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Review Article

Phytopharmacological properties of *Origanum vulgare*: A Review

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ABSTRACT

Origanum vulgare, also called oregano, is a perennial plant that is indigenous to portions of Europe, Western Asia, and the Mediterranean. It is a member of the *Lamiaceae* family. Its complex phytochemical composition which mostly consists of essential oils, flavonoids, phenolic compounds, and terpenoids has earned it widespread recognition for its culinary, medical, and therapeutic uses. Caracole and thymol, the two main bioactive components, are responsible for its strong antibacterial, antifungal, antioxidant, and anti-inflammatory qualities. Oregano essential oils have shown broad-spectrum antibiotic action against a variety of bacterial and fungal infections, such as *Aspergillus niger*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. Oregano also has antiviral, neuroprotective, and gastroprotective qualities, which make it useful for treating gastrointestinal issues, infections, inflammatory diseases, hypertension, and seizures. Its antioxidative and anti-aging properties are also attributed to its capacity to scavenge free radicals, as demonstrated by studies. Because of its ability to flourish in a variety of climates and its resistance to drought and high temperatures, oregano is an important crop in agricultural ecosystems. With increasing uses in cardiovascular health, cancer research, and antimicrobial therapies, its pharmacological relevance continues to attract attention in the field of natural medicine. *Origanum vulgare* has a wide range of therapeutic uses, therefore more research into the plant may increase its use in medicines and nutraceuticals.

INTRODUCTION

The genus *Origanum* (fam. *Lamiaceae*) is a fragrant perennial plant native to Western and Southwestern Eurasia and the Mediterranean area [2]. According to the taxonomy of *Ietswaart* in 1980, it consists of 10 sections with 38 species, 6 subspecies and 17 hybrids. Since his publication, the current day five additional species and one

hybrid have been recognized [1]. The commercial term “oregano” is used for species that are rich in phenolic monoterpenes, carvacrol and thymol, whereas the name “marjoram” corresponds to the species-rich in bicyclic monoterpenoids cis- and trans-sabinene hydrate and cis-sabinene hydrate acetate [3]. The commercial oregano, (*Origanum vulgare*), sometimes called *origanum* or wild marjoram is a fragrant perennial herb of the mint

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family (*Lamiaceae*) native to Western and Southwestern Eurasia and the Mediterranean area. The interest in its natural phytochemicals in connection to therapeutic and positive health effects has been expanding in recent years. For years, it has been utilized as a medicinal plant due to its various healthful features, such as its potent antioxidant, antibacterial and antifungal capabilities [4]. These rich characteristics of the plant's extracts and essential oils, as well as its outstanding tolerance to extreme drought and hard climatic circumstances, led to its attraction and adoption in agricultural ecosystems. The high value of *Origanum vulgare* is ascribed to distinct extracts made from different sections of the plant, which chemically varies depending on extract processing, provenance of plant material (leaves, stems and flowers), developmental stage of the plant and plant taxonomy. Carvacrol and thymol are major components of oregano essential oil, which are responsible for the antioxidant, antibacterial and antifungal effects [5]. Essential oils (EOs) are one of the most significant natural products obtained from plants, due to their varied biological qualities and their therapeutic and nutritional benefits [6]. Many plant EOs have been used as medicine for millennia and have shown numerous health advantages, including impacts on infectious, chronic, and acute disorders [7]. Numerous EOs have exhibited antibacterial action against numerous plant and human diseases [8,9]. Moreover, several EOs have earned a huge prospective interest, being able to successfully cure different types of cancer cells. EOs from *Melissa officinalis* L., *Melaleuca alternifolia* (Maiden & Betche) Cheel, *Salvia officinalis* L., *Thymus vulgaris* L., and *Origanum vulgare* L. are examined for their cytotoxic and antiproliferative actions in tumor cell lines to evaluate their efficiency as possible alternatives for cancer treatments [10,11]. The genus *Origanum* (family *Lamiaceae*) has 39 species extensively dispersed in the Mediterranean area [12,13]. *O. vulgare* is a perennial herbaceous plant, known widely as "oregano", with four subspecies in Italian flora.

The antibacterial and antioxidant activities of oregano have been linked principally to carvacrol and thymol, which are the predominant components of its essential oil [13]. Antibacterial properties have been documented for oregano against *Clostridium perfringens*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* [14-16]. Studies evaluating the antioxidant effects of Mediterranean culinary spices and popular food additives have shown that extracts from oregano were more efficient than butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) in reducing lipid peroxidation [17]. The use of synthetic antioxidants to prevent free radical damage can involve questionable nutritional value and toxic side effects while natural antioxidants present in many plants reduce oxidative damage and help in preventing mutagenesis, carcinogenesis, and aging due to their radical scavenging activities [18]. The involvement of free radicals has been identified in various clinical states, including cancer, cardiovascular illnesses, neurological disorders, and medication toxicity [19-21].



