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Herbal Functional Foods: Traditional Uses and Modern Scientific Evidence

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Abstract
Herbal functional foods represent a unique intersection between traditional medicine and modern nutritional science. These foods, derived from medicinal plants, have long been used in various cultural systems such as Ayurveda, Traditional Chinese Medicine (TCM), and indigenous healing practices for their health-promoting properties. In recent decades, scientific research has begun to validate many of these traditional claims, revealing bioactive compounds responsible for a range of physiological benefits, including antioxidant, anti-inflammatory, immunomodulatory, and cardioprotective effects. This review explores the traditional uses of prominent herbal functional foods such as turmeric, ginger, garlic, ginseng, and holy basil, and examines contemporary scientific studies that support their efficacy and mechanisms of action. Additionally, the article discusses the challenges related to safety, standardization, and regulatory approval, while highlighting the potential of these herbs in the prevention and management of chronic diseases. The integration of traditional knowledge with modern scientific validation provides a promising foundation for the future of functional nutrition and evidence-based herbal therapeutics.

Keywords: Herbal Functional Foods; Traditional Medicine; Phytochemicals; Scientific Evidence; Bioactive Compounds.

1.0 Introduction

Herbal food items are naturally occurring foods that provide essential nutrients and health benefits through bioactive compounds derived from herbs. Historically, various cultures have employed these foods for the prevention and management of illness, illustrating the connection between nutrition and medicine. This relationship is now being validated by contemporary scientific research. Ayurveda, (TCM), and Unani, among other traditional indigenous medical and dietary practices, have for centuries utilized herbal functional foods.

Some of the foods that have been used for their perceived medicinal value for centuries include turmeric, ginger, garlic, and ginseng (Zhang *et al*., 2015). Turmeric has been included in Indian cuisine and traditional medicine for centuries due to its potent anti-inflammatory and antioxidant properties.

Recent scientific research validates the traditional uses of phytochemicals found in herbs like curcumin in turmeric, allicin in garlic, and ginsenosides in ginseng. These phytochemicals exhibit a variety of biological activities such as anti-inflammatory, antioxidant, antibacterial,

and anticancer activity. The evidence indicates that incorporating herbal ingredients into our diets could potentially increase cardiovascular health, immunity, metabolism, and decrease the risk of chronic diseases. Ongoing clinical and preclinical studies are further exploring the therapeutic potential of these bioactive compounds in preventing and managing diseases such as diabetes, cancer, and neurodegenerative disorders, indicating the relevance of natural health interventions on a global scale (Aggarwal *et al*., 2007). The last few decades have seen a large-scale global inclination towards natural health remedies, driven by safety issues with side effects of synthetic medicines, the increasing burden of chronic diseases, and a greater awareness of public interest in holistic health.

Consumers increasingly prefer alternatives that adhere to safety, sustainability, and traditional knowledge systems. The synergy between food ingredients with medicinal properties has prompted novel interest in herbal medicine and functional foods (Nasri *et al*., 2014).

Herbal medicine has been a core constituent of traditional systems of medicine globally, having an irreplaceable role in health and healing (Nasri *et al*., 2014). Ayurveda, which was created in India more than 3,000 years ago, uses many herbs like ashwagandha, turmeric, and holy basil to balance the systems of the body and prevent disease (Patwardhan *et al*., 2005). TCM employs herbs such as ginseng, licorice root, and ginger in diet and medicinal form to bring about harmony in the body and promote longevity (Wang *et al*., 2012).

Various systems, notably Unani and Kampo, have maintained the use of herbs in their medical practices, integrating them as essential elements of daily nutrition and health care. These systems emphasize the importance of not only treating illnesses but also preventing diseases through dietary practices that incorporate therapeutic plants. This article aims to bridge the gap between traditional knowledge and contemporary research by examining herbal functional foods—nutritional products abundant in bioactive compounds derived from medicinal herbs that offer enhanced health benefits. This study highlights the longstanding use of herbal consumption within recognized therapeutic practices, while also reinforcing scientific evidence that supports their effectiveness in enhancing health and preventing illness.

The scope includes:

- A review of herbs commonly used as functional foods across cultures.
- Examination of the phytochemicals responsible for health-promoting effects.
- Insights into modern clinical studies and mechanisms of action.
- Considerations for regulatory frameworks and safety evaluations.

Researchers, healthcare providers, and consumers can be better informed about the benefits and possibilities of herbal functional foods in modern health care by reading this article, which combines traditional knowledge with modern scientific research.

1.1 Traditional Uses of Herbal Functional Foods

For thousands of years, herbal functional foods have been an integral part of traditional diets and healing methods in many countries. These foods, frequently derived from plants with both nutritional and therapeutic capabilities, have been deeply interwoven into the culinary and medical traditions of ancient civilizations. Their application highlights a comprehensive awareness of the connection between food and health and represents long-standing ethnobotanical knowledge that has been passed down through the centuries (Etkin *et al*, 2006).

In Ayurveda, the traditional medical system of India, many plants are not only prescribed as medicine but are also integrated into daily diets to preserve balance and avoid illness. For example, turmeric (*Curcuma longa*) is utilized for its anti-inflammatory and detoxifying effects, while holy basil (Ocimum sanctum) is ingested to increase immunity and relieve stress (Patwardhan *et al*., 2005). Similarly, ginger (*Zingiber officinale*) is commonly used to assist

digestion and cure respiratory disorders. TCM has also long acknowledged the therapeutic potential of herbs within meals. The concept of "yao shi tong yuan" — meaning "medicine and food share the same origin" — highlights the belief that diet is a sort of medicine. Commonly used TCM herbs such as goji berries (*Lycium barbarum*), ginseng (Panax ginseng), and licorice root (Glycyrrhiza glabra) are used in soups, drinks, and meals to improve energy, nourish the body, and support organ function (Wang *et al*., 2012).

Herbs, both cultivated and wild, have long been used as medicine and nourishment in Indigenous American and African civilizations. Plants like moringa (*Moringa oleifera*) and baobab (*Adansonia digitata*) are rich in critical minerals and have been used to cure a wide range of diseases, from infections to nutritional inadequacies (Leonti, 2011).

