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Review Article

SYSTEMATIC REVIEW ON SYNTHETIC AND HERBAL MEDICATIONS FOR THE TREATMENT OF ALOPECIA

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ABSTRACT

Alopecia refers to the scientific word for diminished hair growth or balding. It describes a disease in which hairs fall off from one or more parts of your body, most commonly the scalp. Losing your hair might be triggered by a variety of factors, including hereditary traits, external factors, chemical exposure, medication, dietary insufficiency, chronic tension, or prolonged sickness, among others. Alopecia is categorized into different types depending upon its pattern of diminished hair growth and its genesis. The pursuit of effective treatments has led to the exploration of both synthetic and herbal medications. This study examines the performance, mechanisms of action, tolerability profiles, and limits of synthetic and herbal remedies for alopecia. Synthetic medications such as minoxidil and finasteride are commonly prescribed and have demonstrated varying degrees of success in clinical trials. However, concerns regarding adverse effects and long-term efficacy persist. Conversely, herbal medications, including saw palmetto, ginseng, and pumpkin seed oil, have gained popularity due to their perceived natural origin and potentially fewer side effects. Nevertheless, the scientific evidence supporting their efficacy remains limited and often inconclusive. In addition, challenges in standardization and regulation pose significant barriers to the widespread adoption of herbal treatments. This study aims to provide health-care professionals and patients with a comprehensive overview of the current landscape of synthetic and herbal medications for alopecia, highlighting the need for further research to elucidate their therapeutic potential and optimize patient outcomes.

Keywords: Alopecia, Hair Growth, Synthetic remedies (Minoxidil, Finasteride), Herbal remedies (Fenugreek, Eclipta), etc.

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INTRODUCTION

Alopecia is a disorder characterized by the thinning of hair on the scalp or other parts of the body where hair is normally found [1]. A number of variables can contribute to this, including stress, inheritance, hormones, nutrition, some illnesses, and some drugs such as those used to treat cancer [2]. While the Food and Drug Administration (FDA) has only approved finasteride and minoxidil to treat alopecia, there are other unapproved treatments that claim to repair the situation [3].

The term "Enhanced epithelium" encompasses keratin. The hair is the visible development of tiny hair follicles within the epidermis. It is a structure formed when "Germ cells" get keratinized. Hair is an essential body component that develops through the complexion's dermis. It functions as a defensive part and acts as a further component of the dermis, along with sebum pores, pores for sweating, and nails. Epidermal derivatives are generated during embryonic development and originate from the epidermis [4].

Alopecia is categorized into different types depending upon its pattern of diminished hair growth and its genesis. The pursuit of effective treatments has led to the exploration of both synthetic and herbal medications. This study examines the performance, mechanisms of action, tolerability profiles, and limits of synthetic and herbal remedies for alopecia. Synthetic medications such as minoxidil and finasteride are commonly prescribed and have demonstrated varying degrees of success in clinical trials. However, concerns regarding adverse effects and long-term efficacy persist. Conversely, herbal medications, including saw palmetto, ginseng, and pumpkin seed oil, have gained popularity due to their perceived natural origin and potentially fewer side effects. Nevertheless, the scientific evidence supporting their efficacy remains limited and often inconclusive [5].

HAIR

Hair is an essential element of the body, generated from the skin's ectoderm, and serves as a protective appendage. The integument contains accessory structures such as sebaceous glands and nails. Hair has distinct forms: Hair with vellus structure and terminating hair. Vellus strands are appropriate, faint in color, also erect, whereas the terminal ones are more dense, darker, and also curly. Terminal hair can be found on the scalp, eyelashes, and brows in neonates. These are also known as non-sexual hair because they do not depend on androgen levels. As testosterone concentrations in the blood rise, ambisexual and genital hairs form. Enzyme 5α reductase transforms circulating testosterone to

Dihydrotestosterone (DHT). The following DHT targets follicles that produce hair and is liable for the production of both ambisexual and genital hair. Keratin develops over three cyclical periods. The second stage consists of the anagen, catagen, and telogen phases. On average, between 50 and 100 strands are shed randomly throughout the day. Alopecia, or hair loss, is defined as an average rise of more than 100 hairs each day [6].

