

How to Cite:

Chatterjee, K., Tamta, B., & Mukopadaya, S. (2022). A review on “pharmacological, phytochemical, and medicinal properties of rosmarinus officinalis (Rosemary)”. *International Journal of Health Sciences*, 6(S6), 3491–3500.
<https://doi.org/10.53730/ijhs.v6nS6.10184>

A review on “pharmacological, phytochemical, and medicinal properties of rosmarinus officinalis (Rosemary)”

Kuntal Chatterjee*

Research Scholar, Dev Bhoomi Institute of Pharmacy and Research, Dehradun (Uttarakhand), pin code-248007

*Corresponding author

Mr. Bhupendra Tamta

Assistant Professor, School of Pharmacy and Research, Dev Bhoomi Uttarakhand University, Dehradun (Uttarakhand), pin code-248007

*Corresponding author email: sopr.bhupendra@dbuu.ac.in

Dr. Sayantan Mukopadaya

Associate Dean, School of Pharmacy and Research, Dev Bhoomi Uttarakhand University, Dehradun (Uttarakhand), pin code-248007

Abstract—International use of natural medicinal drugs has been increasing in the last few centuries. In developing international locations, many people were using other natural remedies to meet their fitness care desires. On the opposite facet, developing countries had to make a bigger interest in medicinal herbs. The most vital difficulty in natural medicine is that their market is inadequate regulated, and very restricted statistics have been presented regarding the safety and efficacy of medicinal herbs. there's almost no side impact within the use of herbal merchandise. natural medicines provide harmless and efficient use. Rosemary consists huge form of phytochemicals along with the impact of dietary antioxidative and chemopreventive rosemary phytochemical on the feature of human drug efflux transporter Pglycoprotein and multidrug resistance protein 1 .The effect of natural phytochemical found in rosemary inclusive of carnosic acid , carnosol , rosmarinic acid , and ursolic acid and different many additives. Rosemary appears to boom blood circulation while applied to the scalp, which would possibly assist hair follicles develop. Rosemary extract may additionally help guard the pores and skin from solar harm. for scientific use, extraction is done by using flow distillation. the extraction may be extracted from stems, leaves and flora of rosemary. as a result extracted additives are separated and purified and use according to their pharmacological activities like

Anti-tumor activity, Anti-oxidant activity, Anti-infectious activity, and analgesic sports, CNS & endocrine device activities.

Keywords--stream distillation, Anti- tumor activity, anti – infectious activity, antioxidative, chemo preventive.

Introduction

Rosmarinus officinalis (Linn.) (Rosemary) (Lamiaceae) is also referred to as lawn rosemary and *salvia Rosmarinus*, it's miles a branched, bushy, ever-green sub-shrub that attain a height of one-2 meters. It grows in many areas of the arena, especially within the Mediterranean location. Rosemary leaves are linear, difficult, and darkish inexperienced. The flowers are very small in size and mild blue in color. there are many advantages and uses of rosemary, rosemary turned into traditionally been used to it enhance reminiscence. It stimulates hair growth. it is able to assist relieve aches. and boost the immune machine. it increases movement.[1][2] Rosemary is an aromatic herb this is used as a flavoring in a selection of dishes, together with soups, casseroles, salads, and stews. Rosemary is often paired with hen, red meat, fish, lamb, and rooster, particularly oily fish. Rosemary oil may be toxic if ingested and have to by no means be taken orally. Rosemary flavor like lemony-pine-like and has also been defined as minty, sage-like, and peppery. because of its sturdy taste, start with small quantities as a little goes a protracted way.[2]



Fig 1. Rosemary plant

Taxonomical Classification

| | |
|-----------------|---------------|
| Kingdom: | Plantae |
| Sub-kingdom: | Tracheobionta |
| Super division: | Spermatophyta |
| Division: | Magnoliophyta |
| Class: | Magnoliopsida |

| | |
|------------------|--------------------------|
| Sub class: | Asteridae |
| Clade: | Tracheophytes |
| Order: | Lamiales |
| Family: | Lamiaceae |
| Genus: | Salvia |
| Species: | <i>S. Rosmarinus</i> |
| Biological Name: | <i>Salvia rosmarinus</i> |



Fig 2. Rosemary Plant 1. Flower 2. Roots And Leaves



Fig 3. Dried powder form of Rosemary

Image source: www.istockphoto.com and www.healthline.com .

