Origanum vulgare

Oregano

Related Species

Origanum syriacum, Origanum compactum, Origanum onites.

Indications

Fungal, bacterial, and parasitic infections.

Mechanism of Action

Origanum vulgare has potent antibacterial, antifungal, antioxidant, and anti-inflammatory properties. The composition of the dried leaves of *Origanum vulgare* (excluding the essential oil component) includes a large amount of triterpene phenolic acids including rosmarinic, ursolic, oleanolic, caffeic, and lithospermic,[1,2] with unique components known as origanol A and origanol B),[3] which have demonstrated *in vitro* and *in vivo* anti-inflammatory and antioxidant activity.[4, 5] Other bioactive secondary metabolites with prominent effects include β-caryophyllene oxide,[6] β-sitosterol and flavonoids: eriocitrin, apigenin, luteolin, chrysoeriol, diosmetin, quercetin, and eriodictyol.[7,8]

Major active components of *Origanum vulgare* are phenolic monoterpenes, which constitute approximately 90% of the total composition of *Origanum vulgare* essential oil. Carvacrol is considered the predominant compound, followed by thymol (an isomer of carvacrol), *p*-cymene, and γ-terpinene.[9]

Origanum vulgare essential oil extracts of thymol and carvacrol have shown significant antioxidant and antimicrobial activity *in vitro*, leading to the destruction or growth inhibition of a broad spectrum of microorganisms such as *Escherichia coli, Staphylococcus aureus*,[10,11] *Listeria innocua* and *L. monocytogenes*,[12] *Saccharomyces cerevisiae, Aspergillus niger,*[13] *Bacillus cereus*,[14] *Bacillus subtilis, Candida albicans, and Eimeria tenella.*[15,16]

The comparative efficacy of *Origanum vulgare* oil, carvacrol, nystatin and amphotericin B were examined *in vitro*, and *Origanum vulgare* oil was found to completely inhibit the growth of *C. albicans* in culture, as well as the germination and mycelial growth of *C. albicans* in a dose-dependent manner.[17]

Antibacterial properties are thought to be primarily tied to carvacrol, which is active on its own, but has also demonstrated synergistic effects when combined with thymol.[18,19] Carvacrol has been used for many generations as a food preservative, and it is speculated that these compounds are able to inhibit biofilm formation,[20] disrupt the cell membrane of bacteria, and in particular, sensitize the phospholipid bilayer of the cell membrane, increasing the permeability and leakage of vital intracellular constituents.

In addition, efflux pump inhibition is another proposed intracellular mechanism of action which can boost antimicrobial activity.[21]

An *in vivo* study performed serial extractions of the aerial parts of *Origanum compactum* using either ethyl acetate, essential oil, or water. The parts were then screened for their antioxidant and antimalarial activity, and cytotoxic activity against human breast cancer cells. Among the extracts, the aqueous extract showed the highest antioxidant activity while the ethyl acetate and ethanol extracts showed activity against human breast cancer cells. The essential oil showed the greatest results concerning anti-malarial activity, and was also considered to be nontoxic.[22]

Thymol and carvacrol have also demonstrated antispasmodic activity *in vitro*. The mechanism of action seems to be both musculotropic and neurotropic, indicating an inhibition of smooth muscle responsiveness, and interference with Ca^{2+} availability to the contractile apparatus by acting as Ca^{2+} antagonists.[23,24]

Evidence-Based Research

Origanum vulgare has been shown to possess antioxidant and antimicrobial activity in both *in vitro* and *in vivo* models, and is thus considered potentially beneficial to human health. Human studies that use the leaf or oil extracts are, however, lacking. The oil of *Origanum vulgare* has been used to hinder bacterial replication in the food[25] and cosmetic[26] industries and thus prolong product shelf life.

Human Studies: Adults (*N*=14) with chronic fatigue and gastrointestinal complaints who tested positive for fecal parasites *Blastocytis hominis, Entamoeba hartmanni, or Endolimax nana*, were given 600 mg oil of *Origanum vulgare* daily by mouth for 6 weeks. After 6 weeks of supplementation there was complete disappearance of *Entamoeba hartmanni* (four cases), *Endolimax nana* (one case), and *Blastocystis hominis* in eight cases. Also, *Blastocystis hominis* scores declined in three additional cases, and gastrointestinal symptoms improved in 7 of the 11 patients who had tested positive for *Blastocystis hominis.*[27]

A randomized, double-blind study was performed to determine the effects of 3% *Origanum vulgare* ointment vs. petrolatum on bacterial contamination, subsequent infection on post-surgical wounds, and overall wound healing (i.e., scar appearance) in 40 patients who underwent surgical excision. Cultures were obtained on day 12 and scars were evaluated using the Patient and Observer Scar Assessment tool on days 12, 45, and 90. In the *Origanum vulgare* ointment group, 19% of cultures tested positive for *Staphylococcus aureus* compared with 41% in the petrolatum group. Only one patient in the *Origanum vulgare* group developed cellulitis compared with three patients in the petrolatum group. The *Origanum vulgare* group also had a statistically significant improvement in scar color, pigmentation, and pliability when compared with the petrolatum group.[28]

Animal Studies: In a murine model of systemic candidiasis, infected mice were fed varying amounts of *Origanum vulgare* oil in 0.1 mL of olive oil. The daily administration of 8.6 mg of *Origanum vulgare* oil in 100 µL of olive oil/kg body weight for 30 days resulted in 80% survivability, with no renal burden of *C. albicans* as opposed to the group of mice fed olive oil alone, who died within 10 days. Similar results were obtained with carvacrol; however, the mice fed *Origanum vulgare* oil exhibited cosmetically better clinical appearance compared with those cured with carvacrol.[17]

