



Medicinal Use of Rosemary Plant

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ABSTRACT:

Rosemary, or *Rosmarinus officinalis*, is a well-known aromatic herb that has been used for ages in cosmetic, medical, and culinary uses. With a focus on its bioactive ingredients and therapeutic potential, this article attempts to provide an overview of *R. officinalis*' phytochemical components and pharmacological effects. Numerous essential oils, polyphenols, flavonoids, terpenoids, and alkaloids are found in rosemary, according to phytochemical study. The main bioactive substances are rosmarinic acid, caffeic acid, carnosic acid, and essential oils including camphor and 1,8-cineole. These substances support rosemary's many pharmacological characteristics, which include hepatoprotective, anti-inflammatory, antibacterial, anticancer, neuroprotective, and antioxidant activities. Recent research has also demonstrated the herb's ability to improve digestion, reduce cognitive decline, and have analgesic effects. Despite its potential for treatment, more clinical research and toxicity evaluations are needed.

Keywords: *Rosmarinus officinalis*, rosemary, phytochemicals, pharmacological effects, antioxidants, anti-inflammatory, neuroprotection, hepatoprotection.

Background:

Lawn rosemary and salvia are other names for *Rosmarinus officinalis* (Linn.) (Rosemary) (Lamiaceae). *Rosmarinus* is a sub-shrub that grows to a height of one to two meters and is bushy, branching, and evergreen. It grows across the globe, particularly in the Mediterranean region. Rosemary leaves are dark, challenging, and linear for novices. The blossoms are somewhat blue and minuscule in size. There are numerous benefits and applications for rosemary, which has long been utilised to foster memories. It promotes the growth of hair. It can strengthen the immune system and help with pain relief. utilised as a spice in cooking, as a natural food industry preservative, and as a decorative and therapeutic plant. Numerous phytocompounds with medicinal properties can be separated from necessary





Fig. Rosemary Plant.

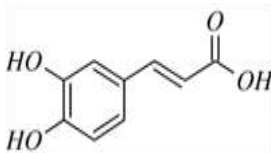
SCIENTIFIC CLASSIFICATION OF ROSMARINUS OFFICINALIS L:

- Kingdom-Plantae
- Subkingdom- Tracheobionta
- Superdivision- spermatophyta
- Division - magnoliophyta
- Class- magnoliopsida
- Subclass-Asteridae
- Order - Lamiales
- Family - Lamiaceae
- Genus -Rosmarinus L.
- Species - officinalis
- Binomial nomenclature -Rosmarinus officinalis L.

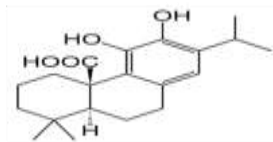
Sr. No.	Class of Compounds	Key Compounds	Biological Activity
1.	1)Essential oil	1) 1,8 Cineole (Eucalyptol)	-Anti-microbial. -Anti-inflammatory. -Cognitive enhancement.
		2) Alpha-pinene	-Anti-inflammatory. -Bronchodilatory. -Anti-oxidant.
		3)Camphor	-Circulatory stimulant. - Anti-microbial. -Anti-inflammatory.
		4)Caryophyllene	-Anti-inflammatory. -Analgesic. -Cannabinoid receptor agonist.

		5)Borneol	- Anti-inflammatory. - Anti-microbial. - Anti-microbial.
		6)Linalool	-Calming. -Anti-anxiety - Anti-microbial.
	2)Phenolic Compound	1)Rosmarinic acid	- Anti-oxidant. - Anti-inflammatory. - Anti-microbial. -Anti-viral.
		2)Carnosic acid	-Neuroprotective. - Anti-inflammatory. -Anti-cancer. - Anti-oxidant.
		3)Carnosol	- Anti-oxidant. - Anti-inflammatory. - Anti-cancer.
		4)Apigenin	- Anti-inflammatory. - Anti-oxidant. - Anti-cancer
	3)Flavonoid	1)Luteolin	- Anti-oxidant. - Anti-inflammatory - Anti-cancer.
		2)Quercetin	- Anti-oxidant. - Anti-inflammatory - Anti-cancer
	4)Diterpenes	1)Rosmaridiphenol	- Anti-oxidant. - Anti-inflammatory
		2)Rosmarinol	-Neuroprotective. - Anti-cancer
	5)Triterpenes	1)Ursolic acid	- Anti-inflammatory - Anti-oxidant. - Anti-cancer
		2)Tannins	- Anti-oxidant. - Anti-microbial - Anti-inflammatory
	6)Phenolic acid	1)Caffeic acid	- Anti-oxidant. - Anti-inflammatory.