HAIR GROWTH [7,8,9,10]

Anagen phase (growth)

The anagen or growing stage is the starting of the hair growth cycle. At this, cells of the bulb multiply efficiently, caused in developing new hairs. Between 80% and 90% of the hair shafts are in this stage. This phase takes approximately 2–7 years (Fig. 1).

Catagen phase (transition)

During the catagen phase, which lasts only 2 or 3 weeks after the anagen, the hair stops growth and separates away from the circulatory system, resulting in the formation of club hairs.

Telogen phase (resting)

During this phase, the club hair lays as new hair forms under them. This hair that grows gradually replaces the club hair. This phase lasts 3 months.

Exogen phase (hair shedding)

During this phase, the remaining club hair is removed and dropped off. Each strand of hair gradually breaks down and it is entirely natural to shed 50–100 strands per day.

Alopecia areata

Alopecia areata is an immunological condition that often causes scalp hair baldness. Several tiny, circular, flawless, flat patches are typically initially developed. It is a short condition where individuals experience recurring bouts of thinning hair [11].

SYNTHETIC MEDICATIONS

Minoxidil (rogaine)

The only FDA-approved topical treatment for alopecia is minoxidil, also known as rogaine [12]. Minoxidil's well-known hair growth enhancement was discovered by chance as a side effect of the hypertension medication [13]. The mechanism by which the medication stimulates hair regeneration is unknown, despite It is widely known for opening potassium channels and causing cell membrane hyperpolarization. Hyperpolarization produces vasodilation and angiogenesis, and the opening of the channels of potassium permits greater amounts of oxygen in the bloodstream, along with food elements to enter the hair shafts [14]. Thus, minoxidil is thought to have a vital role in hair renewal by providing nutrients and a healthy blood supply. Minoxidil helps telogen follicles transition back to anagen. Topical minoxidil therapy has also been shown to prolong the active growth phase (Fig. 2) [15].

Finasteride (propecia)

It is an FDA-approved medicine. This medicine is solely recommended for male individuals who have balding of the hair. It acts by blocking 5-alpha-reductase, an enzyme that converts testosterone into dihydrotestosterone. It blocks the 5-A-reductase enzymes upon the receptors for androgen, preventing testosterone transformation to DHT [16]. Finasteride treatment for androgenic alopecia is most effective when provided early before the hair shafts collapse. This medication to treat androgenic alopecia typically leads to reversed loss of hair due to the medication's failure to tackle the genetic root of the condition, making hair thinning likely to return [17].

HERBAL REMEDIES

Herbs used to treat alopecia are among them:

1. Dietary aid
2. DHT blockers and 5-alpha-reductase antagonists
3. Aromatherapy.

Dietary aid [18,19,20]

Compounds such as iron, potassium, calcium, the metal copper, chromium, iodide zinc, and mg are essential for hair growth to be healthy (Table 3). Mineral insufficiency reduces the capacity to regulate blood flow, which promotes hair development that is healthy, and the production of thyroid hormones that reduce dryness of the hair, balding, and color problems. Too much iron is hazardous to the body. Consult a physician before using dietary supplements.

Vitamin A is essential for overall well health. It also benefits the hair shaft. Vitamin E is an antioxidant that promotes hair development and prevents hair loss by improving circulation in the scalp through enhanced oxygen intake in the blood. Table 1 lists the several plants that give dietary benefits.

DHT blockers And 5-α-reductase antagonists [24-27]

Herbs with strong DHT or 5-α-reductase inhibiting action can effectively treat alopecia, particularly androgenetic. Some plants, including African cherry, saw palmetto, and stinging nettle, were proven to reduce DHT, whereas green tea and Korean ginseng might block 5-α-reductase (Table 1). The potential mode of effect of DHT and 5-alpha-reductase blockers is shown in Fig. 3.

Aromatherapy [28,29]

Aromatherapy is often taken as a bonus therapy for alopecia. It makes use of extremely diluted compounds from a variety of plants (Table 2). Aromatic oils reach the body through the way they smell (breathing in) or through the epidermis.

VARIOUS HERBAL REMEDIES AND METHOD OF FUNCTIONING

Aloe vera

Chemical ingredients

Chromone and anthraquinone.