Another study in mice examined the efficacy of the antimicrobial properties of volatile aromatic oils and medium-chain fatty acids derived from edible plants. Groups of mice (six and eight, respectively)

infected with *Staphylococcus aureus* were given *Origanum vulgare* oil, carvacrol, monolaurin, or combined *Origanum vulgare* oil/monolaurin in 0.2 mL of olive oil for 30 days. Control mice received daily either olive oil alone (negative control) or olive oil orally plus vancomycin (positive control). In the first experiment, the daily dose of *Origanum vulgare* oil was either 2.0 µL (1.6 mg) or 4.0 µL (3.2 mg), and the mice gavaged with carvacrol received doses comparable to the phenol content in the two doses of *Origanum vulgare* oil. In the second study, the daily dose of *Origanum vulgare* oil was the same as the higher dose used before, that is, 4.0 µL (3.2 mg). Monolaurin was given at the same dose, and when both agents were combined, the same individual doses were used, that is, 3.2 mg of each. Both experiments were terminated at the end of 30 days. The body weight, disease status, and overall health of the mice during the experiments were recorded. Injected *Staphylococcus aureus* killed all 14 mice in the control group within a 1-week period. In treated mice, over one third survived for 30 days when given oral *Origanum vulgare* oil daily for 30 days. Interestingly, carvacrol given in a dose equivalent to the phenol content in the *Origanum vulgare* oil, delayed death beyond the control group (21 days compared with 3 days) but did not cure the mice. Thus, carvacrol alone could not duplicate, to the same extent, the beneficial effects of *Origanum vulgare* oil, suggesting that either the addition of thymol and/or other phenols is necessary for full synergistic effect. The authors concluded that the daily oral administration of the studied natural products alone or combined may be highly effective in preventing and treating *Staphylococcus aureus* infections and theoretically may even be effective against antibiotic-resistant strains.[10]

In another experiment, 13 sheep affected by ringworm from *Trichophyton mentagrophytes* infection were treated twice daily for 15 days with a topical mixture of essential oils consisting of *Thymus serpillum* 2%, *Origanum vulgare* 5%, and *Rosmarinus officinalis* 5% in sweet almond (*Prunus dulcis*) oil. The major components of the mixture were identified as thymol, carvacrol, 1,8 cineole, α-pinene, *p*-cymene, and *c*-terpinene. Seven other sheep were given conventional treatment, and two sheep were left untreated. A clinical and etiological cure was obtained at the end of each treatment regimen in only the treated animals. The study concluded that topical treatment with the essential oils was practical and effective, and showed a better result than conventional treatment with regard to the speed of resolution.[29]

Another study looked at the effect of 5% *Origanum vulgare*, 5% *Rosmarinus officinalis,* and 2% *Thymus serpillum* in sweet almond oil administered topically, twice a day for a month on cats infected with dermatophytoses due to *Microsporum canis.* Five out of seven cats treated with the herbal mixture recovered clinically, with four of them showing negative cultures. Two animals healed partially and still yielded positive cultures. No adverse effects were reported for any of these animals.[30]

Safety in Pregnancy and Breastfeeding

There is no information on the safety of *Origanum vulgare* in pregnancy or lactation in the scientific or traditional literature; however, traditional use as an emmenagogue suggests that is best avoided in higher than culinary amounts. It is also recommended to avoid the internal use of essential oils during pregnancy.

General Safety

The only clinical study using *Origanum vulgare* oil for oral supplementation in humans used a dose of 600 mg daily for 6 weeks. No adverse effects or side effects were reported.[27]

Exposure of gastrointestinal mucosa to concentrated essential oils can cause localized irritation, especially with prolonged usage, and could theoretically cause dysbiosis because of the strong antibacterial effects.

Dosage

This herb may be considered safe at doses up to 600 mg/day, for up to 6 weeks.

Traditional Uses

The genus *Origanum* includes 39 species of perennial plants widely distributed throughout the world whose composition of essential oils and other constituents varies with the geographical location, climate, and other ecological factors. The essential oils obtained from aromatic plants such as *Origanum* have been widely used since the Middle Ages for numerous applications.

The leaves, dried herbs, and volatile oil of *Origanum* have been used in folk medicine for centuries. *Origanum* also has a highly developed culinary use as a flavoring and food preservative. Aqueous infusion of *Origanum* is traditionally used to treat dysentery, colitis, bronchopulmonary, gastric acidity, and gastrointestinal diseases.

A major traditional use is as a carminative and stomachic (taken with meals to reduce gastrointestinal distress), and as an antispasmodic, often in the form of a tea but also as aromatherapy in the form of a bath, steam inhalation, and vaporization. Other uses include diuretic, emmenagogue, and aphrodisiac. A warm infusion would be used to produce diaphoresis or promote menstruation, and to reduce general pain and inflammation.

In traditional Chinese medicine *Origanum* spp. are used for the treatment of heat stroke, fever, vomiting, acute gastroenteritis, and respiratory disorders. *Origanum* spp. are also widely used in the treatment of respiratory and cutaneous infections and would often be administered externally as a fomentation. In addition, the herb would be used in a gargling preparation to treat earache and oral infections such as blisters, ulcers, gingivitis, and toothache.

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