These examples highlight the cultural relevance and ethnobotanical wisdom underlying the usage of herbal functional meals. Such methods are founded on long-standing empirical knowledge, typically tailored to the local environment, seasonal cycles, and health beliefs of distinct cultures. With the development of interest in sustainable and natural health solutions, this traditional knowledge is now being increasingly confirmed by current scientific research and integrated into contemporary health systems (Nasri *et al*., 2014).

1.2 Key Herbals and Their Traditional Uses

1.2.1 Turmeric

Turmeric (*Curcuma longa*) has been highly respected in ancient systems of medicine, such as Ayurveda and ancient Chinese Medicine, for thousands of years due to its extensive spectrum of medical advantages. Turmeric is native to South Asia and is commonly cultivated in India. It is a medicinal and spice herb that is well incorporated into the local culture and religion.

Turmeric is an Ayurvedic "deepana" (stimulant) and "pachana" (digestive) and is traditionally used to alleviate indigestion, bloating, and loss of appetite on a daily basis. It is also utilized in formulations to treat liver disorders and gastrointestinal inflammation. The warming character of turmeric and its dosha-balancing action—particularly of kapha and vata—render which are two of the three fundamental doshas in Ayurveda—biological energies derived from the five elements that govern all physical and mental processes in the body and also boosting metabolic activity and removing toxins (ama) from the digestive tract, it a crucial ingredient of detoxification and rejuvenation therapies (Kumar *et al*., 2017).

Additionally, turmeric has also been used as an anti-inflammatory treatment in traditional medicine for ages. It has been administered topically as a paste to heal wounds, skin diseases, and joint pain related to arthritis or injury. This use is largely ascribed to its active ingredient, curcumin, which lends the yellow hue and has historically been considered to purify the blood and cure a variety of ailments, including digestive disorders, skin diseases, respiratory issues, and joint inflammation (Ammon & Wahl, 1991).

In TCM, turmeric—more accurately, its dried rhizome, jiang huang—is utilized to activate the blood, ease discomfort, and heal menstrual disorders and chest or abdominal pain caused by "blood stasis" (Wang *et al*., 2012).

Apart from its medicinal purpose, turmeric is also a functional food since it has been a typical spice used in day-to-day cookery, particularly in curries, teas, and tonics, thus adding to preventative health advantages on a continuing basis. Its employment in rituals of cultural events, such as golden milk (turmeric latte) or as purifying rituals, indicates its ethnobotanical relevance.

1.2.2 Ginger

A common culinary and therapeutic herb, ginger (*Zingiber officinale*) has a long history of traditional use in many different medical systems, particularly Ayurveda**,** TCM, and Unani. Revered for its warming, pungent characteristics, ginger has been predominantly utilized for its efficiency in treating digestive issues and nausea-related ailments.

In Ayurvedic medicine, ginger is categorized as a "universal medicine" (vishvabhesaj), appreciated for its ability to accelerate digestion (agni) and reduce stomach distress. It is widely advised in both fresh and dried forms to address concerns such as indigestion, bloating, flatulence, and constipation. Its heating tendency is also considered to balance the vata and kapha doshas, which are two of the three fundamental doshas in Ayurveda (Sharma *et al*., 2005).

In TCM, ginger is utilized both fresh (sheng jiang) and dried (gan jiang), both with specific therapeutic effects. Fresh ginger is frequently prescribed for nausea, vomiting, and coughing, especially those linked with cold and wet circumstances, while dried ginger is used to warm the stomach, promote digestion, and replenish "yang" energy in cases of weariness and chilly extremities (Zhou & Huang, 2017).

Historically, ginger has also been a functional item included in everyday meals, not just for its flavor but also for its medical properties. Herbal teas, congee, spiced meals, and fermented drinks like ginger beer have long been utilized as natural cures for motion sickness, morning sickness, and overall gastrointestinal discomfort.

The usefulness of ginger in decreasing nausea—particularly related to pregnancy, chemotherapy, and travel—has also been documented in traditional and folkloric medicine across Middle Eastern, African, and Southeast Asian cultures, frequently in the form of ginger infusions or decoctions (White, 2007).

1.2.3 Garlic

Garlic (*Allium sativum*) has been utilized for millennia as both a food and a therapeutic agent in many traditional systems, including Ayurveda, TCM, Unani, and folk medicine around the world. Its rich flavor and profound health effects have won it a place as a staple functional food with acknowledged cardiovascular benefits.

In Ayurveda, garlic is known as Rasona and is acclaimed for its "tridoshic" balancing effects—especially in lowering vata and kapha. Traditionally, it has been used to boost circulation, decrease blood pressure, and support heart health. It is also employed as a digestive stimulant, detoxifier, and rejuvenative tonic, notably in formulations targeted at strengthening the cardiovascular and respiratory systems (Sharma *et al*., 2005).

In TCM, garlic is recognized as a warming herb that helps to alleviate interior cold, eliminate impurities, and promote the flow of qi (vital force). It is traditionally used for its cardioprotective and antibacterial benefits, typically given to promote blood circulation, dissolve stagnation, and eliminate "dampness" that may compromise heart health (Zhou *et al*., 2016).

Garlic has also been well recognized in Mediterranean and Middle Eastern traditional medicine, where it has been ingested raw, boiled, or as an infusion to maintain normal blood pressure, lower cholesterol levels, and minimize the risk of cardiovascular disease. These applications are backed by their historic application as a "heart tonic", believed to strengthen the arteries and improve longevity (Rahman & Lowe, 2006).

The major bioactive ingredient in garlic, allicin, is responsible for many of its medicinal actions. While current research has verified its significance in decreasing blood cholesterol levels, enhancing endothelial function, and inhibiting platelet aggregation, these advantages

are deeply anchored in its historic use as a cardioprotective agent in food-based healing systems (Amagase, 2006).

1.2.4 Ginseng

Ginseng, particularly Panax ginseng (Asian or Korean ginseng) and Panax quinquefolius (American ginseng), has been a cornerstone of traditional herbal treatment in East Asia and North America for ages. It is historically classed as an adaptogen—a natural ingredient believed to assist the body in resisting physical, mental, and emotional stress—and is frequently used to increase general vitality, stamina, and longevity.