Fig 1.1: *Origanum vulgare*

Synonym: Oregano, wild marjoram, pot marjoram.

1. Geographical source

The genus *Origanum* (*Labiatae*) is an annual, perennial and shrubby herb that is endemic to the Mediterranean, Euro-Siberian and Irano-Siberian

areas. A total of 38 *Origanum* species are identified in the World. Most of the *Origanum* species, over 75%, are confined in the East Mediterranean subregion of them, 16 species are recognized as indigenous to the flora of Turkey. *Origanum* species grow abundantly on stony slopes and in rocky mountain locations over a wide range of elevations [22]. *Origanum vulgare*, popularly known as oregano, is a perennial plant of the mint family (*Lamiaceae*). Here's a thorough overview of the plant:

2. Botanical Description

1. **Botanical Name:** *Origanum vulgare*
2. **Common Name:** Oregano
3. **Family:** *Lamiaceae* (mint family)
4. **Type:** Herbaceous perennial
5. **Native Range:** Europe, Western Asia, and the Mediterranean area
6. **Growth Habit:** Woody at the base, herbaceous at the top
7. **Height:** Typically grows 18–24 inches (45–60 cm) tall, but can reach up to 3 feet (90 cm) in good circumstances.
8. **Spread:** It can spread around 1–2 feet (30–60 cm) broad.[23]

2.1. Leaves

The leaves of *Origanum vulgare* are ovate to elliptical (oval-shaped), with smooth edges or sometimes slightly wavy, dark green with a matte texture, occasionally with a somewhat grayish color due to small hairs on the underside. The size of the leaves is typically, 1–4 cm long, depending on growth circumstances. The texture is Aromatic, generally with a little fuzzy texture on the bottom. The arrangement of the leaves is opposite pairs down the stem [24,25].

2.2. Flowers

Small, tubular blooms packed in dense, spherical or slightly elongated clusters are the type of flowers of *Origanum vulgare*. The color of the

flowers is light pink to purple, while white blooms are also found in certain forms. It blooms in summer to early fall (usually July to September). The blossoms are aromatic, albeit less so than the leaves. Pollinators like bees and butterflies attract to the flowers [26-28].

2.3. Stems

Square stems (as is common in the mint family), frequently green or red-tinged in color and slightly woody at the base with a more floral feel higher up in feel [26-28].

2.4. Roots

The roots are Fibrous, spreading from the base of the plant. The function of a perennial, the roots come back every year, allowing the plant to re-establish itself from the same root system [26-28].

3. Uses

The leaves are fragrant and are used as a culinary herb, most notably in Mediterranean and Italian cuisine. Oregano is a mainstay in pizza, spaghetti sauce, and many meat meals. Oregano has been utilized in traditional medicine for its antibacterial, antifungal, and anti-inflammatory qualities. Oregano oil is often utilized for many health advantages, such as strengthening immunological function. The essential oils of oregano are used in aromatherapy and as natural insect repellents [26-28].

4. Growing Conditions

Well-drained, somewhat rich soil is best; however, oregano is extremely drought-tolerant once established. It prefers full sunlight but may tolerate slight shade. It requires regular watering for growth, while the plant is young or in excessive heat and it is drought resistant. It is hard to grow in USDA zones 4–9. It is propagated by seed, cuttings, or division [26-28].



5. Cultivation Tips

5.1. Pruning: Regular pruning can assist preserve the form of the plant and prevent it from becoming too woody. Cutting back after flowering fosters new growth.



Fig 1.2: Flowers of *Origanum vulgare* Fig 1.3: Stem of *Origanum vulgare* Fig 1.4: Roots of *Origanum vulgare*

Table No. 1: Phytoconstituents present in *Origanum vulgare*.