Method of functioning

It includes folic acid and Vitamin B12, which encourage healthy cell production, regrowth, and shine in the hair. Vitamins A, C, and E nourish and rebuild the cuticle lines. You can use these two drugs to prevent hair loss.

Uses

Aloe vera's primary ingredient, aloenin, promotes hair development in alopecia patients [33].

Amla

Chemical ingredients

Polyphenols and flavonoids.

Method of functioning

It contains antimicrobial qualities that assist in eradicating flaking as well as other microbial illnesses while also enhancing the condition of the scalp. It is a potent 5-a reductase antagonist.

Uses

It is employed for male and female baldness. It prevents dandruff, improves scalp health, and purifies the blood [34].

Onion

Chemical ingredients

Quercetin, fisetin, and diallyl trisulfide.

Method of functioning

Zn promotes the generation of crucial sebum and prevents dandruff-related baldness. Iron contributes to the oxygen-enriched body's blood vessels. It is essential for keeping healthy hair and proper production.

Uses

Onion contains sulfur-based compounds, which promote strong, thick hair and reduce hair loss. Collagen promotes glowing skin cells and the development of hair [28].

Garlic

Chemical ingredients

S-propyl-cysteine-sulfoxide (PCSO) and allicin.

Method of functioning

The crude garlic is believed to have properties high in ascorbic acid, which helps to maintain healthy hair.

Uses

Crude garlic contains minerals as well as vitamins which help to maintain hair wellness [35].

Bhringraj

Chemical ingredients

Coumestans, alkaloids, flavonoids, and carbohydrates.

Method of functioning

Extract of methanol increases anagen in hair shafts during the resting phase, thus resulting in increased development of hair.

Table 1: Plants providing dietary aid [21-23]

Biological source	Family	Common name	Part used	Chem. Const.
Avena sativa	*Poaceae*	Wild oats	Seed	Carbohydrates and fibers
Bacopa monnieri	*Scrophulariaceae*	Brahmi	Entire plant	Triterpenoids saponins
Phyllanthus emblica	*Euphorbiaceae*	Amla	Fruit	Vitamin C, Quercetin
Amaranthus spinosus L	*Amaranthaceae*	Bathua	Seed	Minerals
Pelvetia canaliculata	*Fucaceae*	Channelled wrack	Brown algae	Isoflavones
Juglans Regia L.	*Juglandaceae*	Akhrot	Fruit	Fe, proteins, and fats
Lactuca sativa L.	*Asteraceae*	Lettuce	Leaf	Vitamin A and folic acid
Aloe barbadensis	*Liliaceae*	Aloe vera	Leaf	Minerals
Cajanus cajan	*Fabaceae*	Pigeon pea	Seed	Protein, starch, and minerals

Table 2: Herbs in aromatherapy having chemical constituent terpenoids [30,31,32]

Biological source	Family	Common name	Part used
Arnica Montana	*Asteraceae*	Mountain tobacco	Flower
Cedrus atlantica	*Pinaceae*	Cedarwood	Wood chip
Lavandula angustifolia	*Lamiaceae*	Lavender	Flowering top
Ocimum sanctum	*Lamiaceae*	Tulsi	Whole plant
Pilocarpus jaborandi	*Rutaceae*	Jaborandi	Leaf
Rosmarinus officinalis	*Lamiaceae*	Rosemary	Flowering top
Thymus vulgaris	*Lamiaceae*	Thyme	Flowering top

Table 3: Herbs for alopecia with their mode of actions [45,46,47]

Biological source	Family	Common name	Part used	Chem. Const.	Mode of action
Allium cepa L.	*Alliaceae*	Onion	Clove	Eugenol	Stimulates hair regrowth
Allium sativum L.	*Alliaceae*	Garlic	Clove	Scontaining compds.	Nerve stimulation
Camellia sinensis	*Theaceae*	Tea	Leaf	Caffeine	5-α reductase inhibitor
Eclipta alba (L.) Hassk	*Asteraceae*	Bhringraj	Leaf	Daucosterol	Follicular enlargement
Ginkgo biloba	*Ginkgoaceae*	Ginkgo	Leaf	Terpenoid	Increases cerebral microcirculation
Hibiscus rosa sinensis Linn.	*Malvaceae*	Gudhal	Flower	Cyclopeptide alkaloid, riboflavin,	Prolongation of Anagen phase
Capsicum annuum	*Solanaceae*	Pepper	Fruit	Capsaicin and isoflavones	Production of IGF-I
Zanthoxylum rhetsa (Roxb.) DC.	*Rutaceae*	Yellowwood	Seed	Xanthoxylin,	Enhances microcirculation
Panax ginseng	*Araliaceae*	Ginseng	Root	Phytoestrogens	5-α reductase inhibitor
Pygeum africanum	*Rosaceae*	Pygeum	Dried bark	Ferulic acid esters	Lowerdown DHT levels
Nardostachys jatamansi	*Valerianaceae*	Jatamansi	Rhizome	Bornyl acetate	Follicular enlargement

