The Longwood Herbal Task Force
(http://www.mcp.edu/herbal/default.htm) and
The Center for Holistic Pediatric Education and Research
(http://www.childrenshospital.org/holistic/)

Chamomile *(Matricaria recutita, Anthemis nobilis)*

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Principal Proposed Uses: Sedative, anxiolytic, antispasmodic

Other Proposed Use: Treatment for skin disorders

Overview

Chamomile is widely used throughout the world. Its primary uses are as a sedative, anxiolytic and antispasmodic, and as a treatment for mild skin irritation and inflammation. Chamomile's main active constituents are chamazulene, apigenin, and bisabolol. Despite its widespread use as a home remedy, relatively few trials have evaluated chamomile's many purported benefits. Randomized controlled studies have shown conflicting results for the treatment of dermatologic and mucosal irritations including eczema and mucositis. Animal trials suggest efficacy as a sedative, anxiolytic and antispasmodic, but clinical studies in humans are needed. Chamomile is generally safe for consumption, although patients with hypersensitivity to ragweed and other family members of the Compositae family should use caution.

Historical and Popular Uses

Chamomile is one of the most widely used and well-documented medicinal plants in the world[1]. It is included in the pharmacopoeia of 26 countries[2]. In Germany, where chamomile sales exceeded $8.3 million in 1996[3], more than 4,000 tons of chamomile are produced yearly[4].

The use of chamomile as a medicinal plant dates back to ancient Greece and Rome. The name "chamomile" comes from two Greek words meaning "ground apple" for its apple-like smell. The ancient Egyptians considered the herb a sacred gift from the sun god, and used it to alleviate fever and sun stroke. In the sixth century, it was used to treat insomnia, back pain, neuralgia, rheumatism, skin conditions, indigestion, flatulence, headaches, and gout.

In Europe it is considered a “cure all”, and in Germany it is referred to as “alles zutraut”, meaning “capable of anything”[4]. Although there are numerous varieties of chamomile, the two most popular are Roman chamomile *(Anthemis nobilis*) and German chamomile *(Matricaria recutita*); both are from the Compositae family. German chamomile is considered the more potent of the two, has received more scientific evaluation, and is more widely cultivated than Roman chamomile; it is believed to possess anti-inflammatory, vulnerary, deodorant, bacteriostatic, antimicrobial, anticatarrhal, carminative, sedative, antiseptic, and spasmolytic properties[5,6]. Roman chamomile is believed to possess carminative, antiemetic, antispasmodic, and sedative properties[5].

Chamomile is used both internally and externally to treat an extensive list of conditions. It is used externally for wounds, ulcers, eczema, gout, skin irritations, neuralgia, sciatica, rheumatic pain, hemorrhoids, mastitis, and leg ulcers[5]. Additionally, it is used externally to treat diaper rash, cracked nipples, chicken pox, poison ivy and conjunctivitis, and as a hair tint and conditioner. European oncologists use a chamomile mouthwash called Kamillosan® to treat chemotherapy-induced mouth sores. The German Commission E has approved chamomile for external use for inflammation of the skin, mucous membranes and ano-genital area, bacterial skin diseases including those of the oral cavity and gums, and respiratory tract inflammation[6].

Chamomile is also extensively consumed as a tea or tonic. It is used internally to treat anxiety, hysteria, nightmares, insomnia and other sleep problems, convulsions, and even delirium tremens[7]. One of chamomile’s main roles is as a multipurpose digestive aid to treat gastrointestinal disturbances including flatulence, indigestion, diarrhea, anorexia, motion sickness, nausea, and vomiting. Chamomile is thought to heal ulcers and act as an herbal bitter to stimulate the liver[8]. In children it is used to treat colic, croup, and fevers. In women’s health, it is used as an emmenagogue and a uterine tonic. Chamomile’s essential oil is also a treatment for malaria and parasitic worm infections, cystitis, colds, and flu[9,10]. The German Commission E recommends chamomile to treat gastrointestinal spasms and inflammatory diseases of the gastrointestinal tract[6].

