

## *Technical Report*

# Significance of Oregano Oil in CanXida Remove (Formula RMV)

*In CanXida Remove (Formula RMV), oregano oil synergizes its natural antimicrobial, antioxidant, anti-inflammatory, and analgesic properties for effective pathogen clearance and wound healing\*.*

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## Executive Summary

Oregano, found in various aromatic species mainly from the *Lamiaceae* and *Verbenaceae* families, has been used for its flavoring enhancer and medicinal properties over the decade. Oregano oil is a natural supplement associated with various health benefits, particularly in digestive health. Derived from oregano plants, it contains bioactive compounds like carvacrol and thymol.

Oregano oil is known for its antimicrobial properties, including antibacterial, antifungal, and antiviral effects, making it valuable for addressing digestive issues. It may contribute to balancing gut microbiota, reducing inflammation, and providing antioxidant support. While generally recognized as safe, Oregano oil lacks specific FDA regulation as a dietary supplement. Its inclusion in the CanXida Remove formula is essential for holistic digestive support, harnessing its properties to combat pathogens, promote overall gut health, and contribute to general well-being\*.

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\* These statements have not been evaluated by Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease.

## 1 Introduction

Oregano, comprising numerous aromatic species predominantly belonging to the *Lamiaceae* and *Verbenaceae* families, constitutes a substantial portion of globally traded culinary herbs. This botanical diversity not only serves as a key component in the culinary world but also holds significance in traditional medicine, addressing a diverse range of diseases such as bacterial infections, digestive disorders, inflammatory conditions, and others.(Bautista-Hernández et al., 2021)

Oregano has a long history of use dating back thousands of years in ancient civilizations such as the Greeks and Romans, both for culinary and medicinal purposes. While the exact timeline is challenging to determine, it's clear that oregano has been a culturally significant herb throughout history. (Singletary, 2010)

Oregano oils are distinguished by a diverse array of compounds, representing a rich reservoir of bioactive molecules. The principal categories of compounds identified include terpenoids, triterpene acids, phenolic acids, flavonoids, hydroquinone's, hydrocarbons, tocopherols, fatty acids, sterols, and inorganic compounds.

Notably, major bioactive constituents such as carvacrol and thymol are prominent within oregano oil, contributing significantly to their therapeutic properties.(Coccimiglio et al., 2016; Tepe et al., 2016)

Extensive academic investigation has been directed towards various *Origanum* species, aiming to uncover the potential applications of their diverse extracts. These studies have unveiled a spectrum of bioactive molecules that position *Origanum* species as valuable resources with multifaceted properties. Some of the notable areas under investigation include antidiabetic, antiviral, antimicrobial, antioxidant, larvicidal, hepatoprotective, cardiorespiratory, anti-inflammatory, and analgesic activities.(Antoniussen et al., 2021; Coccimiglio et al., 2016; Leyva-López et al., 2017; Singletary, 2010)

Ongoing academic research continues to delve into the effects of *Origanum* species on various physiological aspects. These investigations include colitis i.e., colon injury, and impacts on the gastrointestinal tract. (Antoniussen et al., 2021)

## 2 Bioactive Compounds of Oregano Oil

Oregano oil is typically extracted from the leaves of the oregano plant. (Table 1) The leaves contain the essential oils, such as carvacrol and thymol, which contribute to the medicinal properties of oregano oil. Here are some of the key bioactive compounds found in oregano oil:

### 2.1 Terpenoids:

*Carvacrol and Thymol:* These are the key active ingredients recognized for their antibacterial qualities, which make them efficient against a variety of bacteria, fungus, and parasites.

Major components are carvacrol and thymol that constitute about 78 to 82% of the total oil. (Skoufos et al., n.d.)

### 2.2 Phenolic Acids:

*Rosmarinic Acid:* Contains antioxidant and anti-inflammatory characteristics, which contribute to oregano oil's general health-promoting benefits.

### 2.3 Triterpene Acids:

*Ursolic and Oleanolic Acids:* Both of these compounds have anti-inflammatory which contribute to oregano oil's overall medicinal potential.

### 2.4 Hydroquinone:

*4-Terpineol:* It is well-known for its antimicrobial properties, which aid in the management of infections, including those caused by fungi.

