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Review Article

A Brief Review on *Rosmarinus Officinalis* to Grow Human Health Benefits

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ABSTRACT

Rosemary, a fragrant herb botanically known as *Rosmarinus officinalis* Linn. or *Salvia rosmarinus* Spenn., has been a cornerstone of traditional medicine and industry for centuries. This review provides an exhaustive analysis of rosemary, delving into its historical applications, nutritional composition, and traditional health benefits. The paper also explores the herb's medicinal and cosmetic uses, highlighting its incorporation into pharmaceutical formulations and its function as a natural preservative. Historical records reveal rosemary's extensive use in traditional medicine, particularly for its cognitive-enhancing, anti-inflammatory, and antimicrobial properties. The herb's nutritional profile is characterized by its richness in antioxidants, flavonoids, and phenolic acids. These bioactive compounds have been linked to rosemary's traditional health benefits, including improved cognitive function, digestion, and respiratory health. In the pharmaceutical industry, rosemary is valued for its antioxidant and antimicrobial properties, which make it an effective natural preservative. The herb's essential oils are also used in aromatherapy to promote relaxation and cognitive clarity. Furthermore, rosemary's cosmetic applications include its use in skincare products, hair care treatment, and wound healing agents.

INTRODUCTION

Rosmarinus officinalis (Lamiaceae) also known as Garden Rosemary, Bush herb is a common and dense shrub, perennial and aromatic with fragrant, needle-shaped leaves and white flowers. It is grown in the Mediterranean basin and India. The chemical properties of the plant include an essential oil whose main components are

camphene, camphor, cineole, and borneol. It is reported that it contains a lot of flavonoids, bitter principles, tannins and terpenoids ¹.

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Rosemary contains a large number of components responsible for its antioxidant, anti-inflammatory, anti-mutagenic, anti-carcinogenic, chemo preventive, antimicrobial and antiviral ². Furthermore, the induction of NGF (nerve growth factor) in human glioblastoma cells with rosemary extract has been described ³. Among natural antioxidants, rosemary is widely considered to be one of the species with the greatest antioxidant activity ⁴. Antioxidant properties have been attributed to medicinal plants because they should against the stress caused by oxygen and protect against free radicals, thus preventing our body from oxidative damage. So it is very important that choose medicinal plants for their antioxidant properties ⁵.

2 Nutritional Composition Of Rosemary

The applications cover different fields and the benefits are based on the bioactive compounds present in rosemary, such as monoterpenes, rosmarinic acid and acid or others ⁶. There are more than 20 distinct species, varieties or cultivars of *Rosmarinus officinalis* identified based on morphological descriptors such as fronds, corolla, leaf sizes, inflorescence and the existence of glandular trichomes. However, the infraspecific systematics remains confused and unclear ⁷. This plant has received a lot of attention different nutritional implications, evident in their impact food for humans and animals. The nutritional profile of rosemary shows considerable variation, attributed to factors such as species, variety, growing conditions, harvest time, soil properties, climate, origin and geographical parameters ⁸.

Beyond its role in human nutrition, rosemary has shown potential in poultry nutrition. In the context of metabolic disorders, studies evaluating the preventive effects of rosemary leaf extract standardized to carnosic acid have given encouraging results. The extract, when added to high-fat diets, has been shown to reduce body weight and fat gain, lower fasting blood sugar, and lower plasma cholesterol levels. These results suggest a preventive potential against metabolic disorders, paving the way for further studies in controlled trials ⁹. Rosemary stands out as a versatile plant, including a variety of essential oils, vitamins and minerals that contribute to its nutritional importance and various applications. The essential oils, the aromatic essence of rosemary, play a vital role in determining its sensory profile and are integral to its various health properties. The chemical composition of rosemary essential oils includes prominent compounds such as 1,8-cineole, α -pinene, camphor, linalool and camphene, among others. These compounds contribute to the distinctive aroma and therapeutic attributes associated with rosemary ¹⁰.

3 Benefits Of Rosemary

Rosemary has diverse benefits and applications across various industries.