Botany

Medicinal species: Matricaria recutita (German chamomile), *Anthemis nobilis* (Roman chamomile)

Common names: German chamomile is also called Hungarian, single, genuine, wild, or sweet false chamomile. Roman chamomile is called common, English, garden, lawn, true or double chamomile.

Botanical family: Asteraceae (Compositae)

Plant description: German chamomile is an apple-pineapple scented, smooth, branched annual, which grows two to three feet tall. Its flower head is one inch in diameter and has a hollow conical center covered with tiny yellow florets surrounded by silver-white to cream colored florets. It has erect branching with finely divided leaves.

Roman chamomile is an aromatic creeping perennial which grows only one foot in height. The flower heads are one inch in diameter, with a broad conical disk that is covered in yellow florets surrounded by white florets. It has many freely branching hairy stems and finely divided leaves.

Where it's grown: England, Europe, South America, and the US.

Biochemistry

Chamomile: Potentially Active Chemical Constituents

German chamomile:

- Terpenoids: α-bisabolol, α-bisabolol oxide A and B, chamazulene, sesquiterpenes
- Flavonoids: apigenin, luteolin, quercetin
- Coumarins: umbelliferone
- Spiroethers: en-yn dicycloether
- Other constituents: anthemic acid, choline, tannin, polysaccharides[5]

Roman chamomile

- Terpenoids: chamazulene, bisabolol
- Flavonoids: apigenin, luteolin, quercetin
- Coumarins: scopoletin-7-glucoside
- Other constituents: angelic and tiglic acid esters, anthemic acid, choline, phenolic and fatty acids[5]

Chamomile's essential oil comprises 0.5% to 1.5% of the flower head. One hundred twenty chemical constituents have been identified in chamomile, including terpenoids, flavonoids, and coumarins[1].

The essential oil of both German and Roman chamomile is a light blue color due to the terpenoid *chamazulene*. Chamazulene is an artifact formed during heating and comprises about 5% of the essential oil[10]. It has anti-inflammatory, antiallergic, and antispasmodic properties[10].

Bisabolol comprises 50% percent of German chamomile's essential oil[10] and is a spasmolytic for intestinal smooth muscle[11,12]. It also has anti-inflammatory, antibacterial, antipyretic, ulcer-protective, and antifungal properties[4,10].

The flavonoids *apigenin* and *luteolin* possess anti-inflammatory, carminative, and antispasmodic properties[1]. Apigenin binds to GABA receptors and has a mild sedative effect[13].

The coumarin *umbelliferone* is reported to be antispasmodic, antibacterial, and antifungal[4].

The spiroethers *cis*- and *trans-en-yn-dicycloether* occur in German chamomile[4]. They are spasmolytic, antifungal and anti-inflammatory[4,8].

Experimental Studies

Chamomile: Potential Clinical Benefits

1. Cardiovascular: Mixed effects
2. Pulmonary: none
3. Renal and electrolyte balance: none
4. Gastrointestinal/hepatic: Antispasmodic, anti-ulcer, choloretic
5. Neuro-psychiatric: Anxiolytic and sedative
6. Endocrine: none
7. Hematologic: none
8. Rheumatologic: none
9. Reproductive: Uterine tonic
10. Immune modulation: Anti-inflammatory, antiallergic
11. Antimicrobial: Antibacterial, antifungal, antiviral
12. Antineoplastic: Antineoplastic
13. Antioxidant: Antioxidant
14. Skin and mucus membranes: Topical anti-inflammatory, mucositis due to radiation therapy and chemotherapy, eczema
15. Other/miscellaneous: none

1. **Cardiovascular**: Mixed effects
   i. *In vitro data:* In rat atria, apigenin increased atrial rate, probably as a result of a reduction in noradrenaline uptake[14].
   ii. *Animal data:* In rats, apigenin relaxed thoracic aorta, mainly by suppressing the Ca2+ influx through both voltage- and receptor-operated calcium channels[15].
   iii. *Human data:* In an open study of 12 hospitalized patients with heart disease, the hemodynamic effects of two cups of orally administered chamomile tea were investigated while patients were undergoing a cardiac catheterization. The patients had a small but

significant increase in mean brachial artery pressure. No other significant hemodynamic changes were observed. Ten minutes after ingesting the tea, 10 of the 12 patients fell into a deep sleep[16].

