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Effectiveness of *Rosmarinus officinalis* for Androgenetic Alopecia: A Literature Review

Cintantya Prakasita [1], Desak Nyoman Trisepti Utami [2], Natasha Caroline Gigir [3], Ni Ketut Putri Ratih Sindunata [4]

[1,2,3,4] Bali Mandara General Hospital, Indonesia

Corresponding Author: cintantyaprakasita@hotmail.com

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ABSTRACT

Androgenetic alopecia (AGA), also known as androgenic alopecia or male pattern baldness, is the most common type of progressive hair loss.. Androgenetic alopecia is hereditary and is transmitted through an autosomal dominant genetic pattern. This genetic predisposition is directly associated with androgen hormones, in which androgens induce miniaturization of hair follicles on the scalp and a progressive shortening of the anagen phase in the hair cycle. There are evidence-based therapeutic interventions for androgenetic alopecia, including both pharmacological and non-pharmacological approaches. The 5α-reductase inhibitors, finasteride and dutasteride, effectively suppress dihydrotestosterone (DHT) synthesis but are associated with sexual dysfunction including erectile dysfunction, reduced libido, and ejaculatory disorder as well as gynecomastia. Androgen receptor antagonists such as spironolactone may induce postural hypotension and hyperkalemia, cyproterone acetate carries risks of mood disturbances and hepatotoxicity, and flutamide is linked to

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dose-dependent severe hepatic injury. This literature review explores the therapeutic potential of herbal remedies Rosmarinus Officinalis known for their anti inflammatory agent, anti androgenic agent, anti fungal agent, photoprotective agent, and a vasodilator. This review emphasizes the potential and effectiveness of Rosmarinus Officinalis in advancing dermatological care and providing effective, plant-based solutions for Androgenetic Alopecia with minimal side effects.

Keywords: Androgenetic Alopecia, Rosmarinus officinalis

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INTRODUCTION

Androgenetic alopecia (AGA), also known as androgenic alopecia or male pattern baldness, is the most common type of progressive hair loss. AGA is a polygenetic condition with varying severity, age of onset, and scalp location of hair loss. In men, hair loss typically involves the temporal and vertex region while sparing the occipital region: the characteristic "horseshoe" pattern. [1] Its prevalence and severity are higher in European populations compared to Asian, Native American, and African American populations. [2]

Androgenetic alopecia is hereditary and is transmitted through an autosomal dominant genetic pattern.[2] This genetic predisposition is directly associated with androgen hormones, in which androgens induce miniaturization of hair follicles on the scalp and a progressive shortening of the anagen phase in the hair cycle. [1] Another etiopathological factor contributing to androgenetic alopecia is micro-inflammation of the hair follicles. This may be caused by environmental factors such as air exposure, pollution, nutritional deficiencies, and metabolic syndrome. [3]

The clinical manifestation of androgenetic alopecia typically begins at puberty, when there is a surge in androgen production, particularly dihydrotestosterone (DHT), along with activation of androgen hormone receptors.[2] This condition presents with a characteristic pattern in the frontal, vertex, and temporal regions, which are androgen-dependent areas with a high concentration of androgen receptors. Unlike in women, involvement of the frontal area in men occurs because androgen receptor expression in this region is three times higher than in women. [2,4]

The diagnosis of androgenetic alopecia can generally be established clinically. Scalp examination may reveal signs of inflammation such as erythema, scaling, hyperkeratosis, and follicular dropout. Hair assessment includes evaluating differences in hair density in the frontal, occipital, and temporal areas. When necessary, dermoscopy or trichoscopy may be performed.

