

## *Matricaria chamomilla* (German chamomile)

### Description

Chamomile is a widely recognized herb in Western culture. Its medicinal usage dates back to antiquity where such notables as Hippocrates, Galen, and Asclepius made written reference to it. A common ingredient today in herbal teas because of its

calming, carminative, and spasmolytic properties, it is also a popular ingredient in topical health and beauty products for its soothing and anti-inflammatory effects on skin. Chamomile has a sweet, grassy, and lightly fruity aroma. Its flowers are daisy-like, with yellow centers (approximately 1-1.5 cm in diameter) and white petals (between 12-20 in number). It is from the plant's fresh and dried flower heads that infusions, liquid extracts, and essential oils are made.

Two species of chamomile are generally used in traditional herbalism, *Matricaria chamomilla* (*Chamomilla recutita*; German chamomile; Hungarian chamomile) and *Chamaemelum nobile* (Roman chamomile). Both annual herbs belong to the Asteraceae/Compositae family and are similar in physical appearance, chemical properties, and general applications. German chamomile, however, is the more familiar and more commonly used of the two.

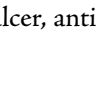
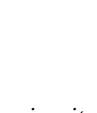
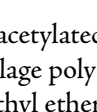
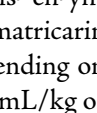
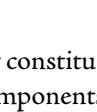
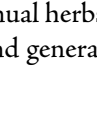
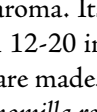
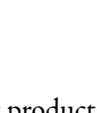
### Active Constituents

German chamomile flowers contain 0.24- to 2.0-percent volatile oil that is blue in color. The two key constituents, (-)-alpha-bisabolol and chamazulene, account for 50-65 percent of total volatile oil content. Other components of the oil include (-)-alpha-bisabolol oxide A and B, (-)-alpha-bisabolone oxide A, spiroethers (cis- and trans- en-yn-dicycloether), sesquiterpenes (antheotulid), cadinene, farnesene, furfural, spathulenol, and proazulene (matricarin and matricin). Chamazulene is formed from matricin during steam distillation of the oil. Yield varies depending on the origin and age of the flowers. European Pharmacopoeia recommends chamomile contain no less than 4 mL/kg of blue essential oil.<sup>1</sup>

Chamomile also contains up to eight-percent flavone glycosides (apigenin 7-glycoside and its 6'-acetylated derivative) and flavonols (luteolin glucosides, quercetin glycosides, and isohamnetin); up to 10-percent mucilage polysaccharides; up to 0.3-percent choline; and approximately 0.1-percent coumarins (umbelliferone and its methyl ether, herniarin). The tannin level in chamomile is less than one percent.

### Mechanisms of Action

Several pharmacological actions have been documented for German chamomile, based primarily on *in vitro* and animal studies. Such actions include antibacterial, antifungal, anti-inflammatory, antispasmodic, anti-ulcer, antiviral, and sedative effects.



The constituents of chamomile thought to have antimicrobial properties include alpha-bisabolol, luteolin, quercetin, and apigenin. Herniarin may also have antibacterial and antifungal properties in the presence of ultraviolet light. Preliminary *in vitro* studies on the antimicrobial activity of chamomile have yielded promising results. Chamomile oil, at a concentration of 25 mg/mL, demonstrates antibacterial activity against such gram-positive bacteria as *Bacillus subtilis*, *Staphylococcus aureus*, *Streptococcus mutans*, and *Streptococcus salivarius*, as well as some fungicidal activity against *Candida albicans*.<sup>2-4</sup> Whole plant chamomile extract at 10 mg/mL demonstrates a similar effect, completely inhibiting growth of group B *Streptococcus in vitro*.<sup>3</sup> In addition, chamomile extract blocks aggregation of *Helicobacter pylori* and various strains of *Escherichia coli*.<sup>3,5</sup> Chamomile extract has also been shown to inhibit the growth of poliovirus and herpes virus. German chamomile esters and lactones demonstrate activity against *Mycobacterium tuberculosis* and *Mycobacterium avium*. Chamazulene, alpha-bisabolol, flavonoids, and umbelliferone display antifungal properties against *Trichophyton mentagrophytes* and *Trichophyton rubrum*.<sup>6</sup>