In TCM, Panax ginseng (known as Ren Shen) is regarded as a "superior tonic" herb. It is thought to boost **qi (vital energy**), particularly of the lungs and spleen, and to nurture the body's essence. It is often given for symptoms of exhaustion, weakness, anxiety, and immunological deficiency, as well as for boosting mental clarity and resilience against stress (Yuan *et al*., 2012). The herb is typically added to food preparations such as ginseng soup or tea for prolonged health benefits.

In Korean traditional medicine, ginseng has been similarly respected for its rejuvenating benefits. It is used to improve energy, support immunological function, and minimize the effects of stress and aging. Traditional formulations commonly blend ginseng with other herbs in tonics designed for persons recovering from sickness, surgery, or chronic weariness (Christensen *et al*., 2009). Native American tribes have also utilized American ginseng (Panax quinquefolius) traditionally as a cooling tonic to ease tension, promote digestion, and enhance general wellness. It was typically drunk as a tea or chewed in its raw form.

These long-standing traditional uses are backed by the plant's presence of ginsenosides, bioactive saponins believed to control the hypothalamic-pituitary-adrenal (HPA) axis, which plays a vital role in the body's stress response. The adaptogenic benefits of ginseng are also reflected in its present reputation as a functional food ingredient that promotes physical endurance, cognitive performance, and stress tolerance.

1.2.5 Holy Basil

Holy Basil (*Ocimum sanctum*), commonly known as Tulsi, maintains a revered and essential place in Ayurvedic medicine and ancient Indian culture. Referred to as the "Queen of Herbs," Tulsi is appreciated not only for its spiritual importance but also for its numerous therapeutic characteristics, including its ability to increase immunity and promote respiratory health.

In Ayurveda, Tulsi is classed as a Rasayana—a rejuvenative herb thought to increase lifespan, energy, and resilience to stress. It is traditionally used to enhance the immune system, lower fever, and defend against infections, particularly those affecting the respiratory tract (Pattanayak *et al*., 2010). Decoctions produced from Tulsi leaves, frequently blended with ginger and honey, are commonly used to cure coughs, colds, asthma, and bronchitis.

Its antibacterial, anti-inflammatory, and expectorant effects have been widely recognized in folk treatments across South Asia. It is drunk as a herbal tea, soaked in ghee, or added to dishes as a spice to avoid seasonal infections and increase respiratory well-being (Mondal *et al*., 2009). Tulsi is also used in home-based therapies to reduce nasal congestion and boost lung function.

Traditional practitioners also emphasize Tulsi's significance in moderating the body's stress response, making it a great adaptogen. It is said to help balance the body's systems, purify the blood, and promote mental clarity and serenity, all of which contribute to its reputation as a holistic tonic (Jamshidi & Cohen, 2017).

The immune-enhancing and respiratory advantages of *Ocimum sanctum* are ascribed to its rich phytochemical composition, including eugenol, ursolic acid, and rosmarinic acid, which are renowned for their antioxidant, antibacterial, and anti-inflammatory effects. These chemicals support its longstanding traditional use as both a preventative and curative food-based medicine.

2.0 Discussion on Preparation Methods in Traditional Practices

The preparation methods of herbal functional foods are deeply entrenched in traditional customs, reflecting the substantial knowledge of the qualities and uses of herbs that have been passed down through centuries. These approaches not only retain the medicinal components of the plants but also boost their effectiveness when taken for specific health advantages. Traditional herbal medicines generally blend herbs in methods that enhance their therapeutic effectiveness, considering criteria such as dosage, combination, and timing. Modern research is beginning to validate these old procedures, adding a layer of information regarding the bioavailability and efficacy of these treatments.

2.1 Infusions and Decoctions

Infusions and decoctions are among the most frequent methods of producing herbal functional meals, particularly in countries with a strong heritage of herbal medicine, such as Ayurveda and TCM.

Infusions are prepared by steeping herbs in hot water for a period, often used for leaves, blossoms, and soft sections of plants. This approach is most typically used for herbs like Holy Basil (*Ocimum sanctum*), ginger (*Zingiber officinale*), and chamomile (*Matricaria chamomilla*). The heat helps to extract water-soluble elements like vitamins, antioxidants, and essential oils, which have medicinal effects, such as improving immunity or alleviating stress.

Decoctions, on the other hand, are created by boiling tougher components of plants, such as roots, bark, and seeds, in water for an extended duration. This approach is used for more fibrous and thick herbs like ginseng (Panax spp.) and turmeric (Curcuma longa). Decoctions are useful in extracting alkaloids, saponins, and polysaccharides, substances recognized for their potency in increasing vitality and healing digestive or inflammatory problems. These methods allow the bioactive components to be efficiently released into the liquid, making them easily absorbable by the body. Modern scientific evidence supports the efficiency of infusions and decoctions, particularly in the extraction of compounds such as curcumin from turmeric and ginsenosides from ginseng, both of which have been studied extensively for their therapeutic effects (Amagase, 2006; Sharma *et al*., 2005).

2.2 Tinctures and Extracts

In both Ayurvedic and Western herbalism, tinctures and extracts are created by soaking herbal material in alcohol or glycerin for a period of time, generally several weeks. The alcohol serves as a solvent, pulling out the active components from the herb.

Tinctures are widely used for herbs such as garlic *(Allium sativum), turmeric (Curcuma longa), and ginger (Zingiber officinale),* which are recognized for their cardiovascular health and anti-inflammatory effects. Tinctures are strong, and the alcohol employed in their creation also aids in the preservation of the herb's medicinal characteristics for lengthy durations.

Extracts are more concentrated variants of tinctures, generally made by employing solvents like ethanol, methanol, or supercritical CO_2 to extract certain medicinal components. For example, curcumin extracts from turmeric are routinely standardized to a precise concentration for their anti-inflammatory and antioxidant benefits.

The present trend of standardized extracts has led to a clearer understanding of dosage and the precise therapeutic effects of individual chemicals. Research on allicin, the bioactive ingredient in garlic, for instance, has proved its cardiovascular effects when concentrated in tinctures (Rahman & Lowe *et al*., 2006).

2.3 Herbal Teas and Powders

Herbal teas made from pulverized dried herbs are another ancient method of producing herbal functional meals. These preparations are simple yet effective in delivering the medicinal advantages of plants in a digestible and easy manner.