### 2.5 Flavonoids:

*Apigenin and Luteolin:* They have anti-inflammatory and antioxidant qualities that add to oregano oil's general health advantages.

### 2.6 Hydrocarbons:

*$\alpha$ -Pinene,  $\beta$ -Pinene, Myrcene:* These substances add to the aromatic profile of oregano oil and have medicinal benefits such as antibacterial and anti-inflammatory properties.

### 2.7 Fatty Acids:

*Linoleic and Oleic Acid:* They may have anti-inflammatory properties and help to preserve the health of the skin.

**Table 1:** Provides a structured overview of the bioactive compounds found in oregano oil, their respective categories (Goliaris et al., 2003; Maria et al., 2014; Viuda-Martos et al., 2007)

Category	Compounds
<b>Monoterpenes</b>	$\alpha$ -Thujene, $\alpha$ -Pinene, Camphene, Sabinene, $\beta$ -Pinene, Myrcene, $\alpha$ -Terpinene, p-Cymene, 1,8-Cineole, Limonene, $\gamma$ -Terpinene, Trans-sabinen-hydrate
<b>Alcohols and Phenols</b>	Borneol, Terpinen-4-ol, $\alpha$ -Terpineol, Methyl thymyl ether
<b>Oxygenated Monoterpene</b>	Thymol
<b>Phenolic Compounds</b>	Carvacrol
<b>Sesquiterpenes</b>	$\beta$ -Caryophyllene, $\alpha$ -Humulene, Germacrene D, $\gamma$ -Cadinene, $\beta$ -Bisabolene, $\delta$ -Cadinene, $\alpha$ -Cadinol
<b>Phenolic Acids</b>	Rosmarinic Acid
<b>Triterpene Acids</b>	Ursolic Acid, Oleanolic Acid
<b>Hydroquinone</b>	4-Terpineol
<b>Flavonoids</b>	Apigenin, Luteolin
<b>Hydrocarbons</b>	$\alpha$ -Pinene, $\beta$ -Pinene, Myrcene
<b>Sterols</b>	$\beta$ -Sitosterol, Campesterol
<b>Fatty Acids</b>	Linoleic Acid, Oleic Acid
<b>Tocopherols</b>	Vitamin E
<b>Inorganic Compounds</b>	Magnesium, Calcium, Potassium

## 2.8 Sterols:

*$\beta$ -Sitosterol and Campesterol:* Plant sterols have anti-inflammatory and possibly

cholesterol-lowering qualities that support cardiovascular health.

## 2.9 Tocopherols:

Oregano oil's overall antioxidant activity is attributed to tocopherols and tocotrienols, which are antioxidants that shield cells from oxidative damage.

## 2.10 Inorganic Compounds:

Magnesium, calcium, and potassium are necessary for a number of physiological processes that promote general health.

## 3 Health Benefits of Oregano Oil

Oregano oil is believed to offer several health benefits (Table 2), including:

### 3.1 Antibacterial Properties:

Oregano oil is renowned for its potent antibacterial properties, attributed to key compounds such as carvacrol and thymol. These active ingredients exhibit broad-spectrum efficacy against both pathogenic and nonpathogenic bacteria. (Coccimiglio et al., 2016)

The oil's antimicrobial effects extend beyond human pathogens to include animal and plant pathogens, as well as bacteria crucial for environmental safety.

Recent research has unveiled the underlying mechanisms, revealing that the aromatic monoterpenes in oregano oil, particularly carvacrol, induce cellular changes leading to membrane destabilization and increased permeability, ultimately causing bacterial cell death. (Mączka et al., 2023)

Additionally, oregano oil has demonstrated gene-inhibitory effects, particularly on virulence genes in certain bacteria. (Mith et al., 2015)

### 3.2 Anti-Fungal Properties:

Thymol and carvacrol-rich oregano oil has strong antifungal properties. It causes a Ca<sup>2+</sup> burst, damages fungal cell membranes, and prevents the synthesis of ergosterol.