The high alpha-bisabolol content in chamomile oil is credited for providing the majority of antibacterial, antifungal, anti-inflammatory, and anti-ulcer activity, although the precise mechanism of action remains unclear.<sup>7-9</sup>

*In vitro*, chamomile extract inhibits both cyclooxygenase and lipoxygenase, and consequently prostaglandins and leukotrienes.<sup>10</sup> Other anti-inflammatory effects are thought to occur via the influence of azulenes (chamazulene, prochamazulene, and guaiazulene) on the pituitary and adrenals, increasing cortisone release and reducing histamine release.<sup>2</sup>

Chamomile extracts exhibit antispasmodic properties. Apigenin, alpha-bisabolol, and the cis-spiroethers appear to provide the most significant antispasmodic effects. When tested on spasms of isolated guinea pig ileum induced by barium chloride, 10 mg of apigenin provided the antispasmodic activity roughly equivalent to 1 mg of papaverine (an opioid antispasmodic).<sup>11</sup> Similar results were observed with alpha-bisabolol and the cis-spiroethers.<sup>11-14</sup> Other flavonoids and the small amount of coumarins contribute to smooth muscle relaxation, but to a lesser degree.

*In vitro* studies demonstrate alpha-bisabolol inhibits gastric ulcer formation induced by indomethacin, ethanol, or stress.<sup>7</sup> Oral administration of chamomile oil to rats at doses ranging from 0.8-80 mg/kg bisabolol demonstrate significant protective effect against gastric toxicity of 200 mg/kg acetylsalicylic acid.<sup>15</sup>

Regarding sedative activity, one study using intraperitoneal administration of chamomile extract in mice concluded that apigenin functions as a ligand for benzodiazepine receptors, resulting in anxiolytic and mild sedative effects, but no muscle relaxant or anticonvulsant effects.<sup>16</sup> In contrast to diazepam, apigenin does not cause memory impairment. A lyophilized infusion of chamomile, also administered intraperitoneally in mice, elicited a depressive effect on the central nervous system.<sup>17</sup>

Research is exploring the antiproliferative and apoptotic effects of chamomile extract in various human cancer cell lines. One preliminary study observed *in vitro* exposure to chamomile results in differential apoptosis in cancer cells but not in normal cells at similar doses; apigenin and apigenin glycosides appear to be the key components responsible for these effects.<sup>18</sup>

## Clinical Indications

Although chamomile is a well-known and widely used herb in Western culture, few well designed, randomized, double-blind, placebo-controlled studies are available to fully assess its therapeutic benefit.

## Sleep Enhancement

In an open case study to examine the cardiac effects of two cups of chamomile tea on patients undergoing cardiac catheterization, the authors observed that 10 of 12 patients in the study achieved deep sleep within 10 minutes of drinking the tea.<sup>19</sup> The patients had a small but significant increase in mean brachial artery pressure. No other significant hemodynamic changes were observed.

## Diarrhea

In a prospective, randomized, multicenter, double-blind, parallel group trial, 79 children (ages six months to five years) with acute, noncomplicated diarrhea received either a commercial preparation of apple pectin and chamomile extract or placebo for three days,

in addition to a typical rehydration and re-alimentation diet. At the end of three days, significantly more children in the pectin/chamomile group (85%) experienced diarrhea alleviation compared to the placebo group (58%) ( $p < 0.05$ ). The children on the pectin/chamomile combination experienced a significant 5.2-hour shorter duration of symptoms compared to the placebo group.<sup>20</sup>

### Colic

A double-blind study observed the efficacy of an herbal decoction consisting of German chamomile, vervain, licorice, fennel, and balm mint on 68 healthy infants with colic. For seven days the infants (ages 2-8 weeks) received 150 mL of the herbal preparation or placebo with each colic episode, but no more than three times daily. After seven days, 57 percent of the infants receiving the herbal preparation experienced colic relief compared to 26 percent in the placebo group ( $p < 0.01$ ).<sup>21</sup>

### Wound Healing

A double-blind trial examined the therapeutic efficacy of a topical chamomile extract on 14 patients with weeping dermabrasions from tattoo applications. Those using chamomile noted a statistically significant decrease in the weeping wound area and increased drying compared to the placebo group.<sup>22</sup>