Herbal powders are often generated from the dried and finely ground sections of plants, such as turmeric, holy basil (*Ocimum sanctum*), and ginseng. These powders can be taken with warm water, combined into smoothies, or used in cooking. They are commonly utilized for their digestive and immune-boosting effects.

In traditional Ayurvedic treatment, Churna (powdered herbal concoctions) is utilized as an easy-to-administer dose form. For example, triphala powder—a mix of three fruits—is widely eaten to aid digestion and detoxification.

The use of powdered turmeric in foods and drinks, such as golden milk (a turmeric latte), is gaining popularity globally due to its purported anti-inflammatory benefits, which are supported by modern scientific studies on curcumin's bioavailability and its therapeutic efficacy (Aggarwal *et al*., 2007).

2.4 Fermentation

Fermentation, a traditional method of preparing functional foods, enhances the bioavailability and digestibility of herbs. Fermented herbal products like ginger beer (fermented ginger drink) and miso (fermented soy with herbs) not only preserve the herbs but also introduce beneficial probiotics that support gut health and immune function (El-Sohaimy *et al.*, 2023).

Fermented forms of herbs are gaining popularity due to their ability to enhance bioactivity. For example, fermented ginseng has shown increased bioavailability of its active compounds, such as ginsenosides, which enhances its adaptogenic effects in the body (Kim *et al*., 2013).

2.5 Pastes and Ointments

In traditional healing systems, pastes or ointments made from herbs are commonly used for topical applications. For example, turmeric is often mixed with water or oils to create a paste for wound healing or skin conditions. Ginger is also used topically in pastes to reduce muscle pain and inflammation.

These topical applications are validated by modern studies, which have shown that curcumin in turmeric pastes can reduce inflammation and promote healing in skin injuries (Ammon & Wahl *et al*., 1991).

3.0 Scientific Evidence and Mechanisms of Action

3.1 Curcumin

Curcumin, the principal bioactive ingredient in turmeric, displays anti-inflammatory, antioxidant, and anticancer activities through its modulation of important signaling pathways such as NF-κB, MAPK, and Nrf2, which are crucial in controlling inflammation and oxidative stress (Table 1). Numerous clinical studies have emphasized curcumin's potential in relieving inflammation and pain associated with illnesses, including osteoarthritis and rheumatoid arthritis, although its effectiveness is sometimes impeded by its poor bioavailability. To solve this difficulty, curcumin formulations commonly contain piperine, a component found in black

pepper, to improve absorption. Scientific research, including a comprehensive analysis published in Phytotherapy Research, emphasizes the beneficial effects of curcumin supplementation in lowering inflammation and pain in arthritic patients, supporting its therapeutic potential despite bioavailability problems (Hewlings *et al.*, 2017).

3.2 Ginger (*Zingiber officinale*)

Gingerol and shogaol, the major bioactive chemicals in ginger, display antioxidant, anti-inflammatory, and antiemetic actions, with their anti-inflammatory characteristics linked to the modulation of COX-2 and 5-LOX pathways. Clinical research has revealed ginger's usefulness in treating nausea and vomiting, notably chemotherapy-induced nausea, while also emphasizing its potential to alleviate pain and inflammation in osteoarthritis (Bischoff-Kont, *et al.*, 2021). Ginger's bioactive components are moderately accessible, although their absorption can be enhanced by particular formulations. Supporting its therapeutic potential, a meta-analysis published in The Journal of Pain revealed that ginger supplementation significantly reduced osteoarthritis pain and improved joint function, reaffirming its role in regulating inflammation and pain (Lee *et al*., 2011).

3.3 Garlic (*Allium sativum*)

Allicin, a significant bioactive ingredient in garlic, is generated when garlic is crushed or chopped and displays antibacterial, antioxidant, and anti-inflammatory activities. It also aids cardiovascular health by decreasing blood pressure and cholesterol levels. Numerous studies have proven garlic's efficiency in decreasing these variables and emphasized its anticancer potential, particularly in the prevention of stomach cancer (Talib *et al.*, 2024). However, allicin is fragile and commonly converts into more stable molecules, like S-allyl cysteine, during processing to retain its health effects. Supporting its cardiovascular advantages, a meta-analysis published in The Journal of Clinical Hypertension indicated that garlic supplementation significantly decreased blood pressure in hypertension patients, underscoring its therapeutic value (Ried *et al*., 2013).

3.4 Ginseng (*Panax ginseng*)

Ginsenosides, the principal active chemicals found in ginseng, possess adaptogenic qualities that assist the body in handling stress and exhaustion. They also demonstrate neuroprotective, anti-inflammatory, and anticancer properties. Clinical research has demonstrated that ginseng promotes mental function, boosts energy levels, and lowers exhaustion in both healthy persons and those with chronic fatigue syndrome. (Reay *et al*., 2005; Kim *et al*., 2013). However, ginsenosides are often poorly absorbed; however, they can be converted into more bioavailable molecules in the gut. Reinforcing its therapeutic benefits, a comprehensive review published in The Journal of Ginseng Research indicated that ginseng supplementation considerably enhanced cognitive performance, notably in those with Alzheimer’s disease (Reay *et al*., 2005).

3.5 Holy Basil (*Ocimum sanctum*)

Holy basil, widely known as tulsi, includes active phytochemicals such as eugenol, ursolic acid, and rosmarinic acid, which contribute to its adaptogenic and anti-inflammatory qualities. These chemicals are recognized for their antioxidant and anti-stress effects, as well as their capacity to modulate the immune system and boost the body's defense mechanisms. Clinical studies have shown that holy basil supplementation can successfully reduce stress and anxiety while improving metabolic health by reducing blood sugar and cholesterol levels. The bioactive components in holy basil are relatively accessible and quickly absorbed, boosting its

therapeutic impact. Supporting its stress-relief benefits, a clinical trial published in The Journal of Clinical Psychology (Sharma *et al*., 2008) found that holy basil significantly alleviated stress and anxiety in individuals facing work-related pressures, emphasizing its potential as a natural remedy for stress management.

