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REVIEW: THE POTENTIAL OF HERBAL PLANTS AS ANTI-ALOPECIA MEDICINES

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ABSTRACT

Hair loss, or alopecia, is a common dermatological condition that affects up to 2% of the world's population. It is often caused by genetic factors, such as male or female pattern baldness, but can also be attributed to various environmental factors, an imbalanced diet, or chronic illnesses. While hair loss is not life-threatening, it can lead to significant anxiety, depression, and other psychological issues, ultimately affecting one's quality of life. Various treatments for baldness, including synthetic drugs like minoxidil and finasteride, or herbal remedies, have been approved by the Food and Drug Administration. Although synthetic drugs are effective, they may come with potential side effects. Natural remedies have been proposed as a viable option for treating baldness because many chronic disorders can lead to alopecia. Therefore, this review focuses on identifying efficient alternative treatment agents with limited side effects. Specifically, it considers medicinal plants as potential healing agents for treating baldness. To gather relevant information for this study, several databases were searched, including Scopus, PubMed, and Google Scholar. Comprehensive searches were conducted using various search terms, such as "baldness," "alopecia," "natural remedies for baldness," "herbal treatment for baldness," and others, to extract relevant scientific articles. Many medicinal plants and natural compounds have shown potential for reducing baldness, thanks to their anti-inflammatory and antioxidant properties. According to existing literature, extracts of medicinal plants and formulations derived from plants, such as *Eclipta alba* (L.) *Hassk*, *Arctium lappa* L., *Centella asiatica* L., *Morinda citrifolia*, *Acorus calamus* var. *angustatus*, *Alpinia zerumbet*, *Cerasus serrulata*, *Clerodendrum fragrans*, *Erythrina variegata*, *Psidium guajava* L., Shallot Extract, *Allium cepa* L., and rice bran extract may be effective in reducing baldness directly or indirectly.

Keywords: Alopecia, anti-alopecia, herbal plants

INTRODUCTION

Hair is a complex structure composed of keratinized epithelial cells that serve as the most efficient protection for the scalp against sunlight exposure. Hair plays a significant role in human life as a symbol of pride for both women and men. Currently, having healthy, beautiful, and well-groomed hair is a highly important factor in one's appearance (Harris, 2021). Hair has had sustained psychological and sociological significance in shaping the character and overall appearance of individuals throughout history (Semalty et al., 2011). One of the common problems frequently encountered and complained about by a majority of patients is hair loss (effluvium) and baldness (alopecia). Hair loss, also known as effluvium, is a condition in which an individual loses approximately 120 strands of hair per day, which can occur evenly across the entire scalp or only in specific areas. If hair loss persists, it can lead to baldness (alopecia) (Harris, 2021).

Alopecia itself is an autoimmune disease that causes hair loss without leaving any trace on the scalp, face, or body. This condition can result in small bald patches, total

alopecia (TA) which causes complete hair loss on the scalp, or universal alopecia (UA) which leads to total hair loss on the scalp, face, and body. Although it affects all age groups and genders, onset typically occurs before the age of forty in over 80% of patients, and before the age of twenty in 40% of patients (Ramírez-Marín and Tosti, 2022). Alopecia or Alopecia Areata (AA) has predetermined subtypes namely alopecia totalis (AT), ophiasis (AO), and universalis. Previous studies have investigated the epidemiology of AA and found significant discrepancies between the estimated prevalence and the actual occurrence of the disease. A recent systematic review of hospital-based studies found that the incidence of AA ranges between 0.57% and 3.8% (Villasante Fricke and Miteva, 2015).

Although many patients experience recovery within the first year after the onset of alopecia, approximately 4.5% to 36.1% of patients eventually develop AT and/or AU. Alopecia has a significant impact on quality of life, social function, and psychological well-being, and also incurs significant costs for patients and the healthcare system (Villasante Fricke and Miteva, 2015).

The research findings by Uzuncakmak, et al., in 2021 in Turkey revealed that alopecia areata (AA) affects approximately 2% of the general population without a predilection for gender, race, or specific age groups. This study found a lower prevalence of AA in the pediatric age group compared to adults, supporting the hypothesis that AA has increased over time (Uzuncakmak et al., 2021).