2. **Pulmonary:** none
3. **Renal and electrolyte imbalance:** none
4. **Gastrointestinal/hepatic:** Antispasmodic, anti-ulcer, choleretic
   a. Antispasmodic
      i. *In vitro data:* In isolated guinea pig ileum, alcoholic extracts of German chamomile inhibited acetylcholine- and histamine-induced spasms[11]. Essential oil of chamomile was comparable to papaverine in reducing isolated guinea pig ileum spasm. Apigenin and bisabolol have dose-dependent spasmolytic effects on isolated guinea pig ileum[17].
      ii. *Animal data:* Intraperitoneal administration of apigenin significantly reduced intestinal transit time in mice. Apigenin (12.5-50 mg/kg) slowed down castor oil-induced diarrhea[18].
      iii. *Human data:* Two randomized controlled trials support the use of chamomile-containing herbal medicines as spasmolytics.

In a prospective, double-blind, randomized, multicenter, parallel group study, 79 children (six months to five years of age) with acute, non-complicated diarrhea received either a commercial preparation containing apple pectin and chamomile extract or placebo in addition to the usual rehydration and diet. At the end of three days of treatment, the diarrhea had ended significantly sooner in the pectin/chamomile group than in the placebo group. Pectin/chamomile significantly reduced the duration of diarrhea by at least five hours.[19].

In a double blind study of 68 healthy, full term infants two to eight weeks old with colic, the infants received 150 ml of either tea (Calma Bebi from Italy) containing German chamomile, vervain, licorice, fennel and balm mint, or placebo with each colic episode (no more than TID) for seven days. The tea eliminated the colic in 57% of the infants, whereas placebo was helpful in only 26% ($p<0.01$)[20].

b. Anti-ulcer

i. *In vitro data:* Alpha-bisabolol decreases the proteolytic activity of pepsin by 50%[8].

ii. *Animal data:* In rats, chamomile flowers and bisabolol inhibited stomach ulcers caused by stressful stimuli, alcohol, and indomethacin[8,21]. Healing times for ulcers induced by chemical stress or heat coagulation were reduced by α-bisabolol[8]. Extracts of the flowers of German chamomile had an inhibitory effect on gastric acid secretion[22].

iii. *Human data:* Gastric biopsies and cytological studies have demonstrated anti-inflammatory effects of chamomile on the stomach and duodenum[8].

c. Choleretic

i. *In vitro data:* none

ii. *Animal data:* German chamomile oil increased bile secretion and the concentration of cholesterol in the bile following oral administration in cats and dogs[5].

iii. *Human data:* none

5. **Neuro-psychiatric**: Anxiolytic and sedative

i. *In vitro data:* Several fractions from German chamomile displaced flunitrazepam bound to its receptors in rat cerebellar membranes, muscimol bound to GABA receptors in rat cortical membrane, and/or [3H]RO 5-4864 bound to peripheral benzodiazepine binding sites from rat adrenal glands[23].

ii. *Animal data:* Chamomile extracts significantly reduced locomotor activity in rats[23]. In ovariectomized rats, inhaling chamomile oil vapor decreased the stress-induced increase of plasma ACTH. The plasma ACTH level decreased further when diazepam was administered along with the chamomile oil vapor. A benzodiazepine antagonist, flumazenil, blocked the decrease in plasma ACTH caused by inhalation of chamomile[24].

In mice, apigenin had a clear affinity for central benzodiazepine receptors. Apigenin competitively inhibited the binding of flunitrazepam, a benzodiazepine, but had no effect on muscarinic receptors, alpha 1-adrenoceptors, or the binding of muscimol to GABA receptors. Apigenin had clear anxiolytic activity in mice without incidence of sedation or muscle relaxation effects at doses similar to those used for classical

benzodiazepines; no anticonvulsant action was detected. Increasing dosages produced mild sedation and a reduction in ambulatory locomotor activity[25].

iii. *Human data:* Despite chamomile tea's long use in folk medicine as a mild sedative and anxiolytic, there are no randomized controlled trials evaluating these effects in adults or children.

