans-trans-farnesol and e- β -farnesol	[66]
	Antioxidant activity, antitumor, chemopreventive	phenols and flavonoids	[67]
	Anti-inflammatory	apigenin	[68]
	Antigenotoxic actions	essential oils	[69]
<i>Stevia rebaudiana</i>	Antioxidant	phenols and flavonoids	[70]
Bigoniaceae			
<i>Tabebuia avellanedae</i>	Anti-inflammatory	arachidonic acid	[71]
Boraginaceae			
<i>Myosotis arvensis</i>	antibacterial	fatty acids, alkaloids, saponins, anthocyanins and flavonoids	[72]
Bromeliaceae			
<i>Ananas comosus</i>	Hepatoprotective activity	tannins, triterpene, steroids and flavonoids	[73]
	anti-inflammatory	campesterol and ethyl iso allocholate	[74]
	Antimalarial	linoleic acid and palmitic acid	[75]
Cactaceae			
<i>Hylocereus undatus</i>	Antioxidant activity	rhamnose, galactose, galacturonic acid, xylose, lignin, salicylic acid and protocatechuic acid	[76]
<i>Selenicereus undatus</i>	Antidiabetic	alkaloid and flavonoid	[77]
Caprifoliaceae			
<i>Lonicera</i>	Antioxidant activity	hexadecanoic acid, trans-farnesol, benzyl benzoate, 2-heptadecanone, linalool, benzaldehyde, anthracene, -terpineol, -muurolene and octadecane	[78]
<i>Valeriana officinalis</i>	Antioxidant activity	phenolic (gallic acid)	[79]
	Antiepileptic, anticonvulsant effect	isovalerate	[80]
	Sleep problem	valepotriates	[81]
	Anxiolytic effects and analgesic	valerenic acid and valerenol	[82]
Caricaceae			
<i>Carica papaya</i>	Antioxidant activity	tannins, pseudo tannin, flavonoids, glycosides, alkaloids	[83]
	Antihypertensive activity	quercetin, rutin, nicotiflorin, clitorin, and manghaslin	[84]
	Wound healing activity	chymopapain and papain	[85]
	Hepatoprotective activity	flavonoids	[86]
	Digestive Health	vitamin c, carotenoids, flavonols, hydroxycinnamic acids	[87]
Caryophyllaceae			
<i>Dianthus caryophyllus</i>	Anticancer effect and antioxidant	6-hydroxy kaempferol-3,6- <i>o</i> -diglucoside, 6-hydroxy kaempferol-7- <i>o</i> -glucoside, quercetin-3- <i>o</i> -sophoroside, and 2'-deoxyguanosine	[88]
	Antibacterial and antifungal	terpenoids and flavonoids	[89]
Costaceae			
<i>Chamaecostus cuspidatus</i>	Antioxidant activity	quercetin, kaempferol, phytol,	[90-91]
	Anticancer activity	lupenone	