Pharmacological Activity

Antioxidant activity

The herbal antioxidants from vegetation are becoming increasingly essential. not only inside the nutritional region but additionally in preventive medicine. The Lamiaceae own family has been a focus of the research on antioxidant compounds due to their excessive polyphenol content. The strong antioxidant houses of rosemary had been mainly attributed to its essential diterpenes,

carnosol, and carnosol acid, in addition to the critical oil components. currently, the vital oils and their lively compounds were of an awesome hobby because of their pharmacological homes. Rosemary leaves are generally used as a condiment for flavoring food, and as a source of antioxidant compounds employed in meals conservation.[2]. while a new rosemary extract is tested, the maximum vital aspect to remember is the approach of extraction and the type of solvent used, as this may have an effect on the antioxidant residences.

numerous extraction strategies for the selective extraction of rosemary leaves were recognized within the clinical literature. This includes both solvent extraction the usage of vegetable oil or animal fats, mechanical urgent techniques, water at alkaline pH, and natural solvents (e.g. hexane, ethyl ether, chloroform, ethanol, methanol, dioxane, and ethylene dichloride).[2]. Nowadays, rosemary extracts are usually prepared from dried rosemary leaves. In all the new methods, the extraction process is often accompanied by a step involving partial deodorization and/or extract decolorization. Considering the methods used, in general, the yield of rosemary extract indicated by various authors varies between 2% and 26% based on the raw material used.[5][6]

Anti-infectious activity

Maximum plants produce antimicrobial secondary metabolites, both from their regular direction of growth and development or in reaction to pressure or pathogen attack. the use of vital oils represents a brand-new way to lessen the proliferation of microorganisms. *Rosmarinus officinalis* L. is wildy used today as a food preservative and known for its effective antibacterial interes[6]. The inhibitory effect of rosemary is the result of the motion of rosmarinic acid, rosmaridiphenol, carnosol, epirosmanol, carnosic acid, rosmanol and isorosmanol. they have interaction with the mobile membrane, inflicting adjustments in genetic fabric and nutrients, altering the transport of electrons, leakage of mobile additives and production adjustments in fatty acid. similarly, it also produced an interplay with the membrane of proteins that produced the loss of membrane functionality and its shape.[7]

Anti-inflammatory and Analgesic activities

Plants are a good source of anti-inflammatory agents and the continuous search for new compounds, especially from plants with historically documented pharmacological effects, represents a huge pharmaceutical potential. Controlling the release of mediators in the inflammatory process is the main objective of anti-inflammatory drugs. Pain and inflammation are related to wound healing and production of free radicals which could extend the inflammation process. Thus, the inflammatory response and the oxidative damage are two main factors that induce cardiovascular and neurodegenerative diseases; however, polyphenols from some plants are able to reduce these problems. In folk medicine, rosemary is known for its therapeutic properties against abdominal pain and for the treatment of respiratory inflammatory diseases, such as bronchial asthma.[8] Some experimental studies have reported the anti-inflammatory and analgesic activities of the essential oil and biologically active terpenes such as carnosic acid, carnosol, ursolic acid and betulinic acid, as well as rosmarinic acid, rosmanol and

oleanolic acid. In fact, it has been reported that they have antinociceptive activity, and that each individual triterpene showed a similar potency to that observed with ketorolac, a nonsteroidal anti-inflammatory drug.[9]

Analgesic activity

Inside the assessment of analgesic activity, concentrations displaying extensive anti-inflammatory pastime had been used. Prostaglandin E2 (PGE2) tiers in collected cell tradition supernatants have been detected with the aid of manner of the usage of a commercially to be had quantitative enzyme-related immunosorbent assay (ELISA) package (Abcam PGE2 ELISA package deal, uk) consistent with manufacturer's instructions.[2]