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Trichoscopy may show follicular miniaturization and assist in excluding scarring alopecia. In the hair pull test, results may be positive in the frontal region but negative in the occipital area. On physical examination, findings such as acne, seborrhea, oily skin, and obesity may indicate underlying hyperandrogenism. [2]

LITERATURE REVIEW

Evidence-Based Medicine Therapy for Androgenetic Alopecia

A substantial and expanding body of literature has systematically examined the most advanced and evidence-based therapeutic interventions for androgenetic alopecia.including both pharmacological and non-pharmacological approaches. Broadly, pharmacological therapies are categorized into androgen-dependent and androgen-independent medications. Androgen-dependent medications act as agonists toward androgen hormones. These therapies reduce testosterone levels, inhibit the 5α-reductase enzyme, and exert antagonistic effects on androgen receptors. [5]

Androgen Dependent Agents

5 Alpha Reductase Inhibitors

Two 5AR inhibitors are used in AGA: finasteride, inhibits Type II Alpha Reductase enzyme, and dutasteride, which inhibits both Type I and type II of the Alpha Reductase enzyme. Finasteride is, so far, the only US FDA-approved oral medication for the treatment of Male Androgenetic Alopecia (MAGA) that blocks the conversion of testosterone to dihydrotestosterone (DHT). The FDA approved finasteride in 1997 at a dosage of 1mg/day for use in adult men with mild- moderate AGA. [1] Among the commonly mentioned sexually adverse effects, including erectile dysfunction, decreased libido, and ejaculation dysfunction, the only adverse effect that was significantly more frequent with finasteride therapy in comparison with placebo treatment was erectile dysfunction, and there is moderate-quality evidence suggesting an absolute increase in the risk of erectile dysfunction of approximately 1.5 % [6,7] These medications are recommended for

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men but not for women, and are contraindicated in pregnant women or those with pregnancy potential due to the risk of feminization of male fetuses.[8]

Dutasteride is a potential alternative to finasteride with proposed increased efficacy. It blocks both type I and type II of the 5-alpha reductase enzyme. dutasteride 0.5 mg daily was not significantly different than finasteride 1 and 5 mg in terms of efficacy and safety.[9] Impotence, decreased libido, breast tenderness and breast enlargement, and ejaculation disorders are more common with dutasteride than with finasteride. In females, dutasteride 0.5 mg daily for 6 months was effective in a patient with limited response to topical minoxidil and oral finasteride [10]

Estrogen and Other Anti-Androgen Treatments

Spironolactone is the most commonly used off-label anti-androgen therapy for female androgenetic alopecia. It is a potassium-sparing diuretic and a structural antagonist of aldosterone. In the treatment of AGA, spironolactone reduces androgen production and competitively blocks androgen receptors in target tissues. [11] The recommended starting dose ranges from 50–200 mg daily for a minimum of six months. Adverse effects include postural hypotension and hyperkalemia. [12]

Cyproterone acetate not only acts as an androgen receptor antagonist but also reduces testosterone levels by suppressing luteinizing hormone (LH) and follicle-stimulating hormone (FSH). Its adverse effects include depressive mood changes and hepatotoxicity. [13]

Flutamide is a potent androgen receptor antagonist that may enhance hair growth after six months of use and provide long-term stabilization of androgenetic alopecia. Its primary adverse effect is dose-dependent hepatotoxicity.[14]

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Androgen-independent medications

Androgen-independent medications act through non-hormonal mechanisms. Minoxidil is currently the only androgen-independent topical therapy approved by FDA for androgenetic alopecia. Its recommended use is 1 mL applied twice daily to a dry scalp for at least four hours, over a minimum treatment duration of six months. Adverse effects include dermatitis, facial hypertrichosis, and temporary increased hair shedding. Minoxidil is contraindicated during pregnancy due to limited data on teratogenicity but is considered safe during breastfeeding. (15)

Additional therapies include prostaglandin analogues; prostaglandin E2 and F2 work synergistically to induce hair growth and prolong the anagen phase. Examples include latanoprost 0.1% and bimatoprost 0.03%. (16)

Ketoconazole 2% shampoo may disrupt the local DHT pathway, thereby enhancing hair growth in androgenetic alopecia. (17)

Melatonin, the secretory product of the pineal gland, has been known to modulate hair growth, pigmentation, and molting in many species including humans. Melatonin, the secretory product of the pineal gland, has been known to modulate hair growth, pigmentation, and molting in many species including humans (18)

Platelet-rich plasma (PRP) is an autologous preparation of plasma with >1,000,000/ ll platelets that are capable of secreting growth factors and cytokines, which stimulate stem cells, can shorten the time of hair follicle formation and enhance the number of newly formed hair follicles. (19)