	Antimicrobial activity	quercetin, kaempferol, and cis-9,10-epoxy octadecan-1-ol	
	Antifungal activity	(z)-14-tricosenyl format	
Clusiaceae			
<i>Garcinia cambogia</i>	Anti-obesity	(-)-hydroxycitric acid	[92]
	Hypolipidemic activity	flavonoids and phenols	[31]
	Antidiabetic activity		
	Anti-inflammatory activity	4,8-epi-uralione f, 4,8-epi-uralione g, uralione s, coccinone j, 6-epi-coccinone c, coccinone i, 36-hydroxy-guttiferone j, multiflora i, garcinia tibolone f and 36-hydroxy-garcinia gifolone f	[93]
	Antioxidant activity, antibacterial	pyrogallol, catechin, catechol, epicatechin, chlorogenic, salicylic acid, flavonoids and isoflavonoids	[94]
	Anti-ulcer activity	d (-)-erythro-hydroxycitric acid (hca)	[95]
<i>Garcinia mangostana</i>	Antioxidant activity	8-hydroxycudraxanthone g, gartanin, α - mangostin, γ -mangostin and smith xanthone a	[96]
Cucurbitaceae			
<i>Cucumis melo</i>	Antioxidant activity	phenolic and flavonoid compounds 3-hydroxybenzoic acid, chlorogenic acid, neochlorogenic acid, isovanillic acid, apigenin-7- α -glucoside, luteolin-7-o-glucoside, and quercetin-3-galactoside	[97]
	Anticancer; cardiovascular diseases	Phenols and flavonoids	[98-]
<i>Momordica charantia</i>	Hypoglycemic activity	polypeptide-p, charantin, momordenol, and momordicin	[100-101]
	Antibacterial activity	flavonoids, alkaloids and tannins	[102]
	Antiviral	flavonoids	[103]
	Anti-HIV	map30,	[104-106]
	Anticancer activity	phenols	[107]
	Abortifacient and antifertility	triterpenoid glycosides, flavonoids and alkaloids	
	Anti-ulcer activity	saponins, sterols, mucilage, glycoside, alkaloids, steroidal saponins	[108]
	Anthelmintic activity	quercetin	[109]
	Antioxidant activity	gallic acid, caffeic acid and catechin	[110]
<i>Siraitia grosvenorii</i>	Antioxidant effects	α -l-arabinose, α -d-mannose, α -D-glucose, α -d-galactose, <u>glucuronic acid</u> , and galacturonic acid	[111]
	Anticancer effects	mogrosides	[112]
Ericaceae			
<i>Vaccinium macrocarpon</i>	anti-thrombotic, anti-inflammatory	polyphenols, phenolic acids (benzoic, hydroxycinnamic, and ellagic acids) and flavonoids (anthocyanins, flavonols, and flavan-3-ols)	[113]
<i>Vaccinium meridionale</i>	Antioxidant activity	anthocyanins, hydroxycinnamic acids, flavonols, and procyanidins	[114]
Euphorbiaceae			
<i>Antidesma buniis</i>	Antioxidant and anti-obesogenic	phenolics and anthocyanins, gallic acid, catechin, anthocyanin-3-glucoside, and protocathechuic acid	[115]
<i>Euphorbia hirta</i>	Antimicrobial effect	alkaloid, flavonoid, saponin, terpenoid, steroid and sterols	[116]
	Antioxidant effect	reducing sugars, terpenoids, alkaloids, steroids, tannins, flavonoids and phenolic compounds	[117]

	Anti-inflammatory, analgesic and antipyretic effects	β -amyrin, 24-methylene cycloartenol, and b-sitosterol	[118]
Fabaceae			
<i>Aspalathus linearis</i>	Antioxidant activity	dihydrochalcones aspalathin and nothofagin	[119]
<i>Caesalpinia sappan L.</i>	Anti Acne agent	brazilin	[120]
	Antimicrobial activity	steroids, tannin, phenol, saponins and flavonoids	[121]
<i>Ceratonia siliqua</i>	Antioxidant activity	gallic acid and gentisic acid	[122]
	Anti-hyperglycaemic		
	Antihyperlipidemic properties	tannins	[123]
	Gastrointestinal benefits	phenolic acids and flavonoids	[124]
<i>Clitoria ternatea</i>	Antimicrobial activities	tannin, phlobatannin, flavonoid, cardiac glycosides, volatile oils, steroids and terpenoids.	[125]
	Anti-inflammatory	phenols and flavonoids	[126]
	Anticancer effect	alkaloids, saponins and flavonoids	[127]
	Antioxidant activity	phenols and flavonoids	[128]
<i>Senna</i>	Antimicrobial activity	organic acid, flavan-3-ol, one flavone, glycosylated flavonols, proanthocyanidin dimers, and proanthocyanidin trimmers	[129]
	Antimalarial activity	piperidine	[130]
	Antioxidant and hepatoprotective	phenols and flavonoids	[131]
Ginkgoaceae			
<i>Ginkgo biloba</i>	Antioxidant, and neuroprotective effect	quercetin, myricetin	[132-133]
Grossulariaceae			
<i>Ribes nigrum</i>	Antispasmodic effect	quercetin	[134]
<i>Ribes rubrum</i>	Antioxidant, anti-inflammatory, and antiplatelet	polyphenolic and flavonoid	[135]
Lamiaceae			
<i>Lavandula angustifolia</i>	Antifungal activity	Linalool and linalyl acetate	[136]
	Antioxidants, anti-microbial, anti-cancer, anti-inflammatory and anti-diabetic effect	(-)-epicatechin, caffeic acid, gallic acid, hydroxytyrosol, kaempferol, and resveratrol, rosmarinic acid, caffeic acid, carnosol, p-coumaric acid, carnosic acid, luteolin, apigenin, and kaempferol, curcumin, colchicine, resveratrol, capsaicin, (-)-epigallocatechin, quercetin, myristicin, and elmicin, isoeugenol, coumarin, piperonal, scoparone, spathulenol, d-limonene, and myrcene	[137]
<i>Mentha piperita L.</i>	Antibacterial activity	terpenoids, steroids, phenols, flavonoids, alkaloids, and tannins	[138]
	Antioxidant activity		
<i>Mentha spicata</i>	Anti-Inflammatory	phenols and flavonoids	[139]
	Antidiabetic Activity		
	Antioxidant Activity		
<i>Monarda didyma L.</i>	Antifungal activity	thymol, γ -terpinene, p-cymene, δ -3-carene, and myrcene	[140]
	Antioxidant activity		
<i>Ocimum tenuiflorum</i>	Antimicrobial activity	camphor, eucalyptol, and eugenol	[141]
	Antihyperglycemic activity	phenols and flavonoids	[142]
<i>Origanum vulgare</i>	Antibacterial and anticancer	carvacrol, terpinen, thymol, sabinine, linalool, terpinolene, quercetin, apigenin	[143]

