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Cultivation, phytochemistry and herbal benefits of chamomile in human wellness

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Abstract

Chamomile (*Matricaria chamomilla* L. and *Chamaemelum nobile*, family Asteraceae) is a medicinal plant rich in bioactive compounds such as flavonoids, terpenoids, and phenolic acids. Chamomile is a widely utilized medicinal herb, having a remarkably rich history, cherished for thousands of years across ancient civilizations. It is most commonly used as a soothing tea, over a million cups are consumed daily worldwide. It is also widely used in cosmetics, aromatherapy, and pharmaceuticals. Chamomile is generally considered safe for everyday use, with evidence supporting its anti-inflammatory, antioxidant, antimicrobial, and neuroprotective properties. Further, It is commonly used as a gentle sedative to promote relaxation and sleep, a digestive aid to ease cramps, bloating, and indigestion, and a skin remedy for wounds, burns, and rashes. Recent research also highlights chamomile's promise in metabolic and cardiovascular health, including lowering blood sugar, blood pressure, and cholesterol. Beyond its medical applications, chamomile carries deep cultural symbolism as a ritual herb representing healing and purity. While widely consumed and generally safe, further toxicity studies are needed to fully validate its therapeutic potential.

Keywords: Soothing tea, anti-inflammatory, sedative, neuroprotective, aromatherapy, blood sugar

Introduction

Chamomile has been a cornerstone of traditional medicine for thousands of years, valued across cultures for its calming, digestive, and healing properties. Ancient Egypt, Greece, Rome, Ayurveda, and Traditional Chinese Medicine (TCM) all incorporated chamomile into remedies for sleep, inflammation, menstrual disorders, and skin ailments. (Tian 2007, Chen 2020) [34] Chamomile bridges traditional healing with modern science, offering benefits for anxiety relief, digestion, blood sugar control and skin health. It is widely consumed herbal teas worldwide. (Sabir 2025) [27]. It have been integral to both traditional and non-traditional forms of medicine dating back at least 5000 years. Chamomile is a native of the old World. Chamomile tea is derived from the daisy-like flowers of the Asteraceae family plants, primarily German chamomile (*Matricaria chamomilla*) and Roman chamomile (*Chamaemelum nobile*). Known for a sweet, apple-like aroma, these plants are easy to grow in full sun, require little maintenance, and are highly regarded for their relaxing herbal tea. (Kimura 2023, Sepp 2024, Ubessi 2019) [17, 37].

Chamomile (*Matricaria chamomilla* L. and *Chamaemelum nobile*) is among the most widely consumed herbal remedies, valued for its therapeutic value and cultural significance. Traditionally employed as a gentle sedative, digestive tonic, and skin remedy, chamomile has been integrated into diverse medical systems across Europe, Asia, and the Middle East. Modern phytochemical investigations have identified key bioactive compounds including flavonoids (apigenin, luteolin), terpenoids (α -bisabolol, chamazulene), and phenolic acids this highlights its anti-inflammatory, antioxidant, antispasmodic, and metabolic regulatory properties. (Tsivelika 2021, Wan 2019) [36, 40].

Clinical and experimental studies further highlight chamomile's potential in cardiovascular health, demonstrating reductions in blood sugar, blood pressure, and cholesterol, alongside its established role in mental health and dermatology. Despite its broad safety profile, caution is needed in populations with Asteraceae allergies, during pregnancy due to uterotonic effects of Roman chamomile, and in individuals taking anticoagulant medications. Chamomile's enduring importance lies not only in its scientifically validated therapeutic effects but also in its cultural symbolism of healing and purity.

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This dual identity positions chamomile as both a cornerstone of traditional herbal medicine and a promising integrative agent in modern phytotherapy. (Shrivastava 2009, Hussein 2024) ^[16].

Key Chamomile Plant Varieties

German Chamomile (*Matricaria chamomilla*): This is the preferred variety for German Chamomile (*Matricaria chamomilla* / *M. recutita*): German Chamomile is an erect annual herb that grows between 10-60 cm tall, with smooth, hairless stems and small daisy-like flowers featuring conical yellow centers. It is the most widely used chamomile variety, prized for its high levels of azulene, which gives its essential oil a distinctive blue color and strong anti-inflammatory properties. This makes it especially popular in herbal medicine, aromatherapy, and skincare. (Hajizadeh 2020) ^[15].