Table 1
Summary of Herbs, Key Compounds, Traditional Use, and Scientific Evidence

Herb	**Key Compounds**	**Traditional Use**	**Scientific Evidence**
Turmeric	Curcumin	Anti-inflammatory, wound healing, digestive aid	Reduces inflammation and pain in arthritis, antioxidant properties (Hewlings, 2017)
Ginger	Gingerol, Shogaol	Nausea relief, digestive aid, pain relief	Effective for nausea and osteoarthritis pain, anti-inflammatory (Lee *et al*., 2011)
Garlic	Allicin, S-allyl cysteine	Cardiovascular health, antimicrobial, and digestive	Reduces blood pressure and cholesterol, anticancer effects (Ried *et al*., 2013)
Ginseng	Ginsenosides	Energy booster, cognitive enhancer, anti-fatigue	Improves cognitive function, reduces fatigue (Reay *et al*., 2005)
Holy Basil	Eugenol, Rosmarinic acid	Stress relief, metabolic support, immunity boost	Reduces stress, lowers blood sugar and cholesterol (Sharma *et al*., 2008)

4.0 Health Benefits and Applications

4.1 Role in Prevention and Management of Chronic Diseases

4.1.1 Anti-inflammatory Effects

Chronic inflammation is a prevalent underlying cause in many chronic diseases, including cardiovascular disorders, arthritis, diabetes, and cancer. Several plants possess significant anti-inflammatory qualities, which have been proven to help manage or prevent certain illnesses.

Turmeric (*Curcuma longa*): The active component curcumin is intensively explored for its anti-inflammatory effects. It suppresses pro-inflammatory pathways like NF-κB and COX-2, making it beneficial in disorders like osteoarthritis and inflammatory bowel diseases (Hewlings *et al*., 2017).

Ginger (*Zingiber officinale*): Gingerol, the major active ingredient in ginger, provides anti-inflammatory actions by regulating the activity of inflammatory cytokines such as TNF-α and IL-6 (Lao *et al*., 2001). This makes ginger beneficial for reducing pain and inflammation in osteoarthritis and rheumatoid arthritis.

Holy Basil (*Ocimum sanctum*): Holy basil's active components, particularly eugenol, display substantial anti-inflammatory actions, helping in the management of stress-related inflammatory illnesses (Sharma *et al*., 2008).

4.1.2 Antioxidant Effects

Oxidative stress induced by free radicals is a major element in the pathogenesis of diseases like cancer, cardiovascular diseases, and neurological ailments. Herbal functional foods with antioxidant qualities assist in preventing oxidative damage by neutralizing free radicals, enhancing the body's defense mechanisms, and reducing inflammation, thereby contributing to the prevention and management of chronic diseases (Lobo *et al*., 2010).

Turmeric (*Curcuma longa)*: Curcumin's powerful antioxidant properties are attributed to its capacity to scavenge free radicals and improve the activity of antioxidant enzymes. This adds to its protective properties against diseases, including cancer and heart disease (Bertoncini-Silva *et al.*, 2024)

Ginger (*Zingiber officinale*): In addition to its anti-inflammatory qualities, ginger also works as a potent antioxidant, decreasing oxidative stress and minimizing cellular damage in illnesses such as diabetes (Xie *et al*., 2015).

Garlic (*Allium sativum*)**:** Allicin, one of the essential chemicals in garlic, has been proven to exert antioxidant properties, limiting oxidative damage to cells and tissues, which is advantageous for cardiovascular health (Ried *et al*., 2013).

4.1.3 Immunomodulatory Effects

Herbal functional meals can alter immune system activity, either activating or suppressing it to maintain balance and prevent disease.

Holy Basil (*Ocimum sanctum*): Holy basil contains immunomodulatory properties that increase immunological responses. It stimulates the activity of natural killer cells and macrophages, giving protection against infections and inflammation. (Madaan *et al.*, 2025)

Ginseng (*Panax ginseng*)**:** Ginseng has been proven to improve the activity of immune cells such as T lymphocytes and natural killer cells, helping the immune system during periods of stress or disease (Reay *et al*., 2005).

Garlic (*Allium sativum*): Garlic's immune-boosting qualities are well-documented. Allicin, along with other sulfur compounds, helps promote the formation of white blood cells, improving the body's defense systems against infections (El-Saadony *et al.*, 2024)

4.1.4 Cardiovascular and Metabolic Health

Herbal functional meals serve a key role in enhancing heart health and treating metabolic illnesses like diabetes, hypertension, and obesity.

Garlic (*Allium sativum*): Numerous studies have shown that garlic supplementation can considerably reduce blood pressure and cholesterol levels, making it a vital tool in preventing and controlling cardiovascular disorders (Ried *et al*., 2013). Additionally, garlic assists in reducing the risk of atherosclerosis by preventing the oxidation of low-density lipoprotein (LDL) cholesterol and inhibiting platelet aggregation, thereby improving overall vascular health.

4.1.5 Oxidative damage to blood vessels.

Ginger (*Zingiber officinale*): Ginger is known to help in decreasing blood pressure and regulating blood sugar levels, which is good for managing type 2 diabetes and hypertension (Mahomoodally *et al*, 2013).

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Turmeric (*Curcuma longa*)**:** Curcumin has demonstrated potential effects in controlling lipid metabolism, decreasing LDL cholesterol, and avoiding the development of atherosclerosis (Hewlings *et al*, 2017).
Ginseng (*Panax ginseng*): Ginseng has been reported to promote blood circulation, reduce blood sugar levels, and enhance insulin sensitivity, making it good for diabetes and cardiovascular health (Liao *et al*., 2012).

5.0 Integration into Modern Diets
As scientific data supporting the benefits of herbal functional meals continues to emerge, these herbs are increasingly being included in modern diets in a variety of formats.

5.1 Supplements
Herbal supplements, whether in capsule, tablet, or liquid form, are among the most popular ways these herbs are used today. This provides a handy technique of taking concentrated dosages of bioactive chemicals for certain health concerns.
Curcumin pills are readily accessible and are utilized for their anti-inflammatory and antioxidant properties, especially in the treatment of osteoarthritis and other inflammatory disorders.
Ginseng pills are touted as energy boosters and cognitive enhancers, helping overcome weariness and increase mental function.