The results of the National Health and Nutrition Examination Survey 1971–1974 first estimated the total prevalence of alopecia at 0.1% to 0.2% in the United States. In the United States, the lifetime incidence risk of Alopecia is estimated to be 1.7% to 2.1%. Patients frequently encountered account for approximately 0.6% to 2.0% of new cases in dermatology clinics in the UK and US. Hospital-based studies worldwide estimate the risk of alopecia occurrence between 0,57% to 3.8% (Mostaghimi et al., 2023).

The Division of Cosmetic Medicine, Department of Dermatology and Venereology, Dr. Soetomo Hospital, Surabaya, treated 4875 patients from 2012 to 2016, with 0.6% of new patients experiencing alopecia. Seventy percent of new alopecia patients were male, and 40% of them were aged 25-44 years. Ninety percent of alopecia patients experienced hair loss or localized baldness. The highest number of new patients with AA who were frequently ill was between 0 and 6 months; 20% of them had a history of untreated cases before, and 76.7% had the diagnosis criteria of small hairless areas. The classic subtype was found in 90% of patients. Topical minoxidil administration (96,7%) and combination supplements were the most common AA therapies. Forty-six point seven percent of patients underwent retreatment (Ardhaninggar and Setyaningrum, 2018).

The management of androgenetic alopecia (AGA) is the primary therapy for men, consisting of topical minoxidil and finasteride. Additionally, for patients who experience treatment failure with finasteride, dutasteride is another medication that can be used as an alternative treatment. In women, antiandrogen treatments such as spironolactone and cyproterone acetate are used. Hair transplantation is an additional procedure that can be performed. However, patients must have a sufficient donor source (more than 40 follicular units/cm^2) to cover the balding area. The main treatment for alopecia is largely based on clinical experience due to the lack of data on the effectiveness of available treatments. For more severe conditions, first-line therapy includes local, topical, and intralesional corticosteroids, along with oral tetracycline. Hydroxychloroquine and immunosuppressants have been used in difficult cases, but their use is limited due to adverse drug effects (Mostaghimi et al., 2023).

Alopecia is a dermatological disorder that is a common problem affecting both men and women. It has been investigated through various methods offered, including natural or synthetic-based products. Natural products continue to gain popularity as does the use of plant extracts in formulations. Synthetic-based products can pose health hazards to humans with several side effects. Natural herbal formulations are used to treat hair as a tonic, stimulate growth, soften, cleanse, and address dandruff, as well as alopecia and lice

problems. Some herbal products have been proven effective in stimulating hair growth (Singh et al., 2016).

As time goes by, society begins to seek alternative ways to treat alopecia by using ingredients derived from nature. Indonesia boasts 940 types of medicinal plants that have been used traditionally, making it one of the countries with the largest wealth of medicinal plants in the world (Mao Y. et al., 2022). Therefore, this journal review is intended to serve as an additional reference regarding efficacious herbal plants with the potential to be developed into alternative treatments for alopecia through further research.

RESEARCH METHOD

The data utilized in this journal review consists of articles focusing on herbal plants that are researched and considered important for development as alternative treatments for alopecia. The data collection process involved direct searches for relevant journals both nationally and internationally through search engines such as Google and websites like Google Scholar, Research Gate, Sciencedirect, NCBI, and Pubmed using keywords such as "baldness", "alopecia", "natural remedies for alopecia ", "herbal treatment for alopecia ", and others to obtain relevant scientific articles. This search resulted in 17 articles used in this review. From these articles, data regarding 12 herbal plants suspected to have anti-alopecia activity and potential as alternative treatments for alopecia were obtained. Additionally, several other journals and articles were also used as additional references regarding alopecia and its various types.