Non-pharmacological therapies for androgenetic alopecia include hair transplantation, scalp reduction surgery, and light-based therapies. Surgical treatments play an important role for patients with AGA who do not respond adequately to medical therapy. These procedures include hair transplantation and scalp reduction, or a combination of both. Among these, hair transplantation is

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the most commonly performed because it is less invasive, whereas scalp reduction using flaps is typically reserved for skilled surgeons. [19]

Low-level light therapy (LLLT) is a relatively new technique used in the treatment of AGA. Several types of product using LLLT, including comb, hood, and helmet, are available for the adjunctive treatment of AGA. [20] Expert consensus based on their experience con- cluded that LLLT, particularly 650–900 nm wavelength at 5 mW, may be an effective alternative treatment for AGA patients either as a stand-alone or adjunctive therapy. [21]

Therapeutic Effects of Rosmarinus officinalis

Rosmarinus officinalis, commonly known as rosemary, is an herb of the Lamiaceae family. It is characterized by a bitter taste and a pronounced aroma and is frequently used in herbal medicine. Rosemary contains numerous biologically active constituents; the principal components are carnosic acid, carnosol, and rosmarinic acid. Other bioactive constituents include camphor, caffeic acid, ursolic acid, betulinic acid, rosmaridiphenol, rosmanol, and 12-methoxycarnosic acid. All of these bioactive components act synergistically. [22]

As an anti-inflammatory agent, carnosic acid and carnosol decrease the expression of pro-inflammatory cytokines, thereby reducing the erythema, edema, and discomfort associated with inflammatory skin conditions. In humans, principal mediators of chronic inflammation include pro-inflammatory cytokines such as interleukins (ILs) and tumor necrosis factor-α (TNF-α), as well as chemokines, prostaglandin E2 (PGE2), and nitric oxide (NO). Carnosic acid inhibits the release of NO, TNF-α, and PGE2 from cells. Carnosol reduces lipopolysaccharide (LPS)-stimulated NO production and inhibits nuclear factor kappa B (NF-κB), a transcription factor that regulates pro-inflammatory gene expression. Other signaling pathways modulated by rosemary constituents include inhibition of the mitogen-activated protein kinase (MAPK) pathway, activation of silent information regulator 1 (SIRT1) which suppresses pro-inflammatory cytokine production and protects cells from oxidative stress via upregulation of antioxidant enzymes, activation of the

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nuclear factor erythroid 2-related factor 2 (Nrf2) pathway leading to antioxidant gene expression, and suppression of the NOD-like receptor family pyrin domain containing 3 (NLRP3) inflammasome involved in inflammatory signaling.[23,24]

As an anti-androgenic agent, 12-methoxycarnosic acid can inhibit dihydrotestosterone (DHT) binding to the androgen receptor and potently inhibit 5α-reductase, actions that are associated with enhanced hair growth. [23,25]

As an antifungal agent, rosemary inhibits the growth of several fungal and yeast species, including Candida albicans, Aspergillus flavus, Aspergillus ochraceus, Microsporum canis, Trichophyton mentagrophytes, Trichophyton rubrum, Epidermophyton floccosum, and Microsporum gypseum. Rosemary extracts have been found to alter hyphal morphology in dermatophytes. Additionally, rosemary may inhibit activation of the aryl hydrocarbon receptor (AhR), a mechanism implicated in antifungal effects against Malassezia furfur. Carnosic acid and carnosol are the constituents most commonly implicated in these antifungal activities. [26,27]

As a photoprotective agent, the scavenging of reactive oxygen species and inhibition of lipid peroxidation protect hair from UVB-induced oxidative damage. UVB exposure has been shown to alter hair size, length, and follicle diameter, ultimately contributing to hair loss. [28]

As a vasodilator, increased blood circulation to the hair follicle augments the supply of oxygen and essential nutrients to the follicle, thereby contributing to reduced hair loss and enhanced hair growth. Furthermore, the conversion of testosterone to DHT is favored in hypoxic environments; therefore, increased oxygenation may reduce local DHT levels. The vasodilatory effect is mediated in part by vascular endothelial growth factor (VEGF), an angiogenic mediator that promotes new blood vessel formation and increases local blood flow. Rosemary constituents such as 1,8-cineole, α-pinene, and camphor have been reported to increase cutaneous VEGF levels. [28]