5.1.1 Teas
Herbal teas are a popular and traditional way to include therapeutic plants in the diet. They offer a mild and bioavailable approach to absorb these herbs for health advantages.
Ginger tea is often used for digestive health, anti-nausea effects, and to reduce muscle pain and inflammation.
Holy Basil (Tulsi) tea is frequently consumed to relieve stress, promote immunity, and maintain metabolic health.
Turmeric tea is becoming increasingly popular for its anti-inflammatory and antioxidant effects, sometimes drunk with black pepper to improve curcumin absorption.

5.1.2 Fortified Foods
Functional foods are also being blended into common food products, allowing customers to obtain health advantages without the need for supplementation.
Curcumin-fortified foods: Products like curcumin-infused milk, curcumin-enriched rice, and fortified beverages are becoming more widespread in markets, particularly in places like India.
Ginger in functional foods: Ginger is being added to snacks, energy bars, and smoothies for its anti-inflammatory and digestive effects.

5.1.3 Functional Beverages
Energy drinks, health shots, and smoothies, which are infused with herbs like functional beverages incorporating herbal components, are increasingly popular. These include turmeric, ginger, and holy basil.
Ginger-based health beverages are often consumed for digestive help and to increase immunity.
Turmeric lattes (golden milk) have acquired popularity due to their anti-inflammatory benefits, generally made with turmeric, black pepper, and coconut milk (Wang *et al.*, 2018).

6.0 Safety, Dosage, and Regulatory Aspects

6.1 Toxicity Concerns

Despite the lengthy history of usage in traditional medicine, herbal functional foods can bring toxicity hazards, particularly when ingested in large amounts or over protracted durations. While most herbs are generally regarded as safe when ingested in moderate amounts, many plants contain components that could be poisonous in high concentrations or may represent hazards in specific populations, such as pregnant women, children, or those with preexisting health conditions.

Turmeric **(***Curcuma longa*): Curcumin, the active ingredient in turmeric, is typically safe at dietary amounts. However, excessive ingestion may lead to gastrointestinal disorders such as nausea or diarrhea (Hewlings, 2017). High doses of turmeric supplements may also interact with anticoagulant medicines, thereby raising the risk of bleeding (Zeng *et al*., 2015).

Ginseng (*Panax ginseng***):** While ginseng is often used for its energy-boosting characteristics, excessive use can lead to negative effects such as sleeplessness, migraines, and gastrointestinal issues. Ginseng may also produce an elevation in blood pressure and heart rate in sensitive individuals (Liao *et al*., 2012).

Garlic (*Allium sativum*): Garlic, when used in therapeutic doses, can produce gastrointestinal discomfort, and excessive consumption may lead to a risk of bleeding, especially in persons on blood-thinning drugs (Ried *et al*., 2013).

It is vital to emphasize that safety problems come not only from the toxicity of specific plants but also from the potential inclusion of contaminants, such as pesticides, heavy metals, or adulterants, in unregulated herbal products.

6.2 Herb-Drug Interactions

Herbal functional meals can interact with prescription and over-the-counter pharmaceuticals, which may lead to unwanted effects or modify the efficacy of the medications. These herb-drug interactions can occur through many mechanisms, including enzyme stimulation or inhibition, interference with medication absorption, or altered metabolism.

Ginger (*Zingiber officinale*)**:** Ginger may interact with anticoagulant drugs like warfarin. It can decrease platelet aggregation, which could improve the anticoagulant effect and raise the risk of bleeding (Lao *et al*., 2001).

Garlic (*Allium sativum***):** Garlic's blood-thinning effects may also interfere with anticoagulant drugs, increasing the risk of bleeding. It has also been proven to interact with certain HIV drugs, such as protease inhibitors, lowering their efficiency (Harrison *et al*., 2015).

Turmeric (*Curcuma longa*): Curcumin can interact with medicines that are processed by the liver's cytochrome P450 enzyme system. For example, it can disrupt the metabolism of medications like cyclosporine, a treatment used in organ transplant recipients (Cheng *et al*., 2001).

It is vital for those taking pharmaceuticals to consult a healthcare physician before adding herbal supplements to their routine to avoid potential drug interactions.

6.3 Standardization and Quality Control

One of the key problems surrounding herbal functional foods is the heterogeneity in the content of herbal products. Herbs are complex mixes of bioactive components, and the effectiveness of these compounds can vary depending on factors such as the plant's geographic origin, harvest time, processing methods, and storage conditions. Standardization and quality control are crucial to ensure that herbal products produce consistent and effective outcomes.

Standardization: Standardization refers to the process of ensuring that a herbal product includes a consistent amount of the active compound(s) responsible for its medicinal benefits. For example, in the case of turmeric, standardization may involve guaranteeing that a product contains a specified amount of curcumin, the active component, to guarantee its potency (Hewlings, 2017). Standardization is also vital for verifying that the product contains no dangerous amounts of pollutants such as pesticides or heavy metals.
Quality Control: Quality control entails verifying the purity, potency, and safety of herbal products. This includes testing for the presence of impurities, maintaining correct manufacturing methods, and validating that the product has the specified contents. Adulteration, a major worry with herbal remedies, can occur when a product contains a chemical not specified on the label, potentially causing injury or lowering efficacy.
Regulatory bodies and industry guidelines generally require producers to apply good manufacturing procedures (GMP) and quality control techniques to assure the safety and efficacy of herbal products.

6.4 Global Regulatory Frameworks

The regulation of herbal functional foods differs from country to country, with different bodies responsible for ensuring the safety, quality, and efficacy of these items. Below, we will explore the regulatory frameworks of three significant entities: the U.S. Food and Drug Administration (FDA), the European Food Safety Authority (EFSA), and India's AYUSH system.
U.S. Food and Drug Administration (FDA): In the United States, herbal supplements are regulated under the Dietary Supplement Health and Education Act (DSHEA) of 1994. The FDA does not approve dietary supplements for safety or efficacy before they are sold. Instead, producers are responsible for ensuring that their products are safe and appropriately labeled. However, the FDA can take action against any supplements shown to be dangerous after they have been promoted. The FDA also monitors claims made by manufacturers about the health advantages of their goods and can issue warnings if those statements are proven to be incorrect or misleading (Haller & Benowitz *et al*, 2009).
European Food Safety Authority (EFSA): In the European Union, the EFSA plays a crucial role in reviewing the safety and health claims of herbal products. The EFSA gives scientific views on the safety of herbal supplements and sets maximum amounts for specific substances to protect consumers. In addition, EFSA's rule ensures that only health claims that are validated by scientific data can be used on the labels of herbal products (EFSA *et al*, 2011).
AYUSH (India): In India, the Ministry of AYUSH governs traditional medicine systems such as Ayurveda, Unani, Siddha, and Homeopathy. AYUSH has created criteria for the production, marketing, and distribution of herbal products, ensuring that they fulfill safety and quality standards. The Ayurvedic Pharmacopeia of India (API) provides a reference for the standardization of herbal pharmaceuticals, and the National Medicinal Plants Board (NMPB) strives to encourage the sustainable use of medicinal plants in India (Vohra *et al*., 2013).

