



Oregano essential oil: composition and results of the review on *Origanum vulgare*

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1. ABSTRACT

This narrative review examines the identity, composition, and studied activities of *Origanum vulgare* and its essential oil. The central point is variability: species, chemotype, cultivation, harvesting, and extraction can change the molecules detected. Therefore, data on extracts do not automatically describe the spice used in meals. The authors' summary collects studies on the plant, essential oil, and oregano extracts. In simple terms, it shows that there is no single chemical profile valid for all products labeled "oregano." Carvacrol and thymol, two phenolic monoterpenes (aromatic molecules of plant origin), are often central in the essential oils studied, but their proportions can change significantly. Other components, such as *p*-cymene, γ -terpinene, linalool, and sesquiterpenes, can also vary. The authors attribute this difference to the plant's genetics, growth stage, environmental conditions, harvesting, and processing. The publication also reports antioxidant and antimicrobial activities observed primarily in laboratory tests. These tests serve to understand whether a preparation can limit oxidation or the growth of microorganisms under controlled conditions. However, they do not prove that the spice used in the diet prevents or cures diseases in humans. The review also highlights a relevant safety point: for many extracts, a sufficiently precise characterization and long-term toxicological data are lacking. The practical message is, therefore, to always distinguish the common culinary herb from concentrated preparations and to verify which material was actually analyzed.

VIDEO ARTICLE



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2. WHAT THIS RESEARCH ANALYZED

The 2025 publication by Nurzyńska-Wierdak and Walasek-Janusz does not present a new experiment. It is a narrative review: the authors consulted scientific databases to gather information on the botany, composition, extraction, food uses, and potential biological activities of common oregano and its essential oil. In practice, it clarifies why the same commercial label can refer to very different materials. The chemical core discussed includes the essential oil, which is the volatile fraction responsible for much of the aroma, and other plant compounds such as polyphenols and rosmarinic acid. Carvacrol and thymol emerge as recurring, though not universal or constant, components. The authors describe chemotypes, which are groups of plants of the same species with a different dominant chemical profile. This highlights the need to consider the species, subspecies, part of the plant, and preparation method together.

3. WHAT RESULTS EMERGE FROM THE STUDY

The main finding is conceptual: oregano is not a chemically uniform product. Genetics, developmental stage, environment, harvesting, drying, and extraction can all alter the quantities and proportions of the substances detected. For the plant cell, this reflects an adaptation; for those using the product, it means that two oils or extracts may not be interchangeable. The review primarily associates carvacrol and thymol with antioxidant and antimicrobial activities observed in experimental systems. Antioxidant activity refers to the ability to counteract oxidation reactions in tests; antimicrobial activity refers to a reduction in the growth of microorganisms under controlled conditions. The authors also cite lines of research on inflammation, angiogenesis, and tumor cells, but they do not report clinical evidence that the dietary use of oregano produces such effects in humans. Aggregate sample sizes, comparable doses, risk values, or unique clinical estimates are not available in the publication.

4. WHY THIS STUDY IS RELEVANT

The relevance lies in separating three levels that are often confused: the spice used in meals, the essential oil, and formulated extracts. The former is a complex

food matrix used in small quantities; the others are concentrated preparations with different compositions and methods of use. This distinction allows for a more accurate interpretation of laboratory results. The review is also useful because it highlights the importance of standardization, i.e., the measurable description of what a product contains. Without this information, comparing biological activities between different samples is difficult. The message is not that oregano is of no interest, but that the potential of an extract cannot be automatically attributed to the culinary spice.

5. STUDY LIMITATIONS AND WHAT IT DOES NOT DEMONSTRATE

As a narrative review, this work does not report a study selection protocol with comprehensive quantitative criteria, nor does it provide a statistical synthesis of the results. Therefore, it does not allow for the estimation of an average effect, the comparison of dosages, or the determination of which preparation is most effective. Furthermore, the collected sources include highly diverse models: chemical analyses, tests on microorganisms, cells, and animals. The publication does not demonstrate that carvacrol, thymol, or essential oil can cure infections, inflammation, tumors, or other conditions in humans. It also does not prove that all oregano-based products have identical composition or safety. The authors themselves point out limitations in long-term toxicological data and in the characterization of certain extracts. A correlation between composition and activity in a test tube does not equate to a clinical benefit.