RESULTS AND DISCUSSION

The treatment of alopecia or hair loss involves various approaches tailored to the type of alopecia, its causes, and individual conditions. Some common mechanisms used in the treatment of alopecia include stimulating hair growth using medications or topical products designed to trigger new hair growth, prolonging the hair growth phase (anagen), and strengthening hair follicles. In cases of androgenetic alopecia (AGA), the use of medications such as 5α reductase inhibitors (e.g., Finasteride, Dutasteride) can help inhibit the conversion of testosterone into DHT, which is a contributing factor to hair loss. Anti-inflammatory or immunosuppressive therapy may be used for alopecia areata or alopecia triggered by inflammation to reduce inflammation and slow down hair loss (Kesika et al., 2023).

Cell therapy, or stem cell therapy, can also be used to stimulate new hair growth by repairing damaged or inactive hair follicles. Additionally, surgical procedures such as hair transplantation can be performed to harvest hair follicles from areas with good hair growth and transplant them to areas experiencing hair loss. Adopting a healthy lifestyle with good dietary habits, reducing stress, and avoiding risk factors such as smoking can also help maintain hair health and prevent hair loss. Moreover, the use of topical hair care products such as minoxidil, hair serums, or specialized shampoos can also help strengthen hair, maintain scalp health, and stimulate hair growth (Kesika et al., 2023).

In this review, 11 plants with potential as anti-alopecia treatments are discussed. The parts of the plants utilized vary, including roots, seeds, flowers, herbs, wood bark, and algae. These plant sources originate from various regions, both local and international. Information regarding the plants believed to have anti-alopecia effects is detailed in Table I.

Eclipta alba (L.) *Hassk*

Eclipta alba (L.) *Hassk*, also known as "False Daisy" or "Bhringraj" in traditional medicine, has shown potential as a potent hair growth promoter. Methanol extract from *Eclipta alba* has been used in research to understand its effects on hair growth. Studies have shown that Eclipta alba extract possesses significant hair growth-promoting properties. In a study utilizing methanol extract from Eclipta alba, the results indicated a significant increase in hair density and clear hair growth areas compared to the control group. Additionally, treatment with Eclipta alba extract also increased the number of hair follicles, as well as

demonstrated by the presence of follicular keratinocytes and cells in the S phase of the cell cycle (Begum et al., 2014).

Table I. Plants with Anti-Alopecia Effects

No	Scientific Names	Local Names in Indonesia	Parts Used	Useful Contents for Alopecia	References
1	*Eclipta alba* (L.) Hassk	*Urang Aring*	leaves and roots	wedelolactone, flavonoids, polyphenols	(Begum et al., 2014)
2	*Arctium lappa* L.	*Gobo*	leaves and roots	flavonoids, inulin, fatty acids essentials, vitamins and minerals	(Skowronska et al., 2021)
3	*Centella asiatica* L.,	*Pegagan*	leaves	triterpenoids, flavonoids, amino acids	(Saansoomchai et al., 2018)
4	*Morinda citrifolia*	*Buah Noni*	fruit	alkaloids, flavonoids, phytosterols, anthraquinones, saponin,tannin	(Susanti et al., 2022)
5	*Acorus calamus var. angustatus*	*Akar wangi*	roots	asarone,cumaric acid	(Park SangOh et al., 2015)
6	*Alpinia zerumbet*	*Variegate/ calathea zerumbet*	leaves	Kaempferol-3-O-β-D-glucuronide (KOG), labdadiene, MTD, and TMOQ	(Taira et al., 2017)
7	*Cerasus serrulata*	*Bunga sakura*	flower	benzaldehydes, pipecolic acids	(Zhang et al., 2023)
8	*Clerodendrum fragrans*	*Daun Sarang Banua*	leaves	alkaloids, steroids, flavonoids	(Anggraini et al., 2019)
9	*Erythrina variegata*	*Daun Dadap*	leaves	tannin, polyphenols, steroids, triterpenoids, quinones, monoterpenoids, and sesquiterpenoids	(Mustarichie et al., 2017)
10	*Psidium guajava* L.	*Daun Jambu Batu*	leaves	quercetin, catechin,g allic acids	(Ruksiriwanich et al., 2022b)