CNS & endocrine system activities

Diabetes mellitus is one of the maximum accepted metabolic disorders within the international. Insulin and oral hypoglycemic retailers are used to deal with diabetes; however, these pills do not cure the ailment and feature great negative results.[2] Rosemary has been shown to decrease blood glucose in numerous in vivo studies. some in vitro and in vivo research have stated an inhibition of gastric lipase in the belly of Zucker rats, after treatment with excessive contents of carnosic acid, which resulted in an enhance of the triglycerides profiles. therefore, carnosic acid collectively with carnosol, proved to be the maximum applicable compounds on glycemic manipulate. moreover, there has been a growing trend of research for brand spanking new neuroprotective drugs from natural resources, which raises a brand new healing wish. illnesses of the CNS (depression, Parkinson, Alzheimer, and so forth.) are incurable chronic conditions, and probably this is why there has been increasingly more studies in *R. officinalis* over latest years, in an try to locate newsolutions.

Concerning depression there are several studies reporting a lowering immobility time and law of several neurotransmitters (dopamine, norepinephrine, serotonin and acetylcholine) and gene expression in mice mind like TH, laptop and MAPK phosphatase (MKP-1).[2][3] these research make a contribution to the information of molecular mechanism behind the antidepressant effect of *R. officinalis* and its essential active compounds. Rosmarinic acid, however, appears to have ability towards neurodegenerative illnesses. It turned into located that this compound had cholinergic and neuroprotective outcomes and inhibited acetylcholinesterase. concerning medical trials, in 2010, Pengelly et al. finished a randomized, placebo-managed, double-blinded, repeated-measures crossover take a look at to analyze possible acute results of dried rosemary leaf powder on cognitive overall performance.[11] This work pronounced full-size speed of reminiscence –a potentially beneficial predictor of cognitive function all through ageing, using rosemary powder at the dose normally used at culinary intake. This work expands the value of destiny studies on results of low doses of rosemary on memory and cognition. more distinctive information regarding in vitro and in vivo experimental studies is displayed in the tables in Supplementary cloth.[9]

Anti-tumor activity

Diabetes mellitus is one of the most ordinary metabolic problems within the global. Insulin and oral hypoglycemic stores are used to cope with diabetes; but, these capsules do now not remedy the disease and feature superb bad effects. Rosemary has been proven to lower blood glucose in severa in vivo studies. a few in vitro and in vivo studies have stated an inhibition of gastric lipase inside the belly of Zucker rats, after remedy with excessive contents of carnosic acid, which led to an beautify of the triglycerides profiles.[4] therefore, carnosic acid collectively with carnosol, proved to be the most applicable compounds on glycemic manipulate. moreover, there was a developing trend of studies for emblem spanning new neuroprotective tablets from herbal sources, which increases a contemporary restoration wish. illnesses of the CNS (despair, Parkinson, Alzheimer, and so forth.) are incurable continual situations, and probably this is why there has been increasingly research in *R. officinalis* over cutting-edge years, in an attempt to locate new solutions.

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Rosemary Extract for Skin Prevents ageing of skin

because it contains certainly powerful antioxidants, rosemary oil strengthens the capillaries and helps to gradual the results of aging on pores and skin. It additionally tightens sagging and free skin to help it look firmer and more elastic. moreover, rosemary stimulates biological activity and cellular growth to reduce first-rate strains and wrinkles.

Treats acne

With its effective disinfectant and antibiotic homes, the herb can help to deal with acne and oily pores, and skin situations. whilst massaged into the face, rosemary

oil can help lightens darkish spots and blemishes on the skin resulting in an advanced pores and skin complexion

Prevents infection

The residences of rosemary extract assist to lessen swelling and puffiness of the skin. It additionally allows to heal burns and soothe the skin. This herb's medicinal characteristics makes it a powerful therapy for persistent skin conditions which includes dermatitis, eczema and psoriasis. homemade cucumber and rosemary pimples treatment masks