Roman Chamomile (*Chamaemelum nobile* / *Anthemis nobilis*): A perennial creeping herb with hairy stems and larger white flowers with flat, yellow centers. It is often used as a ground cover and in aromatherapy, with a strong, apple-like fragrance. Roman Chamomile is a low-growing perennial herb, reaching about 25 cm in height, with hairy stems and daisy-like white flowers surrounding flat yellow centers. Known for its strong apple-like fragrance, it is often used as a fragrant ground cover in gardens and valued in aromatherapy for its calming properties. Beyond its ornamental appeal, Roman Chamomile is also used in herbal teas and skin care remedies, making it both beautiful and beneficial. (Valmy 2025) ^[39].

Moroccan Chamomile (*Ormenis multicaulis*): A third type, is distinct from the more commonly recognized German and Roman chamomile varieties. Unlike those, which are prized in herbal medicine and teas, Moroccan Chamomile is primarily valued in the cosmetics and perfumery industry. It belongs to the Asteraceae family, native to North Africa, especially Morocco. Essential oils extracted from its flowers, the oil has a warm, herbaceous, slightly fruity aroma. It is often added to skincare products for its soothing and anti-inflammatory properties. Widely used as a fragrance component, lending a soft, floral, and slightly exotic note. (El-Assri 2025) ^[10].

Chamomile is indeed emerging as one of the most promising medicinal crops in India. Its cultivation pattern reflects both climatic suitability and market demand. (Shrivastava 2010) Chamomile cultivation in India is concentrated in Jammu & Kashmir (Ideal cool climate, long tradition of medicinal herb farming), Uttar Pradesh, Assam, and parts of Himachal Pradesh, with growing interest in expanding to South India due to its high export value and demand in tea, cosmetics, and pharmaceuticals. Farmers can earn up to ₹2.5 lakh per hectare annually, making it a profitable medicinal crop. Further, rising demand for herbal teas and wellness products along with increasing use in natural skincare and aromatherapy makes it highly valuable herb. (Soesilawati 2025) ^[30].

Propagation: Primarily propagated by seeds via direct sowing or transplanting (1-month-old seedlings). Most chamomile seeds are light-dependent. Scatter them on the surface of pre-moistened soil and press lightly; do not cover

them with soil. In mild climates like parts of India, sow in Winter (Sep-Nov) or Spring (Feb-Mar). Seeds typically sprout within 7-14 days if kept moist.

Spacing: A spacing of 30 cm × 30 cm is considered ideal for maximum flower and oil yield.

Fertilization: Responds well to organic manure, with studies showing that vermicompost and cow manure can significantly increase flower yield, often outperforming or equaling synthetic fertilizers.

Harvesting: Flowers should be picked when they are fully opened, generally at the medium ripening stage. Hand-picking or specialized harvesters are used.

Drying: Freshly harvested flowers have high moisture content (60-85%) and must be dried down to 10%. Shaded, air-drying is often recommended to preserve active compounds, though solar drying also yields high-quality results.

Key Bioactive Compounds

Different classes of bioactive constituents are present in chamomile, which have been isolated and used as medicinal preparations and cosmetics. The plant contains 0.24%-1.9% volatile oil, composed of a variety of separate oils. When exposed to steam distillation, the oil ranges in color from brilliant blue to deep green when fresh but turns to dark yellow after storage. Despite fading, the oil does not lose its potency. Approximately 120 secondary metabolites have been identified in chamomile, including 28 terpenoids and 36 flavonoids. (Das 2019, Lu 2024, Alkuraishy 2015) ^[7, 3].

Flavonoids: These are the most abundant compounds, with apigenin-7-glucoside being the main component and quality marker. Other important flavonoids include luteolin, quercetin, and patuletin.

Terpenoids (Essential Oils): Chamomile's terpenoid-rich essential oils are one of its most distinctive features, giving both therapeutic value and characteristic aroma. Chamomile flowers contain 0.2-1% volatile essential oils, notably chamazulene (which provides a blue color and has anti-inflammatory properties) and -bisabolol.

Phenolic Acids such as Caffeic acid acts as an antioxidant, protecting cells from oxidative stress and supporting gut health. p-Coumaric acid provides antimicrobial and anti-inflammatory benefits, enhancing chamomile's role in digestive and skin applications. Together, these acids strengthen chamomile's ability to calm inflammations and promote healing. (Pequeno 2018) ^[23].