11	Shallot Extract / *Allium cepa* L.	*Bawang merah*	bulb *(umbi*) or cloves (*suing*)	flavonoids, quercetin, sulphur, allicin	(Ruksiriwanich et al., 2022a)
12	Rice bran extract	*Ekstrak dedak padi*	The outer layer of rice grain	flavonoids, phytosterol, omega-3 and omega-6 fatty acids.	(Mustarichie et al., 2017)

***Arctium lappa* L.**

Arctium lappa L., or Burdock, possesses properties that can help alleviate alopecia or hair loss through several mechanisms: Active compounds such as flavonoids, inulin, essential fatty acids, vitamins, and minerals stimulate hair growth by providing the necessary nutrients for hair follicles, strengthening hair roots, and promoting healthy hair growth. The anti-inflammatory compounds in *Arctium lappa* help reduce inflammation on the scalp, which can affect hair growth and cause hair loss. Flavonoid content acts as an antioxidants, protecting hair follicles from oxidative damage that can lead to hair loss and maintaining scalp health. Meanwhile, inulin, as a prebiotic fiber, supports the growth of healthy microbiota on the scalp, maintaining the balance of microbiota essential for hair health and preventing scalp issues that can lead to hair loss (Skowronska et al., 2021).

***Centella asiatica* L.**

Centella asiatica L., or Gotu Kola, is an herbal plant that has long been applied in traditional medicine due to its various benefits. *Centella asiatica* extract is renowned for its significant antioxidant activity and its ability to stimulate hair growth through diverse mechanisms. Active compounds such as triterpenoids, asiatic acid, madecassic acid, and flavonoids in the extract play a role in protecting scalp cells and hair follicles from damage caused by free radicals and oxidative stress. Moreover, this extract has been proven to increase collagen production, which is essential for hair structure, and improve blood circulation in the scalp to supply nutrients to hair follicles, all of which support healthy hair growth. With its anti-inflammatory properties, Centella asiatica extract can also help alleviate inflammation on the scalp, maintain its health, and facilitate optimal hair growth (Saansoomchai et al., 2018).

Morinda citrifolia

Noni fruit, or *Morinda citrifolia*, is an herbal plant known to have various health benefits, including its potential for treating hair and scalp. Several alkaloids found in Noni fruit have been studied for their anti-alopecia properties, which can promote hair growth. Noni fruit, also known as indian mulberry, originates from tropical plants that grow in the South Pacific region and has long been utilized in traditional medicine. Alkaloids in Noni fruit have shown potential in treating hair and addressing alopecia by stimulating hair growth, strengthening hair roots, and maintaining follicle health. Studies indicate that the anti-alopecia properties of these alkaloids can prevent hair loss and stimulate new hair growth through various mechanisms, such as stimulating hair follicles, increasing blood circulation in the scalp, and providing essential nutrients for healthy hair growth. With a combination of anti-alopecia properties, the ability to stimulate hair growth, and the potential to improve scalp health, alkaloids from Noni fruit are an intriguing natural option in alopecia treatment and overall hair health maintenance (Susanti et al., 2022).

***Acorus calamus var.* angustatus**

Acorus calamus var. *angustatus*, known as Sweet Flag or Akar Wangi in Indonesian, is a plant that has been proven to have the potential in treating hair and scalp. Extracts from this plant have been shown to promote hair growth and maintain hair health. Acorus calamus

var. angustatus, as a variety of Acorus calamus, has long been used in traditional medicine for various health conditions, including hair and scalp care. Extracts from this plant contain various active compounds beneficial for hair health, such as asarone, coumaric acid, and other proven beneficial compounds.

Studies indicate that extracts from *Acorus calamus* var. *angustatus* can maintain hair health by increasing hair thickness, density, and length, as well as stimulating new hair growth by enhancing the activity of hair cells and stimulating hair follicles to enter the growth phase (anagen phase). Thus, this plant offers an intriguing potential in hair and scalp care due to its diverse and effective active ingredients (Park SangOh et al., 2015).