**Ergosterol**, is the most abundant sterol in fungal cell membranes, which regulates its permeability and fluidity.

It works well against dermatophytes and *Candida albicans*, and it may be able to manage *Botrytis cinerea* as well. (Karadayı et al., 2020)

### **3.3 Anti-viral Properties:**

Oregano oil possesses significant antiviral properties attributed to its key components, particularly carvacrol. Scientific studies have demonstrated the effectiveness of oregano oil against various viruses.

### **3.4 Balancing Gut Microbiota:**

Maintaining a balanced gut flora is essential for general health, and oregano has been studied for its potential in this regard.

Research indicates that the components found in oregano, especially its essential oils that are high in thymol and carvacrol, may help maintain the balance of gut microbial communities. These bioactive substances have antibacterial qualities that allow them to target only dangerous bacteria and leave healthy ones alone. (Kim et al., 2023; Unusan, 2020)

Oregano may help maintain a healthy balance by altering the bacteria composition of the gut, which would improve digestive health. \*(Chedid et al., 2014; Unusan, 2020) Furthermore, oregano's anti-inflammatory properties could also support a healthy gut

environment, which highlights its ability to support a well-balanced and healthy gut microbiota.

### **3.5 Anti-Inflammatory Effects:**

Oregano oil is thought to have anti-inflammatory qualities, due to its high concentration of bioactive components such as carvacrol, rosmarinic acid and thymol.

According to a 2017 study, certain molecules in oregano essential oil have anti-inflammatory capabilities but can be harmful to specific cells. As a result, further controlled research is required to adequately determine its therapeutic value.(Han & Parker, 2017; Leyva-López et al., 2017)

### **3.6 Improving defense mechanism:**

The potential of oregano oil to strengthen the defense mechanism is well known. It has shown immunomodulatory effects in a number of studies and is rich in bioactive compounds like thymol and carvacrol. It is thought that these substances aid in the body's defense against infections and illnesses by stimulating immune responses\*(Imran et al., 2022)

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*Table 2: List of some clinical trials using oregano & oregano oil as an active ingredient in treatment or prevention. Source: clinicaltrials.gov*

<b>Clinical Trial ID</b>	<b>Health Condition</b>	<b>Status</b>
<b>NCT04779502</b>	Halitosis	<i>Completed</i>
<b>NCT05679310</b>	<ul style="list-style-type: none"> <li>• Body Weight</li> <li>• Homocystine; Metabolic Disorder</li> <li>• Inflammation</li> <li>• Oxidative Stress</li> </ul>	<i>Completed</i>
<b>NCT05197569</b>	Patient Engagement	<i>Completed</i>
<b>NCT06135831</b>	Osteopenia or Osteoporosis	<i>Completed</i>
<b>NCT03514199</b>	Sleep Apnea	<i>Unknown status</i>
<b>NCT01085019</b>	Endothelial Function	<i>Completed</i>
<b>NCT05679310</b>	Oxidative Stress	<i>Completed</i>
<b>NCT01332747</b>	Hyperlipidemia	<i>Completed</i>
<b>NCT03676803</b>	Microbiota	<i>Completed</i>
<b>NCT00954902</b>	<ul style="list-style-type: none"> <li>• Cardiovascular</li> <li>• Psychological Stress</li> </ul>	<i>Completed</i>
<b>NCT04710394</b>	<ul style="list-style-type: none"> <li>• Ageusia</li> <li>• Anosmia</li> <li>• COVID-19 Pandemic</li> <li>• Covid19</li> </ul>	<i>Completed</i>

### **3.7 Antioxidant Property:**

Oregano oil demonstrates noteworthy antioxidant properties, effectively mitigating oxidative stress by neutralizing reactive oxygen species (ROS) produced during metabolic processes. Its effectiveness has been observed in various studies.(Coccimiglio et al., 2016; Karadayı et al., 2020)

The antioxidant capacity, attributed to key components like carvacrol, extends to scavenging ROS, showcasing its potential as a natural antioxidant.

### **3.8 Wound Healing Property:**

The possibility of oregano oil aiding in the healing of wounds has been studied. Oregano oil has antibacterial qualities that can help stop wound infections. It is rich in bioactive compounds like thymol and carvacrol. Oregano oil is a good option for keeping the area surrounding wounds sterile because these compounds have shown efficacy against a variety of bacteria\*.