3.1 Scientific evidence supporting medicinal properties:

Scientific research has provided compelling evidence to support the various medicinal properties of rosemary.

3.1.1 Antioxidant activity:

The antioxidant effect of rosemary is due to the polyphenols present in the leaves (mainly rosmarinic acid, carnosol and carnosic acid), which accumulate in the fatty membrane of the cells where the antioxidant effect is needed ¹¹. Published data on the antioxidant potential of common essential oils and their components can be considered adequate for application to meat and meat products. Positive effects of essential oils

oregano, rosemary, thyme, sage, basil, ginger, and others ¹². They contain compounds with powerful antioxidant properties that attract the interest of food producers and consumers ¹³.

3.1.2 Anti-inflammatory and Immunomodulatory effects:

The carnosic acid contained in rosemary inhibits the secretion of allergic inflammatory mediators, thus reducing pathologies such as atopic dermatitis. Rosemary extracts inhibit the activation of allergic signaling pathways, leading to a reduction in the production of chemokines and proinflammatory cytokines ¹⁴. Essential oils are secondary metabolites of plants with different pharmacological properties, mainly antioxidants, antimicrobials or immunomodulators proven by this study ¹⁵, the inhibition of inflammation through carnosol, a main component of rosemary ¹⁶.

3.1.3 Antifungal and Antibacterial activity:

Rosmarinus officinalis flax leaf extract. The formation of green silver nanoparticles was confirmed to have effective antibacterial and antifungal activity ¹⁷. Rosemary oil has been identified for its antifungal properties, which inhibit the growth of *Candida albicans*, while the essential oil and extracts of rosemary exhibit significant antibacterial activity against a variety of gram-negative and gram-positive bacteria, including very resistant strains ¹⁸. In the same application, biofilms prepared incorporating natamycin (NA) and NA+ rosemary extract (RE) on wheat gluten (WG) and microcrystalline cellulose (MC), showed high antimicrobial activity ¹⁹.

3.1.4 Cancer treatment:

Scientific research has revealed the chemoprotective activity of rosmarinic acid, a key component of rosemary. Rosemary extracts have shown promising results in reducing the occurrence, size and weight of skin cancers. Carnosic acid, another compound present in

rosemary, shows a protective effect against melanoma ^{20,21}. In the search for alternative treatments for neoplastic diseases, given the often reduced effectiveness of standard therapy due to side effects, several natural products have shown promise in the prevention and treatment of tumors. Rosemary in particular, has been shown to exert its effects by inhibiting the activation of carcinogens, increasing the activity of antioxidant enzymes, attenuating tumor-promoting inflammation, reducing cell growth, inducing death programmed cell, and suppression of angiogenesis and tumor invasion ²². The dried leaves of the plant *Rosmarinus officinalis* L. Have been proven to have high antioxidant activity and are commonly used as a spice and preservative ²³. In fact, rosemary (*Rosmarinus officinalis* L.) has been reported to have antitumor activity in vitro and in animal studies ²⁴.

3.1.5 Transdermal effects:

Rosemary oil, rich in monoterpene compounds, has been shown to stimulate skin absorption. This property is essential for transdermal applications, allowing the absorption of beneficial ingredients through the skin ²⁵. The effectiveness of a natural extract derived from rosemary has been proven to protect the skin from damage caused by free radicals ²⁶. A methanol extract of the leaves of the plant *Rosmarinus officinalis* L. (Rosemary) was evaluated for its effects on tumor initiation and promotion in mouse skin ²⁷.

3.1.6 Antilipidemic effects:

Rosemary has shown a role in reducing total cholesterol, fasting blood sugar, LDL-C (low-density lipoprotein cholesterol) and triglycerides, while increasing HDL-C (high-density lipoprotein cholesterol) ²⁸. The inhibitory effect of the diet concerns α -tocopherol supplementation (100 to 500 mg α -tocopherol acetate/ kg food) ²⁹. The same performances were observed with the ethanol extract of *Rosmarinus officinalis* ³⁰. *Rosmarinus officinalis* L. extracts can also be used

in foods, dietary supplements and cosmetic applications ³¹.