Sesquiterpene Lactones such as Matricarin and Matricin are key lactones found in chamomile. These compounds are known for their anti-inflammatory and antispasmodic effects, helping soothe the digestive tract and reduce irritation. They also contribute to chamomile's distinctive aroma and therapeutic potency. (Petronilho 2011, Fen 2021) ^[24, 11]. Chamomile's medicinal properties are attributed to over 120 secondary metabolites, including terpenoids (like α -bisabolol and chamazulene) and flavonoids (Zhao 2018, Wang 2016) ^[44, 41].

Table 1: Health benefits of chamomile extract.

Health benefit	Effect/Mechanism	Active compounds	Potential application
Antioxidant activity	Neutralizes free radicals and reduces oxidative stress via phenolic and flavonoid compounds	Apigenin, quercetin, luteolin, phenolic acids	Functional beverages, nutraceuticals, and anti-aging products
Anti-inflammatory effects	Suppresses pro-inflammatory signaling pathways and reduces inflammation in tissues	Chamazulene, apigenin, bisabolol	Herbal supplements, topical formulations
Cancer-preventive potential	Exhibits anti-inflammatory and multiple anticancer activities through inhibition of cytokines and modulation of cellular pathways	Apigenin, flavonoids, terpenoids	Adjunct nutraceuticals for cancer prevention research
Glycemic control and metabolic improvement	Improves glycemic control, reduces oxidative stress, and improves lipid profile in diabetic conditions	Polyphenols, flavonoids	Functional tea, dietary supplements for metabolic health
Digestive support	Traditionally used to alleviate gastrointestinal discomfort and soothe digestive tract conditions	Essential oils, flavonoids	Herbal tea, digestive formulations
Antimicrobial properties	Exhibits activity against various microbial pathogens, contributing to infection control	Essential oils, α -bisabolol, flavonoids	Natural preservative, oral care, topical products

Herbal Benefits

Digestive Comfort: Chamomile is widely valued for its gentle support to the digestive system. Its natural compounds help relax the gut, ease discomfort, and promote overall digestive balance. It works as a carminative, reducing bloating and helping expel trapped gas (Chauhan 2021) ^[4].

Sleep and Relaxation: Sleep & Relaxation Role Chamomile's calming power largely comes from apigenin, a flavonoid that interacts directly with the brain's receptors. Apigenin binds to GABA-A receptors in the brain. This enhances the effect of gamma-aminobutyric acid (GABA), the neurotransmitter responsible for reducing neuronal excitability. The result is a sedative effect, which promote sleep. (Saadatmand 2024) ^[26].

Anti-inflammatory & Anti-allergic: Chamomile's anti-inflammatory and anti-allergic properties make it a powerful natural remedy for skin and immune-related conditions. Chamazulene and α -Bisabolol are key terpenoids that reduce inflammation. They inhibit the release of pro-inflammatory mediators, calming irritation in tissues. This makes chamomile effective for eczema, dermatitis, and skin rashes. Anti-allergic Role Chamomile helps lower histamine release, which is responsible for allergic reactions. (Sotiropolhu 2020, Al- Dabbagh 2019) ^[2]. This reduces redness, itching, and swelling in allergic skin conditions. It is often used in topical creams and herbal compresses for soothing flare-ups. It is effective in reducing inflammation and histamines, helpful for eczema, rashes, and dermatitis. (Sabir 2025, Valuga 2019, Akram 2023, Valmy 2025) ^[2, 39].

Wound healing: Chamomile (*Matricaria chamomilla* L.) has been extensively studied for its role in wound healing, with evidence showing that topical application accelerates granulation tissue formation and enhances epithelial regeneration. Its bioactive constituents, particularly α -bisabolol and chamazulene, exert potent anti-inflammatory and antimicrobial effects, reducing local irritation and preventing secondary infections. (El-Assri 2025) ^[10]. Comparative clinical trials have demonstrated that chamomile preparations can perform similarly to low-dose hydrocortisone in the treatment of eczema, highlighting its therapeutic potential as a natural alternative. (Sah 2022) ^[28]. These findings suggest that chamomile's pharmacological activity is mediated through modulation of cytokine release, stimulation of fibroblast proliferation, and promotion of collagen deposition, making it a valuable adjunct in

dermatological and wound-care applications. (Mihiyaoui 2022, Ghasemi 2024, Mailander 2022, Drif 2024) ^[9, 12, 8].