Alpinia zerumbet

The mechanism of action of *Alpinia zerumbet* in treating alopecia involves its ability as a source of PAK1 inhibitors. Bioactive compounds isolated from *Alpinia zerumbet*, such as Kaempferol-3-O-β-D-glucuronide (KOG), labdadiene, MTD, and TMOQ, have been shown to enhance the proliferation of human hair follicle dermal papilla cells. Additionally, these compounds also exhibit significant growth activity, even higher than minoxidil, which is one of the commercially available treatments for alopecia. The hypothesized mechanism of action is through the inhibition of oncogenic/ageing kinase PAK1, which may contribute to the anti-alopecia effects of these compounds (Taira et al., 2017).

Bioactive compounds isolated from *Alpinia zerumbet*, such as Kaempferol-3-O-β-D-glucuronide (KOG), labdadiene MTD, and TMOQ, have been shown to enhance the proliferation of human hair follicle dermal papilla cells through cell growth activity assays in cell culture. In the study, these compounds exhibited a significant increase in the proliferation of human hair follicle dermal papilla cells at certain concentrations, with an increase ranging from 117% to 226% for KOG and labdadiene, and approximately 164% to 139% for MTD and TMOQ at a concentration of 10 μM. These results indicate that these compounds have the potential to enhance hair cell growth (Taira et al., 2017).

Cerasus serrulata

The research conducted by Zhang et al. (2023) on the anti-alopecia effects of *Cerasus serrulata* was carried out using two different extraction methods, namely cold vacuum extraction and ethanol extraction. The results of the study showed that the composition of compounds in the *Cerasus serrulata* extract varied depending on the extraction method used. GC-MS analysis indicated that the *Cerasus serrulata* extract was rich in alkanes and aromatic compounds, with benzaldehyde being the main component in the cold vacuum extraction, while pipecolic acid was the main component in the ethanol extract. Additionally, the extract also exhibited strong antioxidant activity in scavenging free radicals and demonstrated good antibacterial abilities in inhibiting the growth of five common bacterial strains. Studies on the alopecia rat model showed that the use of *Cerasus serrulata* extract had a positive effect on maintaining hair follicles, regulating the expression of VEGF, IL-6, β-catenin, FGFR, and IGF-1 proteins, and reducing DHT and 5α-reductase levels (Zhang et al., 2023).

The role of *Cerasus serrulata* in addressing alopecia involves several aspects. *Cerasus serrulata* has been shown to have anti-alopecia effects through two main mechanisms. Firstly, the extract can regulate key proteins in the skin, such as reducing IL-6 levels and preventing the decrease in VEGF, as well as increasing the expression of β-catenin, FGFR, and IGF-1. Secondly, the extract is also capable of reducing dihydrotestosterone (DHT) levels and the 5α-reductase enzyme in experimental rats, which are important factors in alopecia (Zhang et al., 2023).

Clerodendrum fragrans

The Sarang Banua leaves (*Clerodendrum fragrans*) contain various compounds believed to be beneficial in the treatment of alopecia, including alkaloids, steroids,

flavonoids, and antioxidants. These compounds have the potential to stimulate hair growth and combat the hair damage associated with alopecia.

Research conducted by Anggraini et al. (2019) explored the potential use of Sarang Banua leaf extract (*Clerodendrum fragrans*) as an active ingredient in hair tonics to address alopecia. Sarang Banua is known to have a high antioxidant content, which is believed to stimulate hair growth and address alopecia-related issues. This study was conducted using in vivo methods on Wistar white rats, where Sarang Banua leaf extract was administered to treatment groups at different concentrations (5%, 7.5%, and 10%) to examine its effects on hair growth. The test results showed that the 5% concentration extract showed results comparable to 2% minoxidil in stimulating hair growth, indicating the potential of Sarang Banua as a natural alternative in alopecia treatment (Anggraini et al., 2019).

Erythrina variegata

The study conducted by Mustarichie et al. (2017) describes the use of ethanol extract from the leaves of Dadap (*Erythrina variegata*) as a hair growth stimulant or anti-alopecia agent. This research demonstrates that the ethanol extract and water fraction from *Erythrina variegata* are effective in stimulating hair growth in male rabbits. The results of the study indicate that ethanol extract and water fraction at a concentration of 10% were able to stimulate hair growth in rabbits over 18 days, with the 10% water fraction showing the best results in stimulating hair growth (Mustarichie et al., 2017).