	Antioxidant activity	thymol, gamma-terpinene, carvacrol, carvacrol methyl ether, cis-alphabaisabolene, eucalyptol, p-cymene, and elemol	[144]
<i>Premna odorata</i>	Anti-inflammatory and Antioxidant	iridoids (monoterpenes), triterpenes, flavones, and phenylethanoids	[145]
	Antituberculosis	Phenols and flavonoids	[146]
<i>Salvia rosmarinus</i>	Antioxidant, Anti-inflammatory, and Anticancer	rosmarinic acid, luteolin-7-glucoside, rutin, ursolic acid, carnosol, and carnosic acid	[147]
<i>Thymus vulgaris</i>	Antioxidant and antimicrobial	phenols	[148]
Lauraceae			
<i>Cinnamomum verum</i>	Antioxidant	butylated hydroxyanisole, trolox, and ascorbic acid	[149]
<i>Persea americana</i>	Antioxidant activity	hydrocarbon, sterols, and unsaturated fatty acids	[150]
	Anti-inflammatory activity		
	Anticancer activity		
	Wound healing activity	lutein, carotenoids, vitamins a and e, phospholipids, glycolipids, (z,z)-1-(acetyloxy)-2-hydroxy-12,15-heneicosane-4-one, andpersenone a and b	[151]
Lythraceae			
<i>Lagerstroemia speciosa</i>	Antidiabetic property	triterpenes, tannins, ellagic acids, glycosides and flavonoids	[152]
Malvaceae			
<i>Althaea officinalis</i>	Antimicrobial activity	omega-3, palmitic acid, heptacosane, nonacosane, palmitic acid, linoleic acid (omega-6), and naphthalene decahydro 2, 6- dimethyl	[153]
<i>Hibiscus</i>	Breast cancer	phenols and flavonoids	[154]
<i>Hibiscus sabdariffa</i>	Antioxidant and antibacterial	anthocyanins, flavonoids and polyphenols	[155]
	Anti Aging assays	phenols and flavonoids	[156]
<i>Malva</i>	Antimicrobial activities	polysaccharides, coumarins, flavonoids, polyphenols, vitamins, terpenes, and tannins	[157]
	Antioxidant efficacy, Wound healing activity, Anti-inflammatory, Anti Osteoclastogenic		[158]
<i>Tilia americana</i>	Anticonvulsant activity	tiliroside	[159]
Moringaceae			
<i>Moringa oleifera</i>	Antioxidant properties, Hypolipidemic effects	polyphenols	[160]
	Anti-inflammatory	quercetin, kaempferol glycosides, glucoside malonates, acetyl glycosides, and succinoyl glycosides	[161]
	Anticancer properties	gallic acid, quercetin and kaempferol	[162]
Myrtaceae			
<i>Psidium guajava</i>	Antioxidant	phenolic compounds	[163]
Nelumbonaceae			
<i>Nelumbo nucifera</i>	Antioxidant, Cytoprotective, and Anti-angiogenic effect	rutin, catechin, sinapic acid, chlorogenic acid, syringic acid and quercetin	[164]
	anti-obesity, Antidiabetic	polyphenolics, flavonoids, and tannic acid	[165]
Oleaceae			
<i>Jasminum spp</i>	Antimicrobial activity and antioxidant	alkaloids, flavonoids (rutoside), terpenes, phenols, and iridoid glucosides	[166]
	Anti-inflammatory activity	alkaloids, flavonoids, saponins, tannins, and sterols	[167]
	Chemopreventive	alkaloids, tannins, carbohydrates, sterols and terpenoids, flavonoids, cardiac glycosides, proteins	[168]