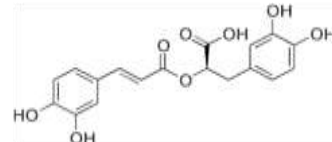
			- Anti-microbial
		2) Ferulic acid	- Anti-oxidant. - Anti-inflammatory. - Anti-cancer
	7) Vitamins	1) Vitamin A	- Anti-oxidant. - Skin health. - Immune support.
		2) Vitamin C	- Anti-oxidant. - Immune support.
		3) Vitamins (eg. Folate)	- Metabolic Support. - Energy Production.
	8) Minerals.	1) Calcium.	- Bone health. - Muscle function.
		2) Potassium	- Electrolyte balance. - Heart health.
		3) Magnesium	- Muscle & nerve function. - Heart health.
		4) Iron	- Oxygen transport. - Energy production.



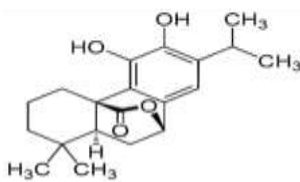
Caffeic acid



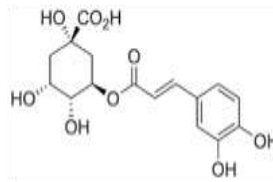
Carnosic acid



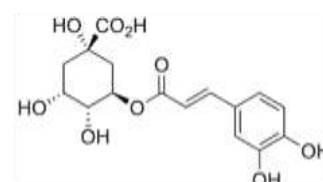
Rosmarinic acid



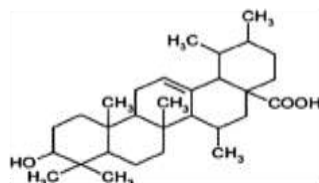
Carnosol



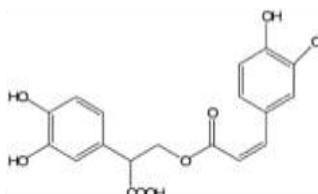
Chlorogenic acid



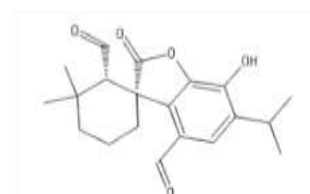
Oleanolic acid



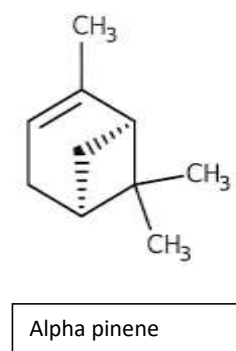
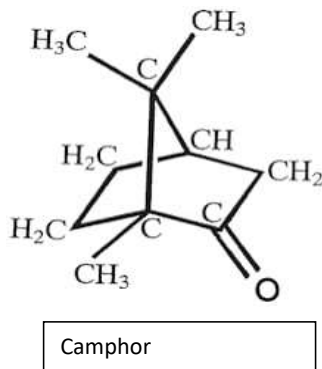
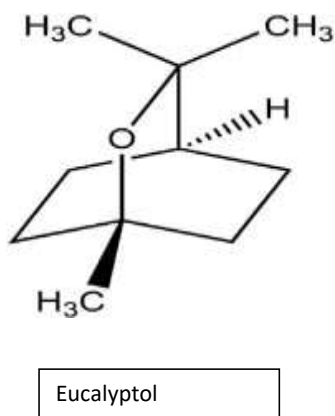
Ursolic acid



Rosmanol



Rosmadiol



Method of extraction:

1.Maceration: Crushed or powdered materials are stirred in solvents for a minimum of three days at room temperature. The solution is then filtered. Plant cells tear down their cell walls to release phytochemicals.