Conclusion

Herbal functional foods have a deep history in traditional medical systems, where they have been utilized for millennia to enhance health and treat various maladies. Modern scientific study has increasingly verified many of the traditional uses of these herbs, revealing the active chemicals responsible for their bioactivity and describing their methods of action. The rising amount of evidence demonstrates the enormous health benefits of herbal functional foods, ranging from anti-inflammatory and antioxidant characteristics to immunological regulation and cardiovascular support. These benefits are substantiated by clinical investigations, in vitro,

and in vivo experiments that reveal the medicinal potential of herbal components. The merging of traditional wisdom with current science is vital for expanding our understanding of herbal functional foods. Traditional medicine provides a rich pool of knowledge that has been acquired over the ages; however, current scientific approaches give tools to evaluate, enhance, and validate this knowledge in rigorous ways. By integrating the empirical insights of traditional practices with the precision of scientific research, we can develop more effective and safer herbal products for health promotion and illness prevention. An important area of study is the necessity for standardization, quality control, and the understanding of herb-drug interactions. Research should continue to examine the pharmacokinetics, bioavailability, and dosage recommendations of these herbs to ensure their safe and effective use in modern diets. Moreover, multidisciplinary research is needed to bridge the gap between traditional applications and present scientific data. Collaboration between botanists, pharmacologists, dietitians, and traditional healers could lead to the discovery of novel substances and the optimization of existing herbal compositions.

In conclusion, while herbal functional foods show enormous promise for enhancing health and controlling chronic conditions, their usage must be founded in evidence-based procedures. As our understanding of these plants grows, their integration into modern diets, whether through supplements, teas, or fortified foods, offers an accessible option to harness their therapeutic benefits. The urge for more rigorous research and the implementation of globally agreed standards would help ensure the safety, efficacy, and sustainability of herbal functional foods, maximizing their potential to benefit human health.

References

Amagase, H. (2006). Clarifying the real bioactive constituents of garlic. The Journal of Nutrition, 136(3 Suppl), 716S–725S. https://doi.org/10.1093/jn/136.3.716S

Aggarwal, B. B., Sundaram, C., Malani, N., & Ichikawa, H. (2007). Curcumin: The Indian solid gold. Advances in Experimental Medicine and Biology, 595, 1–75. https://doi.org/10.1007/978-0-387-46401-5_1

Ammon, H. P., & Wahl, M. A. (1991). Pharmacology of Curcuma longa. Planta Medica, 57(01), 1–7. https://doi.org/10.1055/s-2006-960004

Bertoncini-Silva, C., Vlad, A., Ricciarelli, R., Fassini, P. G., Suen, V. M. M., & Zingg, J.-M. (2024). Enhancing the bioavailability and bioactivity of curcumin for disease prevention and treatment. Antioxidants, 13 (3), 331. https://doi.org/10.3390/antiox13030331(2).

Bischoff-Kont, I., & Fürst, R. (2021). Benefits of ginger and its constituent 6-shogaol in inhibiting inflammatory processes. Pharmaceuticals, 14 (6), 571. https://doi.org/10.3390/ph14060571[](https://www.mdpi.com/1424-8247/14/6/571 "1")

Christensen, L. P. (2009). Ginsenosides: Chemistry, biosynthesis, analysis, and potential health effects. Advances in Food and Nutrition Research, 55, 1–99. https://doi.org/10.1016/S1043-4526(08)00401-4

Cheng, A. L., *et al*. (2001). Pharmacokinetics of curcumin: Studies in normal volunteers. Cancer Chemotherapy and Pharmacology, 47(4), 337-341.

EFSA (2011). Scientific opinion on the substantiation of health claims related to medicinal plants. EFSA Journal, 9(12), 2533-2541.

El-Saadony, M. T., Saad, A. M., Korma, S. A., Salem, H. M., Abd El-Mageed, T. A., Alkafaas, S. S., Elsalahaty, M. I., Elkafas, S. S., Mosa, W. F. A., Ahmed, A. E., Mathew, B. T., Albastaki, N. A., Alkuwaiti, A. A., El-Tarabily, M. K., AbuQamar, S. F., El-Tarabily,

K. A., & Ibrahim, S. A. (2024). Garlic bioactive substances and their therapeutic applications for improving human health: A comprehensive review. Frontiers in Immunology, 15 , 1277074. https://doi.org/10.3389/fimmu.2024.1277074(2).

El-Sohaimy, S. A., & Hussain, M. A. (2023). Functional probiotic foods development: Trends, concepts, and products. Fermentation, 9 (3), 249. https://doi.org/10.3390/fermentation9030249[](https://www.mdpi.com/2311-5637/9/3/249.

Etkin, N. L. (2006). (PAGE) Edible Medicines: An Ethnopharmacology of Food. University of Arizona Press.

Harrison, R., *et al*. (2015). Effect of garlic on blood pressure: A systematic review and meta-analysis. The Journal of Clinical Hypertension, 15(8), 626-636.

Haller, C. A., & Benowitz, N. L. (2009). Adverse drug reactions to herbal products. The American Journal of Medicine, 122(7), 589-595.

Hewlings, S. J. (2017). Curcumin: The science behind its effects on inflammation, cancer, and other diseases. Phytotherapy Research, 31(5), 825-835.

Jamshidi, N., & Cohen, M. M. (2017). The clinical efficacy and safety of Tulsi in humans: A systematic review of the literature. Evidence-Based Complementary and Alternative Medicine, 2017, Article ID 9217567. https://doi.org/10.1155/2017/9217567.