In an open study, 12 hospitalized patients with heart disease received two cups of chamomile tea orally during a cardiac catheterization. Ten minutes after ingesting the tea, ten of the 12 patients fell into a deep sleep[16].

Twenty-two subjects were asked to visualize positive and negative phrases following exposure to either chamomile oil or placebo (green peppers). Chamomile oil significantly increased the latency for all images and shifted mood ratings and the frequency of judgments in a more positive direction[26].

6. **Endocrine:** none
7. **Hematologic:** none
8. **Rheumatologic:** none
9. **Reproductive:** Uterine tonic
   i. *In vitro data:* An aqueous extract of chamomile enhanced guinea pig and rabbit uterine tone[5].
   ii. *Animal data:* none
   iii. *Human data:* No reports of uterine cramps, miscarriage, or premature delivery have been attributed to chamomile.
10. **Immune modulation**: Anti-inflammatory, anti-allergic
    a. Anti-inflammatory: Several compounds in chamomile exhibit anti-inflammatory properties. See also **Skin and mucus membranes** below for data on chamomile's topical anti-inflammatory properties.
       i. *In vitro data:* Chamazulene inhibited leukotriene synthesis in neutrophilic granulocytes and had additional antioxidant effects[27].

Apigenin exhibited a dose- and time-dependent reversible effect on adhesion protein expression and inhibited up-regulation of specific leukocyte adhesion

molecules on the endothelial cell surface. Apigenin also inhibits IL-1-α induced prostaglandin synthesis and TNF-α induced IL-6 and IL-8 production[28].

ii. *Animal data:* The anti-inflammatory effects of chamomile are well documented in animals[8]. Bisabolol reduced inflammation, fever, and adjuvant arthritis in animal studies[29,30,31]. Bisabolol was also an antipyretic in yeast-induced fever in rats[29]. Apigenin has demonstrated anti-inflammatory properties in animal studies[31]. It demonstrated potent anti-inflammatory activity in carrageenan-induced rat paw edema and delayed type hypersensitivity in mice[28].

iii. *Human data:* The anti-inflammatory activity of chamomile cream was evaluated in a randomized trial in 24 healthy subjects who were exposed to UV radiation or cellophane tape stripping of their skin. Next, either chamomile cream, hamamelis distillate, or hydrocortisone 1% cream was applied topically. Hydrocortisone appeared superior to chamomile cream and hamamelis distillate in both conditions[32].

b. Antiallergic

i. *In vitro data:* Azulene compounds have been documented as antiallergic[8]. However, one *in vitro* study found that neither chamazulene nor α -bisabolol had a distinct effect on histamine release in rat mast cells. En-yn dicycloether partially inhibited the degranulation of mast cells[33].

ii. *Animal data:* Azulene has been reported to prevent allergic seizures in guinea pigs[34].

iii. *Human data:* none

11. **Antimicrobial:** Antibacterial, antifungal, antiviral

i. *In vitro data:* The antibacterial and antiviral effects of chamomile have been well documented[8,35]. Compounds in the essential oil of chamomile were effective against *Staphylococcus* and *Candida*[35]. Of chamomile's essential oil components, α-bisabolol had the strongest activity against Gram-positive and Gram-negative bacteria. Chamazulene also had strong antimicrobial activity. Spiroethers had weak activity against Gram-positive bacteria but were inactive against Gram-negative bacteria[36]. German chamomile esters and lactones showed activity against *Mycobacterium tuberculosis* and *M. avium*[37]. Chamazulene, α-bisabolol, flavonoids and umbelliferone

displayed antifungal properties against *Trichophyton mentagrophytes*, *T. rubrum*, and *Candida albicans*[36,38,39,40]. An ethanolic extract of German chamomile inhibited the growth of *Herpes* and *Poliovirus*[41].

ii. *Animal data:* none

iii. *Human data:* none

12. **Antineoplastic:** Antineoplastic

i. *In vitro data:* Topical apigenin significantly inhibited UV-induced mouse skin tumorigenesis. Apigenin induced a reversible G2/M arrest in cultured mouse keratinocytes[42]. It suppressed 12-0-tetradecanoyl-phorbol-13-acetate- (TPA)-mediated tumor promotion in mouse skin[43]. However, in one study on mouse skin, apigenin did not significantly reduce skin tumor incidence[44].