Metabolic regulation and cardiovascular health: Chamomile (*Matricaria chamomilla* L.) has shown promising effects in metabolic regulation and cardiovascular health, supported by both animal and human studies. Its flavonoid constituents, particularly apigenin and luteolin, appear to modulate carbohydrate metabolism by inhibiting digestive enzymes and enhancing insulin sensitivity, resulting in improved glycaemic control in individuals with type 2 diabetes. Additionally, chamomile's vasodilatory and antioxidant properties contribute to reductions in systolic and diastolic blood pressure, while its influence on lipid metabolism has been associated with decreased LDL cholesterol and triglycerides, alongside elevated HDL cholesterol. (Wang 2021) ^[42]. These combined actions suggest that chamomile may lower cardiovascular risk factors through mechanisms involving oxidative stress reduction, cytokine modulation, and vascular protection. (Haghi 2014) ^[14]. While early findings are encouraging, larger-scale clinical trials are required to establish standardized dosages and confirm long-term efficacy in metabolic and cardiovascular disease management. (Dai 2022, Zargaran 2017, Ghosh 2017) ^[6, 43, 13].

Side Effects and Precautions

Allergies: Chamomile is usually safe, but people who are allergic to plants in the Asteraceae family such as ragweed, chrysanthemums, or asters may react to it. This happens because chamomile shares similar proteins with these plants, which can trigger the immune system. Reactions may include skin rashes, itchy eyes, sneezing, or breathing problems, and in rare cases, more serious responses. For this reason, doctors often advise people with known allergies to these plants to avoid chamomile products. (Park 2021, Pooya 2025) ^[22, 25].

Pregnancy: Roman chamomile (*Chamaemelum nobile*) should be used carefully during pregnancy because it can cause uterine contractions. These contractions may increase the risk of miscarriage or preterm labor if taken in large amounts. While chamomile is often used for relaxation or digestive problems, pregnant individuals are advised to avoid Roman chamomile tea and essential oils unless guided by a doctor. German chamomile (*Matricaria chamomilla*) is more commonly used and considered safer, but caution is still recommended. (Trabace 2015) ^[35].

Interaction: Chamomile has mild anticoagulant properties, which means it can slightly thin the blood. Because of this, it may interact with blood-thinning medications such as warfarin, aspirin, or clopidogrel. These interactions could increase the risk of bleeding, especially if chamomile is consumed regularly in tea or supplement form. For individuals taking anticoagulants, doctors usually recommend caution and medical supervision before using chamomile products. This highlights the importance of considering herbal remedies alongside prescribed medications to avoid unintended effects. (Lu 2024, Wang 2021) ^[42].

Conclusion

Chamomile can be seen as a safe and versatile herb that supports many aspects of health. Research shows it works as a gentle sedative to calm the mind and improve sleep, a digestive aid to ease cramps and bloating, and a skin remedy that helps wounds and rashes heal. It also shows promise in metabolic and cardiovascular health by lowering blood sugar, blood pressure, and cholesterol. Beyond its medical uses, chamomile remains important culturally as a symbol of healing and purity, making it both a scientific and traditional cornerstone of herbal medicine. Chamomile's importance lies in its multifunctional role: a safe, accessible herb that supports mental, digestive, metabolic, and skin health, while remaining deeply rooted in cultural traditions. Chamomile's enduring role lies in its versatility as gentle sedative for sleep and anxiety, skin remedy for wounds, burns, and rashes. And a ritual herb symbolizing healing and purity. Chamomile (*Matricaria chamomilla* L. and *Chamaemelum nobile*) represents a multifunctional medicinal herb with broad therapeutic potential supported by phytochemical and pharmacological evidence.

Its bioactive constituents contribute to diverse biological activities such as anti-inflammatory, antioxidant, antispasmodic, and metabolic regulation. Clinical and experimental studies demonstrate its efficacy as a gentle sedative for sleep and anxiety, a digestive tonic, an agent for wound healing, and a supportive adjunct in metabolic and cardiovascular health. Safety concerns are minimal, though caution is needed in populations with Asteraceae allergies, during pregnancy, and in individuals taking anticoagulant medications. Overall, chamomile's relevance lies in its accessibility, cultural symbolism of healing and purity, and its scientifically validated value, making it a valuable component of modern phytotherapy.

Conflict of Interest: Authors declare no competing interests.

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