***Psidium guajava* L.**

The study conducted by Ruksiriwanich et al. (2022) indicates that guava leaf extract contains bioactive compounds such as quercetin, gallic acid, and catechin, which possess antiandrogenic and antioxidant properties. The research demonstrates that guava leaf extract is capable of reducing the expression of the SRD5A gene (5α-reductase enzyme) involved in dihydrotestosterone (DHT) synthesis in HFDPC (hair follicle dermal papilla cells) and human prostate cancer DU-145 cells. This study suggests that guava leaf extract has the potential to reduce hair loss by inhibiting DHT production, which is a crucial factor in androgenetic alopecia (Ruksiriwanich et al., 2022b).

Furthermore, another study by Nantitanon et al. (2010) also indicates that guava leaf extract has high antioxidant activity, which can help protect hair follicles from oxidative damage that may lead to hair loss. Although there is insufficient evidence to support the traditional claims of guava leaf use for hair growth, this research provides scientific evidence demonstrating the potential of guava leaves as an anti-alopecia agent through anti-androgenic and antioxidant mechanisms (Nantitanon et al., 2010).

Shallot Extract

A recent study by Ruksiriwanich et al. (2022) indicates that shallot extract has the potential to be a hair growth promoter and antiandrogenic agent. The active compounds in shallots may have positive effects on stimulating hair growth and regulating androgen hormone activity, particularly dihydrotestosterone (DHT), which is associated with androgenetic alopecia. This research suggests that shallot extract contains bioactive compounds with anti-inflammatory, antiandrogenic properties and the potential to stimulate hair growth. These compounds may work by regulating the expression of genes related to androgen hormones, such as 5α-reductase, involved in converting testosterone into DHT, which is a major factor in androgenetic alopecia (Ruksiriwanich et al., 2022a).

Thus, these findings provide scientific evidence indicating that shallot extract has the potential to be a hair growth promoter and antiandrogenic agent. However, further research is needed to validate these findings and to gain a deeper understanding of the mechanisms of action and the potential use of shallot extract in the treatment of alopecia (Ruksiriwanich et al., 2022a).

Rice Bran Extract

Rice bran extract has been the subject of research due to its potential to address hair loss associated with the activity of the 5-alpha reductase steroid. 5-alpha reductase steroid is an enzyme involved in the conversion of testosterone to dihydrotestosterone (DHT), which is a hormone implicated in causing hair loss in androgenetic alopecia (Tao et al., 2019). Studies investigating rice bran extract have shown that the active compounds contained within it can influence the expression of the 5-alpha reductase steroid gene. By regulating the activity of this enzyme, rice bran extract has the potential to act as an anti-alopecia agent by reducing excessive DHT production on the scalp (Tao et al., 2019). Several compounds found in rice bran extract, such as flavonoids, phytosterols, omega-3 and omega-6 fatty acids, as well as other antioxidants, are believed to have inhibitory effects on the activity of the 5-alpha reductase steroid. Therefore, the use of rice bran extract may help reduce hair loss caused by hormonal factors, particularly in cases of androgenetic alopecia (Tao et al., 2019).

CONCLUSION

Numerous herbal plants have anti-alopecia effects and have the potential to be used as alternative herbal remedies. Plants such as *Eclipta alba* (L.) *Hassk*, *Arctium lappa* L., *Centella asiatica* L., *Morinda citrifolia*, *Acorus calamus* var. *angustatus*, *Alpinia zerumbet*, *Cerasus serrulata*, *Clerodendrum fragrans*, *Erythrina variegata*, *Psidium guajava* L., Shallot Extract, *Allium cepa* L., and rice bran extract may be effective in reducing baldness directly or indirectly. However, further research is needed to deepen our understanding of the mechanisms of action and the appropriate dosage of each plant. Additionally, clinical trials are required to ensure the therapy's effectiveness in humans before these herbal plants can be widely used in the treatment of alopecia.

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