Rosemary Extract for Hair Growth

In keeping with a few medical proof, rosemary can also advantage nerve tissue. Carnosic acid, an energetic factor in the plant, healed tissue and nerve damage in one take a look at. This capability to heal nerve endings may also rejuvenate nerves inside the scalp too, in turn likely restoring hair boom .more revealing recent studies show that rosemary at once enables protect towards hair loss. One 2015 trial relied on source pitted the crucial oil in opposition to minoxidil, commercially referred to as Rogaine. each have been used on human topics with androgenetic alopecia (male or woman pattern baldness). consequences confirmed that rosemary critical oil was just as effective a minoxidil. all through the system, it helped the side impact of itchy scalp more effectively than minoxidil. another take a look at depended on source of rosemary leaf extract (one-of-a-kind from the crucial oil) confirmed it stimulated hair boom. This came about when hair loss become induced by using testosterone (as in sample baldness). This take a look at became completed on mice, however. separate clinical evaluations — one from 2010Trusted source and one from 2011 — also acknowledge rosemary's hair growth capacity. the former cites a take a look at with a success hair regrowth in human beings with alopecia who used vital oils. one of these critical oils became rosemary. within the latter assessment, rosemary important oil become defined as a hair loss restorative. This become due to its movement-enhancing effects.

Benefits

- Antioxidants and anti-inflammatory compounds
Rosemary is a wealthy source of antioxidants compounds, which can be thought to assist boost the immune machine and improve blood move.
- Improving digestion
In Europe, rosemary is frequently used to help treat ingestion In fact, Germany's commission E has authorized rosemary for the remedy of indigestion. but, it ought to be cited that there's presently no meaningful clinical proof to aid this declare.[13]
- Enhancing memory and concentration in accordance to research mentioned therapeutic advances in psychopharmacology, the aroma from rosemary can enhance someone's attention, overall performance, pace, and accuracy and, to a lesser volume, their temper[13]
- Neurological protection, Scientists have observed that rosemary will also be top in your brain. Rosemary includes an ingredient referred to as carnosic acid, which could combat off harm by means of unfastened radicals in the

mind. a few studies in rats have recognized that rosemary might be beneficial for people who have experienced a stroke. Rosemary appears to be shielding towards mind damage trust and might improve healing[13]

- Prevent Brain Aging, Some studies have cautioned that rosemary may additionally substantially help prevent mind getting old source The therapeutic capability of rosemary for prevention of Alzheimer's indicates promise, but more research are needed.
- Cancer, Determined that "crude ethanolic rosemary extract (RO)" slowed the spread of human leukima and breast carcinoma cell some other look at, published in bioscience biotechnology and biotechnology concluded that rosemary might be beneficial as an and anti-tumor agent. additionally, a report published within the journal of food technological know-how revealed that adding rosemary extract to floor pork lessen the formation of cancer agents that could develop all through cooking.
- Protection against macular degeneration, A have a look at posted inside the journal investigative opthamalogy and visual technology , led through Dr. Stuart A. Lipton, Ph.D. and co-workers at Sanford-Burnham clinical research Institute, found out that a carnosic acid, that is a primary thing of rosemary, can considerably promote , eye fitness. this could have medical applications for sicknesses affecting the outer retina, which includes age-related masclar degeneration – the maximum not unusual eye sickness inside the america.

Side effects

Rosemary is generally secure whilst taken in low doses. But , extraordinarily large doses can cause critical aspect effects, even though that is uncommon. aspect effects consist of:

- vomiting
- spasms
- coma
- pulmonary edema (fluid in the lungs)

excessive doses of rosemary may additionally cause miscarriage; consequently it is not really helpful for pregnant girls to take any supplemental rosemary[13]

Conclusion

In current years, plenty attempt has been dedicated to the development of PBMs, proposing them as herbal tablets in lots of pathological conditions consisting of, analgesic, antioxidant, antitumor, anti-infectious, CNS and endocrine machine sports. Phytotherapy is a chief contributor to the invention of new, safer and powerful PBMs, in addition to new drugs, understanding that what pharmaceutical chemistry has sought desperately, nature has in huge quantities. primarily based on the improvement of excessive-accuracy analytical techniques and the advances of molecular biology and genetics, it's far now possible to isolate plant compounds that exist in extremely small quantities. With these improvements, it's far now feasible to look at their chemical structure and healing

capability, and thus, modify the molecule for producing new, more selective therapeutic retailers. This paintings completed an updated assessment on *R. officinalis* L., allowing us to emphasize the modern kingdom of the art, on studies and investigations, mentioning the awareness of the pharmacological sports related to the constituents of this plant.

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