Additionally, by lowering inflammation, oregano oil might help promote the healing of wounds. Although excessive or persistent

inflammation can obstruct the healing process, inflammation is a normal component of the healing response. The active components of oregano oil are responsible for its anti-inflammatory qualities, which may help regulate the inflammatory response and create an environment that is favorable for tissue repair. (Avola et al., 2020)

## **4 Biosafety Profile of Oregano Oil**

Oregano oil generally has a favorable biosafety profile. It is considered safe for use, and adverse effects are infrequent. However, as with any substance, individual reactions can vary.

The U.S. Food and Drug Administration categorizes both oregano and oregano oil as "generally recognized as safe" (GRAS) for use in food. While generally well-tolerated, rare instances of gastrointestinal upset and allergic skin reactions have been reported. Due to limited data, it is recommended to avoid consuming oregano in amounts exceeding typical flavoring levels found in foods. (Kintzios, 2021)

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Carvacrol is the safest chemical substance at low concentrations, has been approved by the FDA, and is used as a food preservative. (Suntres et al., 2014)

It's important to note that concentrated essential oils, including oregano oil, are potent and should be used cautiously. In some cases, direct skin contact with undiluted oregano oil can lead to irritation. Therefore, it is often recommended to dilute the oil before topical application. (Romm et al., 2010)

The extraction methods for oregano oils, including steam distillation, cold pressing, and supercritical fluid extraction methods are generally recognized as non-toxic. These processes prioritize the preservation of the oil's natural properties without introducing harmful substances. (Hrnčič et al., 2020)

Generally, safe and efficient use of oregano oil is ensured by careful application in compliance with advised guidelines\*.

## 5 Effective Targets of Oregano Oil

Oregano oil has antibacterial properties due to its high concentration of bioactive

compounds, particularly carvacrol. Its effectiveness extends to antifungal, antibacterial, and possibly antiviral targets.

### 5.1 Antifungal Targets:

Notable targets include;

- ***Aspergillus***: Common mold, potential respiratory pathogen. Includes:
  - ❖ *Aspergillus niger*
  - ❖ *Aspergillus flavus*
- ***Candida spp.***: Causes candidiasis, and potentially leading to infections.
- ***Penicillium rubrum***: Common indoor mold; may cause respiratory issues in sensitive individuals.
- **Dermatophytes**: Cause skin, hair, and nail infections.

### 5.2 Anti-Bacterial Targets:

Oregano oil demonstrates significant antibacterial activity, particularly through its key components like carvacrol. Various bacterial species are sensitive to oregano oil, including; but not limited to\*,

- ***Acinetobacter baumannii***: Opportunistic pathogen, associated infections.

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- *Klebsiella pneumoniae*: Causes various infections, including pneumonia and urinary tract infections; known for antibiotic resistance.
- *Escherichia coli (E. coli)*: Common gut bacterium; some strains can cause infections.
- *Staphylococcus aureus*: Causes skin infections, and pneumonia etc.

### 5.3 Antiviral Targets:

Research suggests that oregano oil, with its antiviral properties, may target the viruses such as\*:

- Human rotavirus,
- Acyclovir-resistant herpes simplex virus type 1 (ACVRHHV-1)
- human respiratory syncytial virus (HRSV).

## 6 Significance of Oregano Oil in CanXida Remove

The infusion of Oregano Oil into CanXida Remove not only elevates the product's

effectiveness in combating microbial threats but also contributes to a well-rounded approach to overall health and well-being\*.

Oregano Oil, infused with potent antibacterial, antiviral and antifungal compounds like carvacrol and thymol, can enhance CanXida Remove's ability to combat diverse microorganisms that can result in maintaining the healthy microbiota thus, can result in enhancing the overall gut health.

It has also been shown to be effective against candida species thus can provide a better eradication of candida species by preventing infection\*.

Furthermore, Oregano Oil's anti-inflammatory, antioxidant, pain-relieving, and wound-healing properties can collectively aid in combating Candida infections. It may reduce inflammation, counteract oxidative stress, improving body defense mechanism, provide pain relief, and support wound healing, contributing to an effective approach against Candida overgrowth.

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