		and amino acids.	
Paeonaceae			
<i>Paeonia</i>	Antioxidant activity	Kaempferol, luteolin, apigenin, isosalipurposide, quercetin	[169]
	Cytoprotective	paeoniflorin	[170]
Pandanaceae			
<i>Pandanus amaryllifolius</i>	Hepatoprotective effects	<u>tannins</u> , alkaloids, <u>saponins</u> , <u>terpenoids</u> and <u>flavonoid</u>	[171]
	Anti-obesity, hypertension, hyperglycemia and dyslipidemia	phenols and flavonoids	[172-173]
	Antioxidant and anticancer	rutin, epicatechin, naringin, catechin, kaempferol, gallic acid, cinnamic acid, and ferulic acid	[174]
	Antiviral activity	pandanin	[175]
	Antimicrobial	alkaloids, flavonoids, phenols, tannins, steroids, terpenoids, and carbohydrates compounds	[176]
Passifloraceae			
<i>Passiflora edulis</i>	Anti-inflammatory, hypoglycemic and hypertriglyceridemia	pectin	[177]
Phyllantaceae			
<i>Phyllanthus niruri</i>	Antioxidant, anti hepatoprotective	phenolic compounds, phyllanthin and hypophyllanthin	[178-179]
	Gastroprotective effect		
Poaceae			
<i>Bambusa vulgaris</i>	Antimicrobial activity	alkaloids, tannins, flavonoids, phenols, terpenoids	[180]
<i>Cymbopogon citratus</i>	Antibacterial activity	α -citral (geranial) and β -citral (neral)	[181-182]
	Anti-inflammatory, antifungal	essential oils	[183]
	Anti-obesity and antihypertensive	limonene, granite, citral, graminon, myrcene, and linalool	[184]
	Antioxidant activity	flavonoids	[185]
	Anti-HIV activity	not mentioned	[186]
<i>Eleusine indica</i>	Antidiabetic	flavonoids	[187]
<i>Oryza sativa</i>	Antioxidant and anti-inflammatory	glutamic acid (glu), leucine (leu), aspartic acid (asp), arginine (arg) and alanine (ala). however, drb also contained cysteine (cys), glycine (gly), histidine (his), methionine (met), phenylalanine (phe), tryptophan (trp) and tyrosine (tyr)	[188]
Polygonaceae			
<i>Rheum rhabarbarum</i>	Antioxidant activity	flavan-3-ols, flavonols, <u>anthocyanins</u> and gallotannin	[189]
	Anti-inflammatory	rhapontigenin and <u>rhaponticin</u> , typical <u>stilbenes</u>	[190]
	Anticoagulant effect		
Punicaceae			
<i>Punica granatum</i>	Antibacterial	polyphenols, tannins, flavonoids and anthocyanins (cyanidins, delphinidins)	[191]
Rosaceae			
<i>Crataegus monogyna</i>	Antioxidant and antimicrobial	polyphenols and flavonoids	[35]
<i>Fragaria ananassa</i>	Antiproliferative, anti-type 2 diabetes, and antihypertensive	ellagitannins and ellagic acid	[192]
<i>Malus domestica</i>	Antioxidant activity	quercetin and rutin	[193]
	Hepatoprotective and inhibit hepatic steatosis	flavonoid	[194]