2.Infusion: The sample is cooked in specified amounts of water throughout a shorter period of time using the same maceration procedure.

3.Decoction: The same procedures as maceration and infusion are employed, but it is possible to extract thermostable chemicals and compounds from the plant's hard portions, like the roots and bark.

4.Percolation: The same procedures as infusion and maceration are applied. The extraction process takes place for roughly two hours after the material comes into contact with boiling water. The end result is a concentrated extract.

5.Soxhlet extraction: The Soxhlet extractor is used to carry out the extraction procedure. The apparatus is filled with the sample and solvent. The solid particles from the material are removed when the solvent is heated. The liquid that is produced is filtered and absorbed. The solvent is heated without damaging the chemical, and a more concentrated sample is produced.

6.Microwave assisted extraction: Using microwaves to access molecules in a sample inside a solvent is known as microwave aided extraction. The heat produced on the sample's surface encourages modifications to the chemical elements' structures and facilitates the solvent's penetration into the substance, which in turn facilitates the compounds' extraction.

7.Ultrasound-assisted extraction: The chemicals are extracted using ultrasound (20–2000 kHz). Because the plant cell wall is more permeable during this process, there is an increase in solvent contact with the sample. Sound waves promote the release of phytochemical substances by disrupting the cell wall's molecular integrity.

8.Accelerated solvent extraction: Using small amounts of solvents at high temperatures and pressures, chemicals are automatically extracted from solid and semi-solid materials.

9.Supercritical fluid extraction: Both liquid and solid materials are extracted utilising supercritical fluids as solvents. The most often utilised fluid is carbon dioxide (CO₂). Analytical applications, the elimination of undesirable materials, and the isolation of a specific phytochemical in a sample can all be accomplished with this technique. It is important to take into account the temperature and pressure (around 31 °C and 74 bar).

Table of some example of bioactive compounds that can be extracted with different solvents:

Water	Ethanol	Methanol	Chloroform	Dichloromethane	Ether	Acetone
Anthocyanin	Tannin	Anthocyanin	Terpenoid	Terpenoid	Alkaloid	
Tannin	Polyphenol	Terpenoid	Flavonoid		Terpenoid	
Saponin	Flavonol	Saponin				
Terpenoid	Terpenoid	Tannin				
	Alkaloid	Flavone				
		Polyphenol				
Water	Ethanol	Methanol	Chloroform	Dichloromethane	Ether	Acetone

Pharmacological Activity:

Antioxidant activity: Naturally occurring antioxidants derived from plants are becoming more and more significant in the fields of preventive medicine and nutrition (food stability and preservation). Because of its high polyphenol content, the Lamiaceae family has been the subject of research on antioxidant chemicals. Similarly, leaves of *R. officinalis* are frequently used as a condiment to add flavour to meals and as a source of antioxidant chemicals that are used in food preservation applications. The primary components of rosemary's potent antioxidant properties have been identified as its essential diterpenes, carnosol, and carnosol acid. The antioxidant activity of these bioactive substances and the essential oil was confirmed using the 2,2-diphenyl-1-picrylhydrazyl technique. Due to their pharmacological properties, essential oils and their active components were a popular pastime at the time. The role of antioxidants

Anti-infectious properties :Antimicrobial secondary metabolites are produced by the majority of plants either naturally during growth and development or in reaction to pathogen attack or stress. A novel strategy to slow the growth of microbes is the application of essential oils. *Rosmarinus officinalis* L. is a common food preservative used nowadays because of its potent antibacterial properties.

A major factor in the rise of several drug-resistant microbes is the growing use of antibiotics in medicine, agriculture, and livestock. Due to the need for novel, potent antimicrobial bioactives, researchers have been focussing more on the worldwide public health issue of antibiotic resistance. Essential oils include insecticidal, antiparasitic, and antifungal qualities in addition to their antibacterial ones, all of which are critical for the management of human illnesses.