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Effectiveness of Rosmarinus officinalis in Androgenetic Alopecia

Currently, research has been conducted to explore the potential of rosemary extract in the management of androgenetic alopecia. A study by Murata et al. in 2013 utilizing a testosterone-induced alopecia mouse model evaluated topical administration of rosemary extract. The treated mice exhibited significant hair growth promotion on day 16 compared to the control group. Topical rosemary extract demonstrated potent inhibition of 5α-reductase enzyme activity, achieving inhibition rates of 82.4% and 94.6% at concentrations of 200 mg/mL and 500 mg/mL, respectively. Furthermore, in vitro investigation on human prostate cells revealed that rosemary extract suppressed androgen-dependent cell proliferation by up to 64.5% at a concentration of 5 μg/mL, suggesting a direct inhibitory effect on dihydrotestosterone (DHT) binding to androgen receptors.[29]

Rosmarinus officinalis versus Minoxidil

Minoxidil is the first-line topical therapeutic agent for androgenetic alopecia. Its primary mechanism of action involves vasodilation. Minoxidil also exhibits anti-inflammatory and anti-androgenic properties, evidenced by downregulation of type II 5α-reductase gene expression. The commonly used formulations are 2% and 5% solutions. Adverse effects include scalp pruritus, xerosis, cutaneous irritation, and hypertrichosis.[30]

A single-blind randomized controlled trial (RCT) by Panahi et al. in 2015 aimed to compare clinical outcomes between topical rosemary extract and 2% minoxidil in male patients with androgenetic alopecia. A total of 100 male patients aged 18–49 years with androgenetic alopecia were randomly assigned to receive either topical rosemary oil or 2% minoxidil for a duration of six months. Both treatment groups demonstrated significant improvement in hair count at 6 month. No statistically significant difference in hair count was observed between the two groups. However, scalp pruritus was reported significantly more frequently in the minoxidil group compared to the rosemary extract group. The study concluded that topical rosemary extract demonstrates comparable efficacy to 2% minoxidil in the treatment of androgenetic alopecia. Improved treatment

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adherence was noted in the rosemary group, potentially attributable to reduced incidence of scalp pruritus and enhanced patient satisfaction due to decreased hair shedding.[25]

Another experimental study by Al-Ghorafi et al. in 2023 evaluated the hair growth-promoting effects of a combination of rosemary and myrtus extract versus 2% minoxidil in a testosterone-induced androgenetic alopecia model. Male rabbits (6–12 months old) were subjected to dorsal hair removal and subsequently randomized into three groups: Group 1 received testosterone injections alone; Group 2 received testosterone plus topical application of a 2% rosemary and myrtus extract mixture; Group 3 received testosterone plus topical 2% minoxidil. Both treatment groups (Groups 2 and 3) exhibited significant and consistent hair regrowth from day 3 to day 23. In contrast, the control group (Group 1) showed no significant hair regrowth from day 7 to day 23.[31]

Rosmarinus officinalis versus Finasteride

A study that was conducted using mouse models in order to investigate the antiandrogenic effect of *Rosmarinus officinalis* leaf extract in comparison to finasteride and minoxidil, through the inhibition of testosterone 5-alpha-reductase, which has a well-known impact on managing androgenic alopecia. The study revealed that *Rosmarinus officinalis* has a potent inhibitory activity on 5-alpha-reductase of 82.4% and 94.6% at 200 and 500 mg/mL, respectively, in comparison to finasteride at 250 nM, which showed 81.9% inhibition ($P < 0.01$). Subsequently, inhibit the binding of Dihydrotestosterone to androgen receptors. In addition, further investigation revealed 12-methoxycarnosic acid to be the most active inhibitory constituent [25]

CONCLUSION

Androgenetic alopecia presents unique therapeutic challenges due to its genetic predisposition, rendering it largely irreversible with current treatments. Existing pharmacological agents, particularly those targeting androgen dependence, are associated with significant adverse effects that impair patients' quality of life. Therefore, alternative treatments with minimal side

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effects are warranted. Rosemary extract emerges as a promising candidate, exhibiting anti-inflammatory, anti-androgenic, antifungal, ultraviolet-protective, and vasodilatory effects—properties that may counteract the deleterious effects of dihydrotestosterone (DHT) and follicular inflammation in androgenetic alopecia.