	Gastroprotective	phenolic compounds	[195]
	Gastroprotective	phenolic acids (protocatechuic acid glucoside, (neo)chlorogenic acid, 4- hydroxybenzoic acid glucoside, <u>chlorogenic acid</u> , and <u>vanillic acid</u> glucoside), <u>coumarins</u> (aesculetin and its glucoside derivative), dihydrochalcones glucosides (phloretin glucoside, <u>phloretin</u> pentosyl-glucoside, and phlorizin) and flavonoids (kaempferol, <u>quercetin</u> and their mono and dimer glycosides)	[196]
<i>Prunus armeniaca</i>	Anticancer potential	amygdalin	[197]
<i>Prunus avium</i>	Antioxidant capacity	hydroxycinnamic acids, anthocyanins, flavan-3-ols, flavonol	[198]
<i>Prunus persica</i>	Antimicrobial activity	phenolics	[199]
	Antitumor activity	glycosides	[200]
	Antioxidant activity	phenolic and flavonoid	[201]
		ascorbic acid, citric acid and α - tocopherol	[202]
	Anti-allergic	polyphenolics and flavonoids	[203]
	Anticancer activity	polyphenolics	[204]
<i>Pyrus communis</i>	Antioxidant, anti-inflammatory, and antiproliferative activity	phenolic acids, chlorophyllide a, 9- <i>cis</i> - β -carotene, ursolic acid, polyphenols and carotenoids	[205]
<i>Rosa rubiginosa</i>	Antioxidant activity	ascorbic acid and phenolic compounds	[206]
<i>Rubus idaeus</i>	Lower weight, ambulatory activity	phenolics	[207]
Rubiaceae			
<i>Gardenia jasminoides</i>	Hepatoprotective activity	geniposide, crocins and crocetin	[208]
	Anti-inflammatory activity	crocetin	[209]
	Antidepressant activity	genipin and crocin	[210]
	Gastroprotective	genipin and ursolic acid	[211]
	Antithrombotic activity	geniposide and genipin	[212]
Rutaceae			
<i>Citrus japonica</i>	Antioxidant, cytoprotective action	limonene, germacrene d, dodecanol-1 and linolenic acid	[213]
<i>Citrus limon</i>	Antioxidant activity	phenolics and flavonoids	[214]
		lipoc acid, α - tocopherol, and ascorbic acid	[215]
		hesperidin and eriocitrin	[216]
		limonene, γ -terpinene, and β - pinene	[217]
<i>Citrus sinensis</i>	Antimicrobial	phenolics	[218]
	Antifungal	limonene, β -myrcene, β - pinene, α - pinene, citral z and e	[219]
	Antiproliferative	arabinose, galactose, xylose, rhamnose, mannose, and glucose	[220]
	Antioxidant activity	carotenoids, phenolics, α - tocopherol, and physterols	[221]
	Hypocholesterolemic	pectin oligosaccharides	[222]
	Anti-obesity activity	flavanone aglycones	[223]
Sapindaceae			
<i>Dimocarpus longan</i>	Hypoglycemic activity	gallic acid and ellagic acid	[224]
<i>Litchi chinensis</i>	Antioxidant	(-)-epicatechin, quercetin 3-o-rutinoside-7-o- α -l rhamnosidase and quercetin 3-o-rutinoside (rutin)	[225]
Solanaceae			
<i>Lycium ruthenicum</i>	Antioxidant activity	anthocyanins	[226]
	Antidiabetic potential	anthocyanins	[227]

	Anti-fatigue activities	polyphenols	[228]
Theaceae			
<i>Camellia sinensis</i>	Anti-aging activity	epigallocatechin gallate, epigallocatechin, and epicatechin gallate	[229]
	Anti-Alzheimer activity, antistroke,	fatty acids, vitamin e, squalene, phytosterol, flavonoids, and polyphenols	[230]
	Anti-parkinson activity	quercetin	[231]
	Cardiovascular diseases	theanine and quercetin	[232]
	Anticaries activity	(—)-epigallocatechin gallate and (—)-epicatechin gallate	[233]
	Antimutagenic	phenolic and flavonoid	[234]
	Anti-obesity activity	epigallocatechin gallate	[235]
	Antioxidant, anti-inflammatory	theaflavin	[236]
	Anticancer, antidiabetic, antimicrobial, and skin inflammation	catechins	[237]
Urticaceae			
<i>Urtica Dioica</i>	Antiasthmatic activity	phenol (gallic acid)	[238]
	Antibacterial, antioxidant, immunomodulatory	caffeoylmalic acid, caffeoylmalic acid dimer, and ascorbic acid	[239]
	Prevention of atherosclerosis	alkaloids and saponins	[240]
	Antiulcer activity, Analgesic activity, antioxidant, anti-apoptotic, anti-inflammatory, antifungal, and antimicrobial	melatonin and β - carotene	[241]
	Hyperglycaemic, Hypoglycaemic	flavonoids, phenolics, gallic acid, and rutin	[242]
	Antihypertensive effect	atropin	[243]
	Anti-HIV	lectin	[244]
			[245]
Vitaceae			
<i>Vitis vinifera</i>	Antioxidant capacity	melatonin	[246]
	Neuroprotective	phenolics acid (gallic acid) and flavonoids (flavonoids)	[247]
<i>Vitis coignetiae</i>	Anticancer	anthocyanins	[248]
Vitaceae			
<i>Vitex negundo</i>	Anti-inflammatory and antioxidant	3,4,9-trimethyl-7-propyl octanoic acid	[249]
Zingiberaceae			
<i>Elettaria cardamomum</i>	Antioxidant activity	phenolics, and flavonoids	[250]
<i>Zingiber officinale</i>	Antioxidant	flavonoids, polyphenols, and tannin	[251]
	Peptic ulcer	alkaloid, steroids, terpenoids, flavonoids, and resins	[252]
	Anti-inflammatory		
	Antiemetic, anxiolytic, anticonvulsant	gingerol	[253]