DHT: Dihydrotestosterone. IGF-I: Insulin-like growth factor 1

Uses

That provides nourishment to the head and the hair shaft, promoting hair growth. The false daisy plant, a Vitamin E-rich herb, nourishes also promotes hair follicles. Hydrates the epidermis, letting it become glossy and more hydrated [36].

Tea

Chemical ingredients

Catechins, flavonols, leucoanthocyanins, and phenolic acid.

Method of functioning

It includes catechins, which stimulate the hair shaft and improve the supply of blood to the hairline.

Uses

It inhibits enzymes which lead to thinning hair and improves new hair growth by boosting follicles [7].

Fenugreek

Chemical ingredients

Carbohydrates, proteins, lipids, alkaloids, flavonoids, fibers, saponins, steroidal saponins, vitamins, and minerals.

Method of functioning

It can inhibit DHT's capacity to attach to hair follicles.

Uses

It repairs damaged hair follicles from dryness and color treatments[37].

Coconut

Chemical ingredients

Ninety percent of saturated fatty acid, 10% unsaturated fatty acid, myristic acid, and lauric acid.

Method of functioning

Coconut oil's antifungal and antibacterial properties help to protect against bacterial infections that can hamper hair growth.

Uses

Hair is moisturized and reduces damage [38].

Almond

Chemical ingredients

Dietary fiber and glycerides.

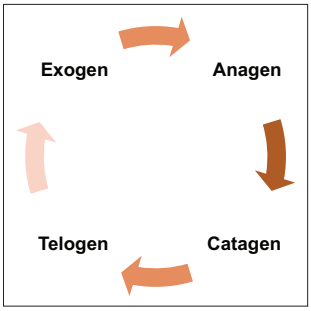

Fig. 1: Hair growth cycle

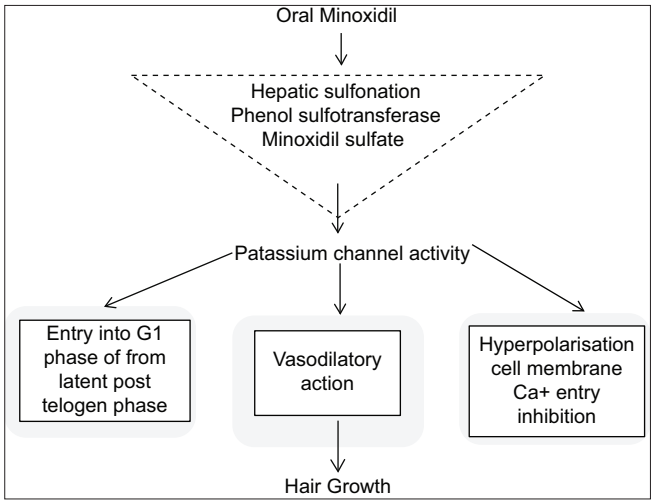

Fig. 2: Proposed mechanism of action of minoxidil

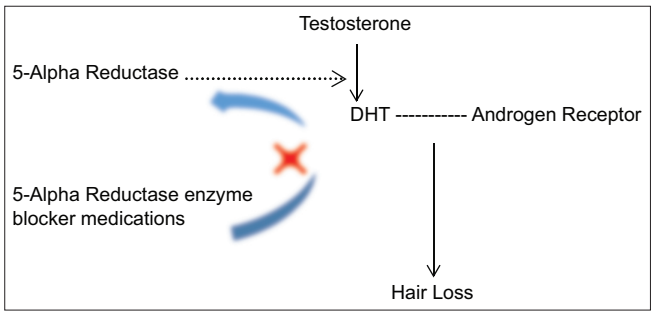

Fig. 3: Potential mode of effect of DHT and 5-alpha-reductase blockers

Method of functioning

It contains biotin, so rubbing it into your hair is an effective way to promote hair growth and prevent thinning.