Anti-inflammatory and analgesic properties: Plants are a good source of anti-inflammatory chemicals, and there is a lot of pharmaceutical promise in the ongoing search for novel molecules, particularly from plants with known pharmacological effects.

The primary goal of anti-inflammatory medications is to regulate the release of mediators during the inflammatory process. Inflammation and pain are linked to the healing of wounds and the generation of free radicals, which may prolong the inflammatory process. Therefore, oxidative damage and the inflammatory response are two major causes of cardiovascular and neurological illnesses; polyphenols from some plants can lessen these issues. Rosemary has been used in traditional medicine to treat respiratory inflammatory conditions such as bronchial asthma and to relieve stomach pain. Several experimental investigations have revealed.

Activities of the central nervous system and endocrine system: Diabetes mellitus is one of the most common metabolic diseases worldwide. Insulin and oral hypoglycemic medications are used to treat diabetes; however, they have significant adverse effects and do not treat the condition. Several *in vivo* investigations have demonstrated that rosemary lowers blood glucose. According to several *in vitro* and *in vivo* studies, Zucker rats treated with high levels of carnosic acid showed an increase in their triglyceride profiles as a result of the inhibition of gastric lipase in their abdomen. Consequently, carnosic acid and carnosol together were found to be the most effective chemicals for glycaemic control. Additionally, there has been an increasing trend of research into novel neuroprotective medications derived from natural resources.

Anti-tumor action:One of the most common metabolic disorders in the world is diabetes mellitus. Insulin and oral hypoglycemic medications are used to treat diabetes; nevertheless, these pills have excellent side effects and do not cure the condition.

Numerous *in vivo* investigations have demonstrated that rosemary lowers blood glucose. Following treatment with high levels of carnosic acid, a few *in vitro* and *in vivo* investigations have reported an inhibition of gastric lipase inside the Zucker rats' bellies, which improved the triglyceride profiles.[4] Consequently, carnosic acid and carnosol together were found to be the most useful substances for glycaemic control. Additionally, research on novel neuroprotective tablets derived from herbal sources was on the rise.

Benefits:

1. Antioxidants and anti-inflammatory substances Antioxidant chemicals found in abundance in rosemary may help strengthen the immune system and enhance blood flow.
2. Improving the digestive system
3. Rosemary is commonly used to treat indigestion in Europe. In actuality, the German Commission E has approved the use of rosemary as an indigestion treatment. However, it should be noted that there is currently no significant clinical evidence to support this claim.
4. Improving memory and focus According to studies on therapeutic developments in psychopharmacology, the scent of rosemary can improve a person's focus, general performance, speed, and accuracy as well as, to a lesser extent, their temperament.
5. Neurological protection: Researchers have found that rosemary is also highly effective in protecting your brain. One of the ingredients in rosemary is called carnosic acid.

Side effects:

When used in small dosages, rosemary is generally safe. Yet, although it is rare, extremely high dosages can have detrimental side effects. Side effects include

coma

pulmonary oedema (fluid in the lungs)

vomiting

spasms

For pregnant women, taking extra rosemary is not very beneficial because high dosages of the herb can also result in miscarriage.

Conclusion:

A lot of effort has been made in recent years to produce PBMs, suggesting that they be used as herbal tablets for a variety of pathological illnesses, including analgesic, antioxidant, anticancer, anti-infectious, CNS, and endocrine system disorders. In addition to novel medications, phytotherapy has played a significant role in the development of safer, more potent PBMs since it recognises that nature provides vast amounts of what pharmaceutical chemistry has been searching for.

It is now feasible to separate plant components that exist in incredibly minute amounts, mostly due to the development of molecular biology and genetics as well as the growth of excessive-accuracy analytical procedures. Thanks to these advancements, it is now possible to examine their chemical makeup and capacity for healing in order to alter the molecule and create novel, more targeted therapy.

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