REFERENCES

1. Lolli F, Pallotti F, Rossi A, Fortuna MC, Caro G, Lenzi A, et al. Androgenetic alopecia : a review. Endocrine [Internet]. 2017;1–8. Available from: http://dx.doi.org/10.1007/s12020-017-1280-y
2. Kang S, Amagai M, Bruckner AL, Enk AH, Margolis DJ, McMichael AJ, et al. Fitzpatrick's dermatology. 9th ed. Vol. 1. United States: McGraw-Hill Education; 2019.
3. Śliwa K, Synia D, Placek W, Owczarczyk-Saczonek A. The diagnosis and treatment of androgenetic alopecia: a review of the most current management. Forum Dermatologicum. 2023;9(3):99–111.
4. Kaiser M, Abdin R, Gaumond SI, Issa NT, Jimenez JJ. Treatment of Androgenetic Alopecia: Current Guidance and Unmet Needs. Clin Cosmet Investig Dermatol [Internet]. 2023;16:1387. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10239632/
5. Varothai S, Bergfeld WF. Androgenetic alopecia: An evidence-based treatment update. Vol. 15, American Journal of Clinical Dermatology. Springer International Publishing; 2014. p. 217–30.
6. Mella M. Efficacy and Safety of Finasteride Therapy for Androgenetic Alopecia. 2013;146(10):1141–50.
7. Labinas G, Amaral F, de Souza Antunes VM, Jardim M, Bella LM, Oliveira CR. Hair Growth Promoting Effect of Trichoxidil<up>TM</up>: A New Natural Compound for Hair Loss. J Cosmet Dermatological Sci Appl. 2020;10(04):176–90.
8. Bowman CJ, Barlow NJ, Turner KJ, Wallace DG, Foster PMD. Effects of in utero exposure to finasteride on androgen-dependent reproductive development in the male rat. Toxicol Sci.

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2003;74(2):393–406.

9. Gupta AK, Charrette A. The efficacy and safety of 5α-reductase inhibitors in androgenetic alopecia: A network meta-analysis and benefit-risk assessment of finasteride and dutasteride. J Dermatolog Treat. 2014;25(2):156–61.
10. Trüeb RM. Male androgenetic alopecia. Hair Disord Diagnosis Manag. 2021;15–23.
11. Van Zuuren EJ, Fedorowicz Z, Carter B. Evidence-based treatments for female pattern hair loss: A summary of a Cochrane systematic review. Br J Dermatol. 2012;167(5):995–1010.
12. Diba S, Gozali MM, Kurniawati Y. Diagnosis and Management of Female Pattern Hair Loss. Biosci Med J Biomed Transl Res. 2020;4(1):29–47.
13. Peereboom-Wynia JDR, Van der Willigen AH, Van Joost T, Stolz E. The effect of cyproterone acetate on hair roots and hair shaft diameter in androgenetic alopecia in females. Acta Derm Venereol. 1989;69(5):395–8.
14. Paradisi R, Porcu E, Fabbri R, Seracchioli R, Battaglia C, Venturoli S. Un estudio de cohorte prospectivo sobre los efectos y la tolerabilidad de flutamida en pacientes con pérdida de pelo de patrón femenino. Ann Pharmacother. 2011;45(4):469–75.
15. Lucky AW, Piacquadio DJ, Ditre CM, Dunlap F, Kantor I, Pandya AG, et al. A randomized, placebo-controlled trial of 5% and 2% topical minoxidil solutions in the treatment of female pattern hair loss. J Am Acad Dermatol. 2004;50(4):541–53.
16. Valente Duarte De Sousa IC, Tosti A. New investigational drugs for androgenetic alopecia. Expert Opin Investig Drugs. 2013;22(5):573–89.
17. Hugo Perez BS. Ketocazole as an adjunct to finasteride in the treatment of androgenetic alopecia in men. Med Hypotheses. 2004;62(1):112–5.
18. Fischer TW, Slominski A, Tobin DJ, Paus R. Melatonin and the hair follicle. J Pineal Res. 2008;44(1):1–15.
19. Rose PT. The latest innovations in hair transplantation. Facial Plast Surg. 2011;27(4):366–77.
20. Gupta AK, Daigle D. The use of low-level light therapy in the treatment of androgenetic alopecia and female pattern hair loss. J Dermatolog Treat. 2014;25(2):162–3.