Uses

Massage oil on the scalp increases the flow of blood to the roots, which promotes the growth and strength of hair [7].

Tulsi

Chemical ingredients

Linalol, ocimene, pinene, cineol, anethol, estragole, thymol, citral, eugenol, and camphor.

Method of functioning

It is good for your hair because it rejuvenates the follicles and strengthens the roots, which helps to control the falling of hair.

Uses

It can prevent hair loss and thinning, and enhance thickness [39].

Ginkgo

Chemical ingredients

Terpene lactones and flavone glycosides.

Method of functioning

After extracting the drug, it is massaged lasting a minimum of 2 min in coconut oil to relax it.

Uses

It increases cerebral microcirculation, which elevates the amount of oxygen that is available [40].

Amla

Chemical ingredients

Ellagic acid, phyllemblin, quercetin, and ascorbic acid.

Method of functioning

The oil prepared by heating powdered Indian gooseberry chunks in the presence of coconut oil is regarded as a potent hair stimulant that promotes hair growth. A shampoo containing a combination of fresh Indian gooseberry liquid and citrus juice improves hair growth and minimizes thinning hair.

Uses

Iron helps oxygenate your body's blood vessels [41].

Rosemary

Chemical ingredients

Triterpenes, and phenolic acids including rosmarinic acid.

Method of functioning

For a duration of 7 months, the head was massaged with these essential oils for a minimum of 2 min daily.

Uses

Aromatic substances penetrate into the body through the epidermis, the auditory mechanism, or both. They then go to the bloodstream, where they attach to endings and alter their chemistry. External treatment with herbs improves the growth of hair and has been demonstrated to be the safest way to treat baldness [42].

Akhrot

Chemical ingredients

Phosphorus, magnesium, potassium, and zinc.

Method of functioning

The oil extracted from walnuts rubbed to the scalp and massaged throughout the hair's bases can also help alleviate the loss of your hair. This feeds your hair and promotes its development.

Uses

It contains essential components that stimulate the growth of healthy hair. As stated previously, iron enhances the flow of blood and oxygenation, whereas zinc aids in the secretion of essential fluid from the scalp, preventing dandruff, which can contribute to balding [43].

Liquorice

Chemical ingredients

Glycyrrhizin.

Method of functioning

Licorice paste is an excellent treatment for patching hairline. It is made simply by crushing the pieces with milk and adding a touch bit of saffron. This paste has to be spread over the regions of baldness at bedtime before asleep.

Uses

Licorice components encourage hair development [44].

EFFICACY OF HERBAL MEDICATIONS

It is crucial to remember that the efficiency of herbal treatments for alopecia varies widely, and scientific evidence is sometimes poor or mixed. Patients should always speak with their doctors before introducing herbal supplements into their treatment plans [48].

CONCLUSION

The treatment landscape for alopecia encompasses a diverse array of synthetic and herbal medications, each with its own set of benefits and limitations. Synthetic medications such as minoxidil and finasteride have shown promise in clinical settings but come with potential side effects and uncertainties regarding long-term efficacy. On the other hand, herbal remedies offer a natural alternative with perceived safety benefits, yet their efficacy remains largely anecdotal and lacks robust scientific validation.

Moving forward, bridging the gap between traditional pharmaceuticals and herbal therapies requires concerted efforts in research and development. Robust clinical trials, standardized formulations, and regulatory oversight are crucial. Furthermore, collaboration between health-care professionals, researchers, and the herbal medicine community is essential to optimize treatment outcomes and provide patients with evidence-based care.

Ultimately, while synthetic medications remain the cornerstone of alopecia treatment, the potential of herbal remedies should not be dismissed. By embracing a holistic approach that integrates both conventional and alternative therapies, we can better address the diverse needs of patients with alopecia.

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COMPETING INTEREST

The authors declared that there is no conflict of interest for the publication of this article.

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