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RESEARCH ARTICLE
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HARNESSING THE POWER OF ROSEMARY AND KALONJI SEEDS FOR HAIR HEALTH: A REVIEW

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Abstract-
This review paper gives overview on Hair health as a major problem in dermatology and cosmetology, and natural therapies are gaining popularity due to their low side effects and possible usefulness. This review examines the combined benefits of rosemary (Rosmarinus officinalis) and kalonji seeds (Nigella sativa) on hair health, concentrating on their phytochemical characteristics, modes of action, and therapeutic potential. Rosemary, which contains bioactive chemicals such as rosmarinic acid, caffeic acid, and essential oils, has long been used to encourage hair growth and treat scalp disorders like dandruff. Its antioxidant and anti-inflammatory characteristics promote scalp circulation, which may aid in hair follicle stimulation and growth. Furthermore, rosemary has been shown to block the hormone DHT (Dihydrotestosterone), a crucial role in androgenetic alopecia, making it an important component in the treatment of hair loss. Kalonji seeds, known for their high thymoquinone concentration, provide numerous hair health advantages. Thymoquinone has potent antioxidant, anti-inflammatory, and antibacterial capabilities, which protect hair follicles from oxidative stress and infections that cause hair loss. Kalonji oil has also been shown to strengthen hair, enhance texture, and prevent premature graying. The synergistic effect of rosemary and kalonji seeds in hair care is a potential topic of research since they have complementary qualities that improve hair growth, strength, and general health. This review summarizes current research on these natural compounds, focusing on their potential applications in treating common hair diseases such alopecia, dandruff, and scalp infections. The findings of this analysis will open new way for more natural, effective, and accessible hair care products.

Keywords- Rosemary, kalonji seed (Nigella sativa), Anti-inflammatory, Antioxidant, Hair growth, Alopecia

Introduction-

Hairs are like crown of every human in different style and beauty of the person. Healthy hairs make the look more attractive towards people and absolutely stunning. Rosemary has long been revered for its ability to promote hair growth and strengthen hair follicles. This fragrant herb is packed with nutrients that nourish the scalp and encourage healthy hair growth. Incorporating rosemary into your hair care routine can help improve the overall health and appearance of your hair.[3]

Anatomy of hair- Hair, one of the body parts derived from the skin ectoderm, is a complex structure made up of the scalp, hair follicle, and hair shaft. The scalp, a thick layer formed by both skin and hair, contains a high density of hair follicles and sebaceous glands. The hair follicle is considered a mini-organ, responsible for regulating growth phases and producing the hair shaft. [3]

The shape of the hair shaft is also determined by the bulb, in particular the degree of axial symmetry/asymmetry of the hair matrix. The stem is a keratinized cellular extension produced in the follicle, which suffer continuous cytoplasm transformation into hair leading to hair growth. The stem extends from the hair follicle to the stratum corneum, that communicate it with the external environment. Thus, growth occurs in alternating cycles with periods of both growth and rest throughout bulb life.[5]

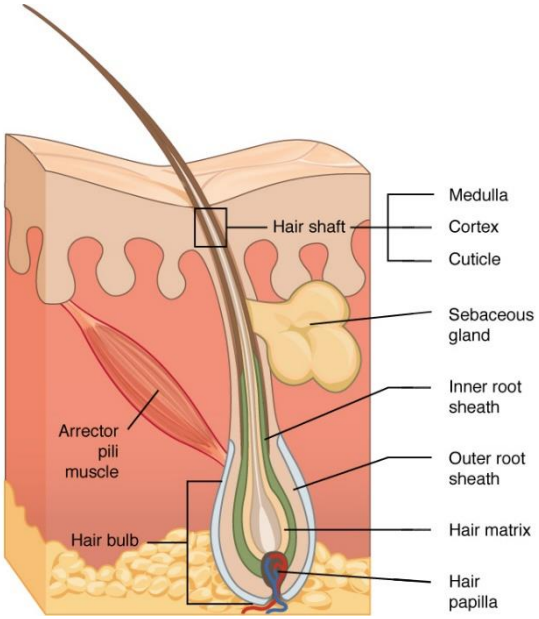

Figure 1 Anatomy of hair

Hair type- 1.Vellushair

2.Terminal hair

Terminal hair are thicker dark and may be curly and on the region of eyelashes and eyebrows. 70-100 hairs loss a day is very common however, dropping over 100 hairs a day lasting longer than a couple of week indicates a serious problem[12]

Types of hair loss- Alopecia Areata (prime stage), Temporary Alopecia Areata**,** Ophiasis Alopecia Areata, Alopecia Totalis, Alopecia Universalis, Traction Alopecia, Chemotherapy and hair loss, Diffuse Alopecia[12]

Symptoms of hair loss-[12]

- Autoimmune disorders
- Chemicals (hair dyes)
- Chemotherapeutic agents/ drugs.
- Diabetes
- Hair loss following childbirth
- Hair styling products
- Hair styling techniques
- High iron deficiency
- Nutritional deficiencies
- Other fungal infections
- Physical trauma to the scalp
- Poisons
- Poor blood circulation
- Poor diet or malnutrition
- Prescription drugs
- Psychological
- Radiation exposure
- Ringworm
- Skin disease
- Stress
- Sudden weight loss
- Surgery
- Thyroid disease.