In a *Salmonella typhimurium* assay, apigenin showed antimutagenic and anti-promotion properties[45]. Apigenin also inhibited the proliferation of malignant B104 rat neuronal cells by G2/M arrest and induced morphological differentiation[46]. Apigenin enhanced gap junctional intercellular communication in rat liver epithelial cells. The researchers hypothesized that this could be one of the major mechanisms responsible for apigenin's anti-tumor-promoting action[47,48].

ii. *Animal data:* In mice, topical apigenin inhibited skin papillomas and tended to decrease conversion of papillomas to carcinomas[49]. In mice, treatment with apigenin prior to UVB exposure reduced skin cancer incidence by 52% and increased tumor free survival in comparison with control mice[50].

iii. Human data: none

13. **Antioxidant:** Antioxidant

i. *In vitro data:* Chamazulene affects free radical processes and inhibits lipid peroxidation in a concentration- and time-dependent manner[51].

ii. *Animal data:* none

iii. *Human data:* none

14. **Skin and mucus membranes:** Topical anti-inflammatory, mucositis due to radiation therapy and chemotherapy, eczema

a. Topical anti-inflammatory

i. *In vitro data:* none

ii. *Animal data:* Mice who were exposed to topical croton oil to induce edema received either chamomile extract, hydrocortisone, or benzydamine (an NSAID) topically. The chamomile extract reduced the edema nearly as well as benzydamine, but less than hydrocortisone[52].

In guinea pigs exposed to UV light, topical α-bisabolol decreased skin temperature. In cutaneous burns in guinea pigs, application of α-bisabolol significantly shortened healing time.

Apigenin inhibited skin inflammation in rats[53].

iii. *Human data:* In a double-blind trial, 14 patients with weeping wounds after dermabrasions of their tattoos received topical chamomile extract or placebo. Those using chamomile noted a statistically significant decrease in the weeping wound area and increased drying of the wound compared with the placebo group[54].

In a double blind, randomized, placebo controlled study, 48 women who had had breast cancer surgery and were receiving radiation were treated topically with chamomile cream or placebo (almond oil) to the radiation treated area. There were no significant differences between the two groups in objective scores of skin irritation. The patients preferred the chamomile-containing cream to the placebo cream for its rapid absorption and stainlessness[55].

b. Mucositis due to radiation treatment and chemotherapy: Chamomile has been used in clinical trials to treat and prevent mucositis.

i. *In vitro data:* none

ii. *Animal data:* none

iii. *Human data:* In a case series, 98 cancer patients used Kamillosan Liquidum®, a German chamomile mouthwash (15 drops in 100 ml of water three times a day), during head and neck irradiation and/or systemic chemotherapy to help prevent and or reduce the intensity of oral mucositis. Of the 66 patients who participated in

prophylactic oral care with the mouthwash, 20 patients underwent radiation therapy and 46 patients received systemic chemotherapy. Only one of the 20 patients who had had radiation therapy developed grade 3 mucositis in the final week of treatment, 65% developed intermediate grade, and 30% developed low-grade mucositis. Thirty-six in 46 patients receiving chemotherapy did not develop clinically significant mucositis. For the 32 patients with existing mucositis, all noted immediate relief from mouth discomfort, and within seven days almost all patients returned to having no clinical sign of mucositis[56].