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Copyright © International Medical Journal Corp. Ltd. All rights reserved

21. Avram MR, Leonard RT, Epstein ES, Williams JL, Bauman AJ. The current role of laser/light sources in the treatment of male and female pattern hair loss. J Cosmet Laser Ther. 2007;9(1):27–8.
22. Benzie IFF, Watchel-Galor S, editors. Herbal Medicine Biomolecular and Clinical Aspects. 2nd ed. Boca Raton: Taylor & Francis Group; 2011.
23. Sahlabgi A, Lupuliasa D, Stanciu G, Lupșor S, Vlaia LL, Rotariu R, et al. The Development and Comparative Evaluation of Rosemary Hydroalcoholic Macerate-Based Dermatocosmetic Preparations: A Study on Antioxidant, Antimicrobial, and Anti-Inflammatory Properties. Gels [Internet]. 2025;11(3):149. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC11942321/
24. Habtemariam S. Anti-Inflammatory Therapeutic Mechanisms of Natural Products: Insight from Rosemary Diterpenes, Carnosic Acid and Carnosol. Biomed 2023, Vol 11, Page 545 [Internet]. 2023;11(2):545. Available from: https://www.mdpi.com/2227-9059/11/2/545/htm
25. Panahi Y, Taghizadeh M, Marzony ET, Sahebkar A. Rosemary Oil vs Minoxidil 2% for the Treatment of Androgenetic Alopecia: A Randomized Comparative Trial. Skinmed. 2015;13(1).
26. Mikaeili A, Modaresi M, Sozani S, Karimi I. The Antifungal Activities of Rosemary against Trichophyton Tonsurans and Microsporum Canis. Available online www.ijpras.com Int J Pharm Res Allied Sci [Internet]. 2016;5(2):472–83. Available from: http://www.ijpras.com
27. Li Pomi F, Papa V, Borgia F, Vaccaro M, Allegra A, Cicero N, et al. Rosmarinus officinalis and Skin: Antioxidant Activity and Possible Therapeutical Role in Cutaneous Diseases. Vol. 12, Antioxidants. MDPI; 2023.
28. Luziani S, Darwinata AE, Praharsini IGAA, Wijaya VO. Rosmarinus officinalis Essential Oil Increases Hair Length and Follicle Diameter of Ultraviolet B-exposed Mice Through VEGF. Indones Biomed J. 2023;15(4):296–368.
29. Murata K, Noguchi K, Kondo M, Onishi M, Watanabe N, Okamura K, et al. Promotion of hair growth by rosmarinus officinalis leaf extract. Phyther Res [Internet]. 2013;27(2):212–7. Available from:

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https://www.researchgate.net/publication/224770011_Promotion_of_Hair_Growth_by_Rosmarinus_officinalis_Leaf_Extract

30. Chen S, Li L, Ding W, Zhu Y, Zhou N. Androgenetic Alopecia: An Update on Pathogenesis and Pharmacological Treatment. Drug Des Devel Ther [Internet]. 2025;19:7349. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC12380480/
31. Abd M, Al-Ghorafi H, Alburyhi MM. EFFECT OF ROSEMARY AND MYRTUS EXTRACTS COMBINATION ON ANDROGENETIC ALOPECIA: A COMPARATIVE STUDY WITH MINOXIDIL" [Internet]. Vol. 10, European Journal of Pharmaceutical and Medical Research www.ejpmr.com ⎮. 2023. Available from: http://www.ejpmr.com

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