Alopecia-

Alopecia is a chronic dermatological illness that causes hair loss, either partial or total Stress and dietary variables have contributed to an increase in the prevalence of alopecia Excess testosterone in the blood capillaries is substantially connected with this illness; hence, Antiandrogens have been shown to reduce hair loss. C57BL/6 mice with testosterone-induced baldness were treated topically with hydroalcoholic rosemary extracts (2 mg/day/animal) and demonstrated a substantial increase in hair growth after the 16th day of treatment was compared to individuals in the control group. The hydroalcoholic extract was examined. In vitro study of 5αR enzyme activity revealed substantial suppression of binding. DHT binds to its receptor.[10]

Rosemary-

The R officinalis L. plant, commonly known as rosemary, family lamiaceae is a versatile herb with a strong aroma and flavour that is widely used in cooking and traditional medicine. Native to the Mediterranean region, rosemary is prized for its medicinal properties and has been used for centuries to treat various ailments. With its distinctive taste and scent, rosemary remains a popular ingredient in cuisines around the world and continues to be studied for its potential health benefits. Some have reported side effects. The therapeutic elements of the plant include flowering twig tips, dried leaves, fresh leaves, aerial portions, and flowering branches. Are been used [24]

Figure 2 Rosemary plant

Figure 3 Rosemary dry leaves

In vitro Studies-Rosemary was found to have anti-inflammatory properties by inhibiting the enzyme COX-2. Additionally, rosemary solvent extracts may enhance immunity by significantly increasing TNF-α levels. The effects of R. officinalis aqueous extract on neutrophil trafficking, chemical mediator secretion, and oxidative stress were studied using oyster glycogen-recruited peritoneal neutrophils treated with the extract (1, 10, or 100 μg/mL). The results showed decreased neutrophil chemotaxis, NO2 generation, and shedding of L-selectin and β2 integrin[8]

Table 1 Results of IN-vitro Study

AIM	SAMPLE TYPE	MODEL SYSTEM	RESULT
Examine the optimal conditions for extraction of rosemary leaves and determine whether the extracts exert anti-inflammatory and/or anti-tumour	Supercritical fluid (10% ethanol in CO2) extraction of rosemary leaves (1 μg/ml)	Human hepatoma cells (Hep 3B) and human normal liver cells (Chang liver)	Significant ($p < .01$) suppression of NO production in RAW 264.7 cells at a dose of 1.56 μg/ml and higher Significant increase of TNF-α levels from 11.4 ± 3.0 pg/ml in untreated Hep 3B cells to 1,576 ± 75.6 pg/ml in treated Hep 3B cells

Anti-bacterial studies- With a few minor adjustments, the microplate bioassay was used to assess the antibacterial activity of the pure chemicals and essential oils (CLSI, 2006). Reductions in Mueller Hinton broth (MH) (Difco, MD, USA) with 0.5% Tween 80 were made from pure chemical solutions in ethanol or an 80% (v/v) essential oil. At a final bacterial density of 5 105 CFU/mL (obtained by adding 10 mL/well of a 1 108 CFU/mL solution of the investigated strain in MH), each substance (0.4e40 mL/mL, 200 mL each well) was incubated in 96-well flat bottom microplates with each bacterial strain. After being aseptically sealed, the microplate was continuously shaken (at 100 rpm) for 16 to 24 hours at 37 °C. Every experiment was run three times. After a 24-hour incubation period at 37°C, lowest concentration of plant chemical that could stop bacterial growth was determined by measuring the absorbance at 625 nm, which is known as the minimum inhibitory concentration (MIC). Bactericide concentration was measured using time-kill tests. Five millilitres of MH broth were infected with 1 x 106 CFU/mL of E. coli ATCC 35218 (Aeschlimann & Rybak, 1998). The concentrations employed in the test were ½ MIC, MIC, and 2 MIC. CFU/mL was measured after 1,2, 4, 8, 12, and 24 hours of exposure to the substances using Trypticase soy broth (TSB) agar plates incubated at 37°C. To prevent antibiotic carryover, samples were centrifuged, reconstituted in fresh MH medium, then serially diluted 10 times in 0.9% saline before plating.[21]

Kalonji seed-

Medicinal plants have been used to treat diseases for millennia in a variety of indigenous medicinal systems and folk medicines. In addition, medicinal herbs are employed in herbal medicine manufacture since they are regarded safer than modern allopathic treatments. Because just a few plant species have been thoroughly studied for medicinal characteristics, potential, mechanism of action, safety assessment, and toxicological investigations, many researchers concentrate on medicinal plants. Nigella sativa (N.sativa) (Family *Ranunculaceae*) is emerging as a miraculous herb with a rich historical and religious history among therapeutic plants, with several studies revealing its broad pharmacological potential. N. Sativa is generally known as black seed. N,sativa is endemic to Southern Europe, North Africa, and Southwest Asia. [26][28]