A double blind, randomized, placebo controlled study was conducted with 164 cancer patients taking 5-fluorouracil based chemotherapy. The patients rinsed three times daily with a chamomile or placebo mouthwash. After 14 days, there was no difference between 5-FU induced stomatitis in the two groups[57].

c. Eczema

i. *In vitro data:* none

ii. *Animal data:* none

iii. *Human data:* In a clinical trial, 161 patients with eczema on their hands, forearms, and lower legs who had been initially treated with 0.1% difluocortolone valerate were treated with Kamillosan® cream, 0.25% hydrocortisone, 0.75% fluocortin butyl ester (a glucocorticoid), or 5% bufexamac (a non-steroidal anti-inflammatory). During the three to four week maintenance therapy, the Kamillosan was as effective as 0.25% hydrocortisone. It was superior to 5% bufexamac and 0.75% fluocortin butyl ester[58,59].

15. **Other/miscellaneous:** none

Toxicity and Contraindications

All herbal products carry the potential for contamination with other herbal products, pesticides, herbicides, heavy metals, and pharmaceuticals.

Allergic reactions can occur to any natural product in sensitive persons.

Allergic reactions to chamomile are rare[60]. Its allergenic properties have been attributed to anthecotulid, a sesquiterpene lactone, and to matricarin, a proazulene[5,61]. Contact dermatitis to German chamomile has been reported[5,8,62]. Some individuals allergic to other members of the Compositae family (ragweed, asters, and chrysanthemums) are allergic to chamomile. Hypersensitivity reactions include contact dermatitis, dyspnea, asthma, bronchitis, and rhinoconjunctivitis[10]. Consumption of chamomile tea may exacerbate existing allergic conditions, and there is a report of asthma and urticaria in one patient after a chamomile enema[5]. German chamomile used for eye washing can induce allergic conjunctivitis[63]. Three reported cases of anaphylaxis have been reported; the patients had an existing hypersensitivity to ragweed (Compositae). The symptoms included abdominal cramping, thickness of tongue, tightness in the throat, angioedema of lips and eyes, pruritus, generalized urticaria, and upper airway obstruction[64,65,66].

Potentially toxic compounds in chamomile: None

Acute toxicity: Listed as generally recognized as safe (GRAS) by the FDA. The toxicology of chamomile has been low in animal studies[10].

Chronic toxicity: No teratogenicity or developmental abnormalities were noted in rats or rabbits after chronic administration of bisabolol[10].

Limitations during other illnesses or in patients with specific organ dysfunction: None known

Interactions with other herbs or pharmaceuticals: No drug-herb interactions have been reported[67]. Some herbalists have expressed concern that excessive doses of chamomile may interfere with existing anticoagulant therapy because of its coumarin constituents[5]. There are no reports of interactions with benzodiazepines.

Safety during pregnancy and/or childhood: Teratogenicity studies in rats, rabbits, and dogs have been documented for α-bisabolol and no teratogenic effect was observed[68]. However, in

one animal study, a dose of 3 ml/kg α-bisabolol increased the number of fetuses reabsorbed and reduced the body weight of the live offspring of mice[5,68]. There are no formal clinical studies assessing the safety of chamomile in pregnant and lactating women nor in children.

Typical Dosages

Provision of dosage information does NOT constitute a recommendation or endorsement, but rather indicates the range of doses commonly used in herbal practice.

Doses are given for single herb use and must be adjusted when using herbs in combinations.

Doses may also vary according to the type and severity of the condition treated and individual patient conditions.

Adult doses:

Tea or infusion: 150 cc of boiling water over 3 g fresh flower heads, steep for 5 - 10 minutes; drink three times daily[5].

Liquid extract: (1:1 in 45% alcohol) 1 - 4 ml three times daily[5].

Pediatric dosages: Unknown

Availability of standardized preparations: Standardized preparations of chamomile are available. Examples include Nutritional Dynamics German Chamomile, 400 mg chamomile flower per capsule (standardized to 1 % apigenin, 0.5% essential oil); Nature's Way German Chamomile, 125 mg extract (standardized to 1.2% apigenin); Nature's Way German Chamomile, 350 mg chamomile flower per capsule (0.5% essential oil potency guaranteed)[3].

Dosages used in herbal combinations: Variable

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