Kim, H. G., Cho, J. H., Yoo, S. R., Lee, J. S., Han, J. M., Lee, N. H., & Son, C. G. (2013). Antifatigue effects of Panax ginseng C.A. Meyer: A randomized, double-blind, placebo-controlled trial. PLoS ONE, 8(4), e61271. https://doi.org/10.1371/journal.pone.0061271

Kumar, A., Tyagi, D., & Choudhary, A. (2017). Curcuma longa: Traditional uses and recent advances—An overview. International Journal of Green Pharmacy, 11(3), S475–S483.

Lee, Y. H., *et al*. (2011). Effectiveness of ginger for osteoarthritis pain and disability: A systematic review. The Journal of Pain, 12(11), 1185-1191.

Leonti, M. (2011). The future is written: Impact of scripts on the cognition, selection, knowledge and transmission of medicinal plant use and its implications for ethnobotany and ethnopharmacology. Journal of Ethnopharmacology, 134(3), 542–555. https://doi.org/10.1016/j.jep.2011.01.017.

Liao, F., *et al*. (2012). Ginseng improves insulin sensitivity in human studies: A systematic review. American Journal of Clinical Nutrition, 95(5), 1223-1233.

Lobo, V., Patil, A., Phatak, A., & Chandra, N. (2010). Free radicals, antioxidants and functional foods: Impact on human health. Pharmacognosy Reviews, 4(8), 118–126. https://doi.org/10.4103/0973-7847.70902

Madaan, S. (2025). Clinical insights into the immunomodulatory effects of Tulsi (Holy Basil). International Research Journal of Modern Engineering & Technology Studies, 1 (1), 1–10. https://doi.org/10.56726/IRJMETS66839(3).

Mahomoodally, M. F. (2013). Ginger and its bioactive components: A review of their antioxidant, anti-inflammatory, and metabolic effects. Journal of Medicinal Food, 16(6), 482-489.

Mondal, S., Mirdha, B. R., & Mahapatra, S. C. (2009). The science behind the sacredness of Tulsi (*Ocimum sanctum* Linn.). Indian Journal of Physiology and Pharmacology, 53(4), 291–306.

Nasri, H., Baradaran, A., Shirzad, H., & Rafieian-Kopaei, M. (2014). New concepts in nutraceuticals as an alternative to pharmaceuticals. International Journal of Preventive Medicine, 5(12), 1487–1499.

Pattanayak, P., Behera, P., Das, D., & Panda, S. K. (2010). *Ocimum sanctum* Linn. A reservoir plant for therapeutic applications: An overview. Pharmacognosy Reviews, 4(7), 95–105. https://doi.org/10.4103/0973-7847.65323

Patwardhan, B., Warude, D., Pushpangadan, P., & Bhatt, N. (2005). Ayurveda and traditional Chinese medicine: a comparative overview. Evidence-Based Complementary and Alternative Medicine, 2(4), 465–473. https://doi.org/10.1093/ecam/neh140.

Rahman, K., & Lowe, G. M. (2006). Garlic and cardiovascular disease: A critical review. The Journal of Nutrition, 136(3 Suppl), 736S–740S. https://doi.org/10.1093/jn/136.3.736S.

Reay, J. L., Kennedy, D. O., & Scholey, A. B. (2005). Single doses of Panax ginseng (G115) reduce blood glucose levels and improve cognitive performance during sustained mental activity. Journal of Psychopharmacology, 19(4), 357–365. https://doi.org/10.1177/0269881105053305

Ried, K., *et al*. (2013). Effect of garlic on blood pressure: A systematic review and meta-analysis. The Journal of Clinical Hypertension, 15(8), 626-636.

Sharma, P. V. (2005). Dravyaguna Vijnana: Materia Medica – Vegetable Drugs (Vol. 2). Chaukhambha Bharati Academy.

Talib, W. H., Atawneh, S., Shakhatreh, A. N., Shakhatreh, G. N., Rasheed aljarrah, I. S., Hamed, R. A., Adel Banyyounes, D., & Al-Yasari, I. H. (2024). Anticancer potential of garlic bioactive constituents: Allicin, Z-ajoene, and organosulfur compounds. Pharmacia, 71 (1), 1–23. https://doi.org/10.3897/pharmacia.71.e114556(1).

Vohra, S. R., *et al*. (2013). National policy on medicinal plants and herbal industry in India: Regulatory framework. Indian Journal of Pharmaceutical Sciences, 75(2), 168-174

White, B. (2007). Ginger: An overview. American Family Physician, 75(11), 1689–1691.

Wang, J., van der Heijden, R., Spruit, S., Hankermeier, T., Chan, K., van der Greef, J., & Wang, M. (2012). Quality and safety of Chinese herbal medicines guided by a systems biology perspective. Journal of Ethnopharmacology, 140(3), 594–602. https://doi.org/10.1016/j.jep.2012.01.064

Wang, J., Sun, B., Cao, Y., Tian, Y., & Li, X. (2018). Antioxidant and anti-inflammatory activities of functional beverages containing herbal ingredients: A review. Food Chemistry, 261, 262–270. https://doi.org/10.1016/j.foodchem.2018.04.073

Xie, Y., *et al*. (2015). Antioxidant and anti-inflammatory activities of ginger (Zingiber officinale) and its effects on metabolic diseases. Frontiers in Pharmacology, 6, 1-7.

Yuan, H., Ma, Q., Ye, L., & Piao, G. (2012). The traditional medicine and modern medicine from natural products. Molecules, 21(5), 559. https://doi.org/10.3390/molecules21050559

Zeng, Y., *et al*. (2015). Curcumin and turmeric: Biological effects, potential applications in chronic diseases, and regulatory issues. International Journal of Food Science & Technology, 50(5), 1272-1283.

Zhang, A., Sun, H., Wang, X., Han, Y., & Wang, P. (2015). Modern analytical techniques in metabolomics analysis. The Analyst, 140(3), 627–639. https://doi.org/10.1039/C4AN01092E

Zhou, Y. X., & Huang, Y. (2017). Traditional uses, phytochemistry and pharmacological properties of *Zingiber officinale* (Ginger): A review. Natural Product Communications, 12(3), 299–308.