3.1.7 Wound healing:

Rosemary oil has been shown to improve tissue viability, reduce tissue necrosis and accelerate wound healing in diabetic and non-diabetic animals ³². The efficacy of the use of rosemary cream on a wound infected with candida albicans in mice has been reported ³³. In addition, *Rosmarinus officinalis* has been used in Jordanian folk medicine for wound management and treatment ³⁴. Many pharmacological studies have shown that rosemary extract and its phenolic compounds, including carnosic acid, rosmarinic acid and carnosol, can significantly improve diabetes mellitus by regulating glucose metabolism, lipid metabolism, anti-inflammation and antioxidation and avoiding many injury problems ³⁵.

3.1.8 Aromatherapy:

Rosemary essential oils have been explored for their potential in aromatherapy, showing their ability to reduce nervous tension and stress levels, improve mental activity, provide a sense of clarity, relieve fatigue and function of respiratory support ³⁶. Together, these findings highlight the scientific basis for rosemary's traditional uses in various medicinal applications, ranging from skin health and cancer treatment to anti-inflammatory and antimicrobial effects. The wealth of scientific evidence places rosemary as a versatile and valuable plant in the field of natural medicine. *Rosmarinus officinalis* L. Is a perennial aromatic plant with a characteristic aroma, but the content and composition of rosemary oil was affected by harvest stage and fertilizer levels ³⁷. The use of rosemary leaves when canned meat and fish are heated minimize potential human carcinogens ³⁸. Rosemary and sage are composed of bioactive molecules in high demand by the food, pharmaceutical and cosmetic industries to produce value-added products ³⁹.

3.2 Cosmetic uses:

Rosemary has transcended its traditional role as a kitchen herb to become a key player in the cosmetics industry. The use of rosemary in cosmetic formulations arises from antioxidant and antimicrobial properties to potential applications in hair care ⁴⁰. This part explores the different applications of rosemary in cosmetics, highlighting its role in the preservation of formulations, improving skin conditions and addressing specific dermatological problems.

3.3 Preserving cosmetic formulations:

Storage of cosmetic formulations, cosmetic products are likely to deteriorate due to the oxidation of fatty ingredients, catalyzed by microorganisms such as bacteria and fungi ⁴¹. Rosemary, with its powerful antimicrobial properties, has become a natural preservative in cosmetic formulations ⁴². The growth of essential oils in cosmetics is part of this trend, contributing not only to conservation but also to improve the overall sensory experience of the product ⁴³. Extracts and essential oils show bactericidal and antifungal effects, fighting a spectrum of microorganisms commonly found in cosmetics. Several studies have shown the effectiveness of the essential oil rosemary against specific strains of candida, demonstrating its potential as preservative. Increase consumer preferences for products natural and safe has led to the exploration of plant-based preservatives as an alternative to synthetic chemicals, such as lavender oil, etc., combined with other botanical extracts, offer a safer alternative without compromising efficacy ⁴⁴.

3.5 Rosemary as a cosmetic product:

The European Commission defines cosmetics as substances intended for surface contact with the human body, excluding the treatment or diagnosis of diseases. In this context, rosemary is considered a cosmetic product, emphasizing its role in promoting the health and appearance of the skin. The analysis of the prevalence of ingredients

derived from rosemary in cosmetic formulations reveals its widespread use ⁴⁴. Rosemary extracts find applications in the relief of minor muscles and joint pain, in accordance with their traditional uses ⁴⁵. The safety assessment shows that rosemary leaf extract, rosemary leaf oil and rosemary extract are used in various cosmetic products, with applications ranging from skin conditioning to fragrances skin ⁴⁶. Rosemary leaf extract is particularly used in concentrations up to 10% in body and hand products, demonstrating its versatility ⁴⁷.