C. limon, commonly known as Lemon, is a key ingredient in various teas, including The Good Harvest Dried Fruit and Tea Infusion, Crafta Nutty Blueberry Balm, and Twinings of London teas. These teas claim medicinal benefits, asserting they have antioxidant properties to prevent heart diseases like heart attacks or strokes, are rich in Vitamin C, and can enhance collagen production. Lemon is recognized for its bioactive compounds, including flavonoids, phenolic acids, and vitamins. The antioxidant effect, attributed to flavonoids like hesperidin and hesperetin, can combat free radicals [254]. Moreover, Vitamin C in Lemon protects DNA from mutations and inhibits free radical production. Research indicates that dermocosmetics containing Vitamin C from *C. limon* contribute to increased collagen production

when applied externally, promoting smoother and tighter skin. When combined with Vitamin E, it acts synergistically as an antioxidant, reducing fine wrinkles and slowing down the aging process [255]. The scientific studies conducted on this medicinal plant, Lemon, likely play a crucial role in determining the effectiveness of the teas mentioned above.

The plant species *J. sambac* Linn is a prominent ingredient in Craftea Nutty Brainy and Savvy herbal tea, with claims to alleviate headache and migraine symptoms. A research study has verified that the ethanolic extract of *J. sambac* Linn leaves possesses antinociceptive activity. This pain-relieving effect is attributed to the presence of bioactive compounds in the plant, including alkaloids, tannins, flavonoids, and glycosides [256]. Consequently, the inclusion of this plant enhances the effectiveness of the mentioned tea in addressing pain-related issues.

A mixture of various medicinal plant species is evident in herbal teas, such as the Rita Ritz Pito-Pito Dried Herbal Tea. This mixture includes *Lagerstroemia speciosa*, *Psidium guajava*, *Mangifera indica*, *Pandanus amaryllifolius*, *Centella asiatica*, *Pimpinella anisum*, and *Premna odorata*. The tea is claimed to offer a range of health benefits, including lowering blood sugar, promoting healthy gums, alleviating symptoms of loose bowels, exhibiting antibacterial properties, acting as a pain reliever, aiding in wound healing, muscle relaxation, providing gastric protection, supporting the digestive system, and even contributing to the treatment of tuberculosis. The medicinal plant *C. asiatica* is noted for its antidiabetic activity attributed to asiaticoside, which facilitates increased insulin levels and enhances the secretion of healthy pancreatic β -cells. Additionally, it demonstrates significant wound healing activity in both normal and delayed healing models, with asiaticoside being the primary active constituent [257]. *P. anisum*, containing a high level of trans-anethole, exhibits wound contraction and proven wound-healing activity [258]. This plant also provides gastric protection through its anti-ulcer activity, linked to chemical constituents like α -Zingiberene, Ar-curcumene, β -Bisabolene, β -Pinene, etc. [259]. Furthermore, *L. speciosa* showcases antibacterial activity primarily due to the presence of bioactive compounds such as proteins, amino acids, glycosides, alkaloids, terpenoids, saponins, phytosterols, flavonoids, etc. [260]. The chemical compounds identified in these medicinal plants substantiate the claims associated with the tea's health benefits.

Leaves, commonly used in teas, are recognized for their richness in active compounds such as alkaloids, tannins, coumarins, flavonoids, essential oils, and inulins. These compounds, crucial in many herbal remedies, are produced and stored through photosynthesis in leaves [261]. Compared to other plant parts, leaves have the highest concentration of secondary metabolites, contributing to antibacterial, antioxidant, antibiotic, and antidiabetic properties [262-263]. Moreover, leaves are the most abundant and easily collectible plant parts, facilitating plant conservation. Utilizing diverse leaf extracts ensures better preparation of active components for medications [264].