In a double-blind, randomized, placebo-controlled study, 48 women receiving radiation therapy for breast cancer were treated topically with either chamomile cream or placebo (almond oil) to protect the radiation-treated area. While 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 for its rapid absorption and stainlessness.<sup>23</sup>

### Mucositis

Mucositis, characterized by inflammation and ulceration of the gastrointestinal tract (including the mouth), is a dose-limiting consequence of some radiation and chemotherapy treatments. If severe, the patient is unable to eat solid food (grade 3) or even liquids (grade 4). A case series examined the effect of 15 drops

of Kamillosan Liquidum, a German chamomile mouthwash preparation, in 100 mL of water taken three times daily, for radiation and/or chemotherapy-induced mucositis. Cancer patients ( $n=98$ ) were divided into two groups. One group of 66 patients (20 undergoing radiation therapy, 46 undergoing chemotherapy) participated in prophylactic oral care with the mouthwash. The remaining 32 patients underwent chemotherapy and were treated therapeutically after mucositis had developed. Of the 20 patients undergoing radiation, only one developed high-grade (grade 3) mucositis in the final week of treatment, 65 percent developed intermediate-grade mucositis, and 30 percent developed low-grade mucositis. Of the 46 patients concurrently receiving chemotherapy and the mouthwash, 36 remained free of any clinically significant mucositis. Of the 32 patients with existing mucositis, all noted immediate relief from mouth discomfort, and within seven days almost all patients had no clinical sign of mucositis.<sup>24</sup>

A randomized, double-blind study was conducted with 164 cancer patients taking 5-fluorouracil (5-FU) chemotherapy. The patients rinsed three times daily with either a chamomile mouthwash or placebo. After 14 days, no difference was observed between the two groups in the incidence of stomatitis induced by 5-FU.<sup>25</sup>

### Eczema

In an open, bilateral comparative trial, 161 patients with eczema on their hands, forearms, and lower legs initially treated with 0.1-percent diflucortolone valerate received one of four treatments: chamomile cream (Kamillosan), 0.25-percent hydrocortisone, 0.75-percent fluocortin butyl ester (a glucocorticoid), or 5.0-percent bufexamac (a nonsteroidal anti-inflammatory). After 3-4 weeks, the chamomile cream was found to be as effective as hydrocortisone and demonstrated superior activity to bufexamac and fluocortin butyl ester.<sup>26</sup>

### Drug-Botanical Interactions

Only one report of a possible chamomile-drug interaction has been documented. A 70-year-old woman on warfarin was admitted to the hospital with multiple internal hemorrhages after using chamomile products (tea and body lotion) to alleviate upper respiratory tract

symptoms.<sup>27</sup> That chamomile contributed to the hemorrhaging is doubtful since the coumarin compounds in German chamomile lack the chemical configuration necessary for human anticoagulant activity.<sup>28</sup>

### Side Effects and Toxicity

Chamomile use has a high level of safety, as confirmed by numerous animal models.<sup>12,29-31</sup> One particular toxicity study using rabbit models determined the acute oral LD<sub>50</sub> and acute dermal LD<sub>50</sub> to be greater than 5 g/kg body weight.<sup>32</sup> The U. S. Food and Drug Administration (FDA) has classified the oil and extract of both German and Roman chamomile as substances Generally Regarded As Safe (GRAS).<sup>33</sup>

A few reports indicate that individuals allergic to the Asteraceae/Compositae family (ragweed, chrysanthemum, marigold, daisy, etc.), can experience cross-over hypersensitivity reactions to chamomile. One report involved an eight-year-old boy with a history of atopy who ingested a chamomile tea infusion that precipitated an anaphylactic reaction.<sup>34</sup> In another report, a 20-year-old woman with confirmed sensitivity to chamomile experienced acute rhinitis from merely using chamomile-scented toilet paper.<sup>35</sup>

### Dosage

In adults, oral administration for traditional uses are generally as follows: (1) dried flower heads: 2-8 g as an infusion three times daily; (2) liquid extract/tincture: 1-6 mL up to three times daily of 1:1 potency; 7-15 mL up to three times daily of 1:5 potency.

### Warnings and Contraindications

Individuals with known hypersensitivity to members of Asteraceae/Compositae family (ragweed, chrysanthemum, marigold, daisy, etc.), should avoid use of chamomile-containing products to reduce the likelihood of an allergic reaction.

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