Figure 4 Nigella sativa plant Figure

5 Nigella sativa seed (black seed)

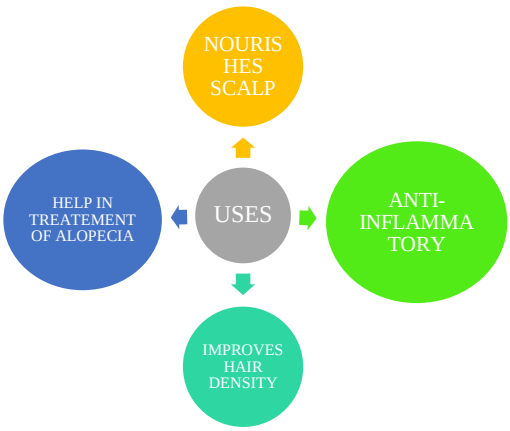

Figure 6 Uses of Nigella Sativa

WOUND HEALING EFFECT-
N.sativa oil effectively healed wounds in all tested Wistar albino female rats, completing the process on day 21 after 14 days. In comparison to ozonated sesame and hypericum perforatum oils (59). N. sativa was found to significantly improve wound healing in a rat model of burn wound injury, with no signs of infection (58). N. sativa oil significantly increased the metabolic activity, proliferation, and viability of sheep tenocyte cells within 24 hours. [29]

CHEMICAL COMPOSITION-
Many academics have intensively examined Nigella sativa seed as a herbal medication. Researchers have identified numerous active principles, such as Thymoquinone, Nigellimine-N-oxide.Nigellicine,Nigellidine,Nigellone,Dithymoquinone.Thymol,Arvacrol, 6- methoxy-coumarin, 7-hydroxy-coumarin, Oxycoumarin, Alpha-hedrin, Steryl-glucoside, Tannins, Flavinoids, Essential fatty acids, Essential amino acids, Ascorbic acid, Iron and calcium Rich contents of natural products provide profound therapeutic value to Nigella sativa seeds and its derivative. In many studies, [35]
USES- Nigella sativa seeds has proved to be anti-inflammatory, analgesic, antihistaminic, anti-allergic, anti-cancer, anti-oxidant, immune stimulant, anti-hypertensive, anti-asthmatic, hypoglycemic, anti-bacterial, anti-viral, anti-fungal and anti-parasitic [35]

ALOPECIA SCORING-
After injecting cyclophosphamide, the dorsal skin surface was checked daily to monitor alopecia signs. Daily images were used to visually quantify hair loss. Hair loss was rated as follows: Alopecia is classified into four grades: no detectable alopecia, mild alopecia (<50% hair loss), moderately severe alopecia (50% hair loss), and total alopecia (>90% hair loss).[30]
HAIR ANALYSIS-Skin samples from sacrificed rats were stored in 10% formalin solution. To assess follicle morphology and proportion of hair follicles in the anagen and catagen phases, longitudinal sections of skin samples were taken using a digital microscope after slide preparation.[30]
RESULT-On day 9 of depilation, each group experienced about equal hair growth.[6]

Table 2 Treatment Result

Treatment	No. of rates	Alopecia grade
Normal control	5	0
Cyclophosphamide plus minoxidil	5	1
Cyclophosphamide plus 5% N. sativa decoction	5	1
Cyclophosphamide plus 10% N. sativa decoction	5	1
Cyclophosphamide plus 15% N. sativa decoction	5	2

Future impacts-1) Natural and Organic Alternatives- As consumers increasingly seek natural and organic alternatives, rosemary-based products may offer a popular and effective option for individuals who avoid synthetic chemicals.
2) Enhanced Understanding of Herbal Medicine- This research has the potential to improve our understanding of how plant-based compounds can be used effectively in dermatology and trichology (hair and scalp health).
3) Educational Value- Integrating herbal medicine research into academic courses can enhance understanding in subjects like dermatology, pharmacology, and cosmetics.

Discussion-
Hair abnormalities, are usually not life-threatening, can exert a significant impact on patients' social relationships and psychological well-being. A recent poll indicates that in many developing nations, a significant fraction of the population relies on traditional remedies and medicinal plants for primary healthcare. Recent study shows that the plant elements listed above have medical and nutritional benefits for hair. These plants offer a cost-effective and nutritionally beneficial treatment for hair

issues. The Ayurvedic medical system evaluates hair formulations such as oil and shampoo for exterior applications. This section also discusses how the ingredients may promote hair growth and reduce hair problems. The global trend is towards safer, non-toxic natural products for traditional uses. To address hair issues, it is recommended to use ayurvedic products rather than synthetic ones.[18]

Conclusion-Hair is an important aspect of human individuality. Herbal compounds, including minerals and amino acids, contribute significantly to hair development. Herbal goods contain phytochemicals and botanicals that serve as both cosmetics and natural remedies for skin and hair health. These medications are effective for hair care and have fewer adverse effects than synthetic alternatives.[18]

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