The current investigation highlights that the predominant biological activity identified in medicinal plants is antioxidant activity. A study showed that plants naturally have antioxidants, both enzymatic (e.g., proteins) and non-enzymatic (e.g., flavonoids and polyphenols) antioxidants. These antioxidants act as a defense system, helping plants deal with different types of stress and keeping them healthy [265]. As an example, medicinal plants like *C. limon*, *Prunus persica*, and *P. anisum* were extensively studied and demonstrated a robust correlation with antioxidant activity. A previous study reveals that phytochemical screening from the fruit of *C. limon* exhibits antioxidant activity due to its bioactive compounds, such as catechin, rutin, tannic, gallic, and vanillic acids that were detected in the peel, whereas in pulp quercetin, tannic and gallic acids were found [266]. Also, different solvent extraction of this medicinal plant shows great source of phenolic compounds, flavonoids and Vitamin C. Bioactive compounds such as carotenoids, phenolic compounds, ascorbic acid, fibers, and pectins give a strong correlation to its antioxidant properties [267]. This plant is a key ingredient in various popular tea brands like Twinings of London, The Good Harvest, Craftea Nutty, and Ahmad Tea. These teas claim to enhance the immune system, stimulate collagen production, and reduce blood pressure. The antioxidants, particularly Vitamin C, present in the plant, are believed to contribute to lowering oxidative stress, thereby lowering blood pressure and providing protection against damage caused by free radicals [268]. Clinical studies on Vitamin C have affirmed its positive effects on the skin, emphasizing its role in collagen formation [269-270]. Therefore, the medicinal claims associated with these teas find support in multiple research studies.

P. persica is a rich source of bioactive compounds particularly phenols such as gallic acid (3,4,5-trihydroxybenzoic acid), protocatechuic acid, protocatechualdehyde, chlorogenic acid, p-Coumaric acid, and ferulic acid which contributes to its antioxidant activity [271]. This medicinal plant, known for its diverse health benefits, is a key ingredient in various teas, including Ahmad Tea Beauty, Flower Tea, and Herbal Slimming Tea. The teas claim to support internal cleansing, boost thermogenic activity (heat production), aid in weight loss, act as a gentle laxative for eliminating excess fats and toxins, address skin issues, and promote better sleep. Some of these claims are supported by scientific research. For instance, a study confirms that gallic acid extracted from *P. persica* has free radical scavenging activity, contributing to various biological activities like reducing cholesterol levels and providing a protective effect on the skin [272]. It's important to note that some claims may be attributed to the combined medicinal properties of multiple plants in the tea mixture.

Previous study reveals that *P. anisum* has main phenolic compounds that are responsible for its antioxidant potential such as naringin, chlorogenic acid, quercetin, gallic acid, and rosmarinic acid [273]. It was reported that naringin was the main phenolic compound of ethyl acetate aniseed extract that is known as a strong antioxidant and scavenger of free radicals [274-275]. This medicinal plant is an ingredient in RITA RITZ Pito-Pito Dried Herbal tea, combined with other medicinal plants. The tea is renowned for its diverse benefits, claiming to lower blood sugar, promote healthy gums, relieve pain, aid wound healing, relax muscles, provide gastric protection, support the digestive system, and even contribute to tuberculosis treatment. Scientific studies confirm the antioxidant potential of naringin, a bioactive compound, suggesting a significant hypoglycemic (blood sugar-lowering) effect [276-277]. This scientific basis supports the tea's claim of lowering blood sugar. A previous study highlights naringin's therapeutic benefits in addressing conditions such as gastric ulcer and lung cancer by modulating protein expressions.