S. No.	Phytoconstituents Present	Activity
1.	Essential Oils	
1.1.	Carvacrol (30-70%)	A phenolic monoterpene having antibacterial and antioxidant effects.
1.2.	Thymol (1-5%)	A phenolic monoterpene having antibacterial and antioxidant effects.
1.3.	p-Cymene (5-15%)	A monoterpene having antibacterial and anti-inflammatory effects.
1.4.	γ -Terpinene (2-10%)	A monoterpene having antibacterial and antioxidant effects [29].
2.	Phenolic Compounds	
2.1.	Rosmarinic acid	A polyphenolic molecule having antioxidant and anti-inflammatory effects.
2.2.	Caffeic acid	A polyphenolic molecule with antioxidant and anti-inflammatory effects.
2.3.	Ferulic acid	A polyphenolic molecule having antioxidant and anti-inflammatory effects [30].
3.	Flavonoids	
3.1.	Quercetin	A flavonoid having antioxidant and anti-inflammatory effects.
3.2.	Luteolin:	A flavonoid having antioxidant and anti-inflammatory effects [31].
4.	Terpenoids	
4.1.	Ursolic acid	A triterpenoid having antioxidant and anti-inflammatory effects.
4.2.	Oleanolic acid	A triterpenoid with antioxidant and anti-inflammatory effects [32].

6. Pharmacological activity

6.1. Antimicrobial Activity

Antibacterial inhibits the growth of bacteria such as *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*, and antifungal antagonize the growth of fungi such as *Candida albicans* and *Aspergillus Niger* [29]. Antiviral: Inhibits replication of viruses such as Herpes simplex and Influenza [30]. Antibacterial qualities prevent the growth of dangerous microorganisms, such as *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. These bacteria are usually responsible for a range of infections, from moderate skin irritations to life-threatening disorders. By suppressing their growth, antibacterial medicines play a critical role in avoiding the spread of bacterial diseases and supporting overall health. In addition to its antibacterial characteristics, some chemicals also exhibit antifungal qualities, which limit the growth of fungi such as *Candida albicans* and *Aspergillus niger*. Fungal infections can range from superficial skin infections to serious systemic infections, such as candidemia. Antifungal medicines are vital in treating and preventing various types of infections [32].

6.2. Anti-Inflammatory Activity

Inhibition of inflammatory mediators is a crucial step that limits the production of pro-inflammatory cytokines and enzymes. These molecules are involved in beginning and sustaining the inflammatory response, which can lead to numerous chronic diseases, such as arthritis, diabetes, and cardiovascular disease. By lowering the production of pro-inflammatory cytokines and enzymes, a drug can effectively reduce the inflammatory response and promote healing. Antioxidant activity is another crucial feature that scavenges free radicals and decreases oxidative stress. Free radicals are unstable chemicals that can cause oxidative damage to cells, leading to

many diseases, including cancer, neurological disorders, and aging. Antioxidants destroy free radicals, thereby lowering oxidative stress and boosting cellular health. Free radical scavenging is a unique process by which antioxidants neutralize free radicals. This procedure involves the donation of electrons to stabilize free radicals, preventing them from generating oxidative damage. By neutralizing free radicals, a chemical can efficiently reduce oxidative stress and enhance cellular health [32]. Antioxidant enzymes enhance the activity of antioxidant enzymes such as superoxide dismutase and glutathione peroxidase [33].

6.3. Cardiovascular Effects

Origanum vulgare works as a vasodilator which relaxes blood vessels and reduces blood pressure so it is used in the treatment of hypertension, it also produces antiplatelet activity which works by inhibiting platelet aggregation and reducing the risk of thrombosis [34-35].

6.4. Neuroprotective Effects

It works in the management of seizures and convulsions which helps to maintain conditions like anxiety and tension which means it acts as an anticonvulsant and anxiolytic [36-37].

6.5. Gastrointestinal Effects

The Gastroprotective activity protects against stomach ulcers and inflammation by protecting the lining of the stomach and reducing the acid secretion from the stomach. (38) The Antidiarrheal activity reduces diarrhea and intestinal irritation. (39)

CONCLUSION

The complex phytochemical content of *Origanum vulgare*, which includes flavonoids, terpenoids, phenolic compounds, and essential oils, makes it a highly prized medicinal herb. Its exceptional



antibacterial, antioxidant, anti-inflammatory, and anticancer properties are a result of these bioactive substances. Traditional medicine has made considerable use of the plant to treat a wide range of conditions, including gastrointestinal disorders and infections. Recent research supports oregano's therapeutic promise by demonstrating how well it works to fight bacterial and fungal infections, lower oxidative stress, and provide cardiovascular and neuroprotective advantages. In particular, the antioxidant qualities offer a natural substitute for artificial additives, highlighting *Origanum vulgares* vital role in preserving health. By investigating novel uses, refining extraction techniques, and enhancing comprehension of its pharmacological effects, more studies could establish *Origanum vulgare* as a useful tool in contemporary medicine and nutraceuticals.

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