6. INDEPENDENT CONFIRMATORY EVIDENCE

The strongest chain starts with composition. Teixeira and colleagues compared essential oil and aqueous or ethanolic extracts of *O. vulgare* in the laboratory. The oil mainly contained carvacrol, *b*-fenchyl alcohol, thymol, and γ -terpinene; the hot aqueous extract showed the highest antioxidant activity, while the extracts did not inhibit the seven bacteria tested, whereas the oil did. This directly supports the idea that the extraction method changes the measured functional profile, but it does not concern people or food consumption [1]. A second step concerns the

genotype. Zinno and colleagues analyzed eight oils obtained from two botanical groups grown on eight farms. Samples rich in carvacrol and those rich in thymol differed both in composition and in some experimental activities. This is a direct confirmation of the variability between chemotypes, although the number of samples and the in vitro model limit generalizability [2]. Jerković and colleagues instead followed plant material collected in different seasons, with three replicates per period. Thymol, carvacrol, *p*-cymene, and γ -terpinene showed marked fluctuations; shade drying slightly reduced the oil yield without qualitatively changing the detected compounds. This evidence supports the role of harvesting and processing, but it concerns only one subspecies and one drying method [3].

7. CONFLICTING EVIDENCE

Evidence does not deny that carvacrol and thymol are important in many oregano oils, but it shows that they cannot be considered mandatory markers for every population. Lukas and colleagues examined 502 individual *O. vulgare* plants from 51 populations. They identified three main monoterpene profiles, including types with linalool or sabinyl compounds, and total oil contents ranging from 0.03% to 4.6%. This data reduces the generalizability of unique chemical descriptions [4]. Consistently, De Martino and colleagues studied three wild populations and identified three chemotypes: carvacrol/thymol, thymol/ α -terpineol, and linalyl acetate/linalool. The latter oil showed lower antibacterial activity in the model used compared to the phenol-rich samples. The result indicates a dependence on the sample and the microorganism tested, rather than a ranking valid for human health [5].

8. QUADRO COMPARATIVO E SINTESI DELLE EVIDENZE

Comparison between independent publications and the central thesis of the review: the composition and activity of oregano depend on the material and the experimental context.

Quadro comparativo

Study	Model and sample size	Main result	Relation to the review
Teixeira et al., 2013 [1]	In vitro tests; oil and three extracts; seven bacteria	Oil and extracts showed different activity profiles	Confirms the effect of the extraction method
Zinno et al., 2023 [2]	Eight oils from two botanical genotypes	Carvacrol- or thymol-rich chemotypes differed in composition and activity	Confirms variability linked to genotype
Jerković et al., 2001 [3]	Seasonal collections with three replicates per period	The season markedly modified the main volatile compounds	Confirms the role of collection and processing
Lukas et al., 2015 [4]	502 plants, 51 populations	Three major chemical profiles and wide variability in oil content	Downsizes the idea of a single profile
De Martino et al., 2009 [5]	Three wild populations and ten bacteria	Three chemotypes with non-overlapping antibacterial activity	Shows dependence on chemotype and test



9. SINTESI EDITORIALE E CONCLUSIONI

EDITORIAL CONCLUSION

The review by Nurzyńska-Wierdak and Walasek-Janusz offers, above all, a key takeaway: speaking about oregano without specifying which product has been analyzed can be misleading. *Origanum vulgare*, dried spice, essential oil, and extract are not equivalent. Carvacrol and thymol are relevant components in many samples, but their presence and quantity depend on genetics, harvesting, environment, and processing. Independent publications confirm that extraction, season, and chemotype modify both the composition and the activities observed in the laboratory. At the same time, populations rich in linalool, linalyl acetate, or other compounds show that there is no universal model. The antioxidant and antimicrobial activities described are useful experimental data, but not proof of the clinical efficacy of the spice in the diet. The most rigorous conclusion is to value oregano as a food ingredient and to interpret the effects attributed to concentrated oils and extracts with particular caution.

Aggiornato al 22/10/2026. Questo contenuto riflette una sintesi divulgativa delle evidenze scientifiche al momento della pubblicazione e non sostituisce il parere medico.

10. TRANSPARENCY AND SCIENTIFIC RESPONSIBILITY

Artificial Intelligence was used solely as a tool for editorial and documentary support. All content, interpretations, bibliographic citations and conclusions have been verified, reviewed and approved by the author, who assumes full scientific responsibility for them.

The manuscript was also subjected to independent peer review prior to publication.

To ensure the greatest transparency, the complete history of the article, including the dates of submission, revision, acceptance and publication, as well as information on the peer review process, is available on the dedicated Article History page.

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