Aside from antioxidant properties, some medicinal plant species exhibit anti-inflammatory and antimicrobial properties. An earlier investigation focused on the extraction of *Malva* species (*Malva sylvestris* L.), revealing that malvidin 3-glucoside is the primary bioactive compound responsible for its anti-inflammatory effect. Subsequent research identified rutin, a common flavonoid in this plant, as another potential phytochemical ingredient for treating chronic inflammation or serving as a promising functional food [278]. Recent studies have uncovered that the same *Malva* species includes 8-hydroxy-flavonoid sulphates and flavonoid glycosides, displaying bioactivity suitable for treating inflammatory diseases [279]. Moreover, another species within the *Malva* genus, *Malva parviflora*, has been identified to possess two compounds, oleanolic acid and scopoletin, which are responsible for its anti-inflammatory effect [280]. While these results may not directly validate the medicinal claim of the tea (PURETEA 14 Day Skinny Tea) regarding weight loss, various studies have explored the connection between anti-inflammatory effects and weight loss. It is mentioned that weight loss plays a crucial role in reducing inflammation, leading to a decrease in inflammation markers in the white adipose tissue of obese subjects [281]. In addition, *P. amaryllifolius* also exhibits antimicrobial properties. The extraction from the leaves of this medicinal plant contains bioactive compounds, including pandamarilactonine-A, B, C, piperidine (1 and 2), pyrrolidine (3 and 4), norpandamarilactonine-A, -B, pandamarilactone-1, pandamarine, and pandanamine, which belong to the alkaloid category. These alkaloids exhibit antibacterial properties [282], [283]. Additionally, the leaves of this plant release various secondary metabolites such as quercetin, carotenoids, tocopherols, tocotrienols, and essential oils, showcasing antitubercular activities against *M. tuberculosis* [284]. Pandanin, found in this plant, also demonstrates antiviral activities against human viruses, including herpes simplex virus type-1 (HSV-1) and influenza virus (H1N1) [285]. The significant phenolic content is suggested to be a major contributor to its antimicrobial activities against oral bacteria [286]. Several claims of RITA RITZ Pito-Pito Dried Herbal tea, such as its ability to lower blood sugar, promote healthy gums, provide pain relief, aid in wound healing, muscle relaxation, gastric protection, support the digestive system, and cure tuberculosis, were validated through the pharmacological activity of the medicinal plants within the tea. This pharmacological activity plays a crucial role in the effectiveness of the tea.

The 98 medicinal plants revealed that phenolic compounds, flavonoids, and alkaloids are the predominant bioactive constituents found in these plants. Flavonoids possess several medicinal benefits, including anticancer, antioxidant, anti-inflammatory, and antiviral properties [287] and flavonoids rutin, quercetin, naringenin, hesperitin, kaempferol, anthoxanthins, and isoflavonoids are examples. In addition, phenolic compounds are vital in defense responses, such as anti-aging, anti-inflammatory, and antioxidant effects [288]. Common phenolic compounds are gallic acid, caffeic acid, ferulic acid, ellagic acid, and rosmarinic acid. They are found abundantly in plant food and beverages, which play vital parts in pabulum and healthcare. Alkaloids have been widely studied owing to their beneficial biological properties, [289] antimalarial, antibacterial, antifungal, anti-inflammatory, and analgesic activity. Different alkaloids include piperidine, purine, and isoquinoline.

These bioactive compounds that were discovered in the 98 medicinal plants vary in their chemical structures and biological activities, however, they are both beneficial to human health and have numerous potential medical applications. For instance, flavonoids and phenolic compounds are used as antioxidants, anti-inflammatory drugs, anticancer drugs, and even have potential for managing type 2 diabetes [290-291]. Alkaloids are known to have muscle relaxant properties, antibacterial, antifungal, antitubercular, antidiabetic and anticancer [292].

CONCLUSION:

The efficacy and safety of herbal teas are crucial, especially for consumers who rely on their medicinal benefits that could treat their illnesses. Although some therapeutic claims of these commercialized herbal teas were validated by some laboratory-based investigations, there are still several plant species contained in herbal teas that are less investigated and provide less information about their purported activities. Additionally, limited studies were conducted about the toxicity of each plant to human health. Herbal teas have been made from a wide variety of plants, either separately or in combination, but research into how those plants interact biochemically is still lacking.

Given the diverse composition of various plants present in herbal teas, thorough laboratory investigations are essential to explore the biochemical reactions linked to the bioactive compounds in each plant, particularly those sharing similar medicinal properties/functions. This research is essential for assessing the efficacy of herbal teas and holds the potential for establishing a pharmacological foundation for future medical development. This study also recommends additional research on the biochemical analysis of each medicinal plant's natural compounds, particularly to determine any potential toxicity or adverse reactions that can help more in revealing the underlying structure and relationships between medicinal plants and medicinal properties.

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