3.5 Advances in formulation technology:

The integration of rosemary in cosmetic formulations goes beyond its role as a preservative. Technological advances aim to take advantage of the properties of rosemary to improve formulation stability and enhance product attributes ⁴⁸. Studies have explored the use of rosemary extracts to stabilize certain emulsions, thus contributing to the overall quality of cosmetic products. In addition, microencapsulation of rosemary essential oils protects them from degradation, ensuring controlled release and prolonged efficacy ⁴⁹.

3.6 Hair care and beyond:

Rosemary's influence extends to hair care, where it is believed to prevent hair loss. Historical formulations and contemporary practices indicate its enduring popularity for hair problems ⁵⁰. Animal studies show that rosemary leaf extracts improve hair growth by inhibiting 5 α -reductase, a key factor in androgenetic alopecia ⁵¹. Studies on androgenetic alopecia, a common type of baldness, suggest that rosemary oil, compared to minoxidil can improve the number of capillaries with less scalp irritation ⁵². Beyond skin and hair care, rosemary derivatives have shown promise in the treatment of various dermatological conditions. Antiviral activity against herpes simplex, fungicidal effects against dermatophytes, and improvements in skin hydration and elasticity for

cellulitis have been reported ⁵³. The dynamic landscape of cosmetic research continues to reveal new opportunities to exploit the full potential of rosemary in promoting the health and aesthetic aspects of personal care products. The integration of rosemary in the cosmetic industry represents a harmonious blend of tradition and modern science. Its natural preservation properties, combined with technological advances in formulation, especially microemulsions, make it a valuable asset in cosmetic formulations ⁵⁴.

3.7 Use in pharmaceuticals:

The presence of rosemary in pharmaceutical formulations is based on its rich range of bioactive compounds, including but not limited to rosmarinic acid, carnosic acid and essential oils ⁵⁵. In the field of pharmaceutical applications, rosemary is increasingly recognized for its various contributions to drug formulations and development ⁵⁶. The integration of rosemary into pharmaceutical formulations reflects not only its historical uses, but also a strategic approach aimed at exploiting its versatile bioactive compounds for therapeutic purposes ⁵⁷. These compounds give rosemary antioxidant, anti-inflammatory and antimicrobial properties, making it a valuable addition to various pharmaceutical preparations. For example, rosemary extracts have been studied as stabilizers in numerous emulsions, highlighting their potential role in improving the stability and shelf life of pharmaceutical formulations ⁵⁸. The historical application of rosemary in pharmaceutical formulations is reflected in contemporary practices ⁵⁹. The focus on natural and plant-derived ingredients aligns with the broader shift toward sustainable and holistic health solutions ⁶⁰. Since consumers are increasingly looking for alternatives to synthetic compounds, the integration of rosemary in pharmaceutical formulations is not only a sign of tradition, but a strategic choice for its therapeutic benefits ⁶¹.

4 Future of rosemary:



The field of bioactive chemical extraction from natural sources, such as the versatile rosemary, is set for revolutionary breakthroughs. Prospective directions for scientific advancement and industrial uses are shown by future developments in extraction techniques and the use of bioactive compounds ⁶².

CONCLUSION

This thorough analysis sheds light on the diverse range of uses and complex significance of *Rosmarinus officinalis* Linn., popularly known as rosemary. The historical roots are entwined with several cultures, reflecting its centuries-long symbolic and therapeutic roles. The traditional uses are supported by scientific research, which identifies rosemary as a source of bioactive chemicals with a wide range of possible medical uses. Thorough scientific data supports rosemary's medicinal flexibility, which includes anti-inflammatory, anti-cancer, and transdermal effects. The growing interest in its culinary, medicinal, and cosmetic uses is a vibrant fusion of innovation and tradition, opening up new avenues for overall wellbeing. The review explores the complex interrelationships of rosemary cultivation, environmental awareness, and socioeconomic factors, placing sustainability front and centre. It becomes crucial to adopt sustainable farming methods for the sake of environmental conservation as well as for determining the nutritional and bioactive makeup of rosemary.

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