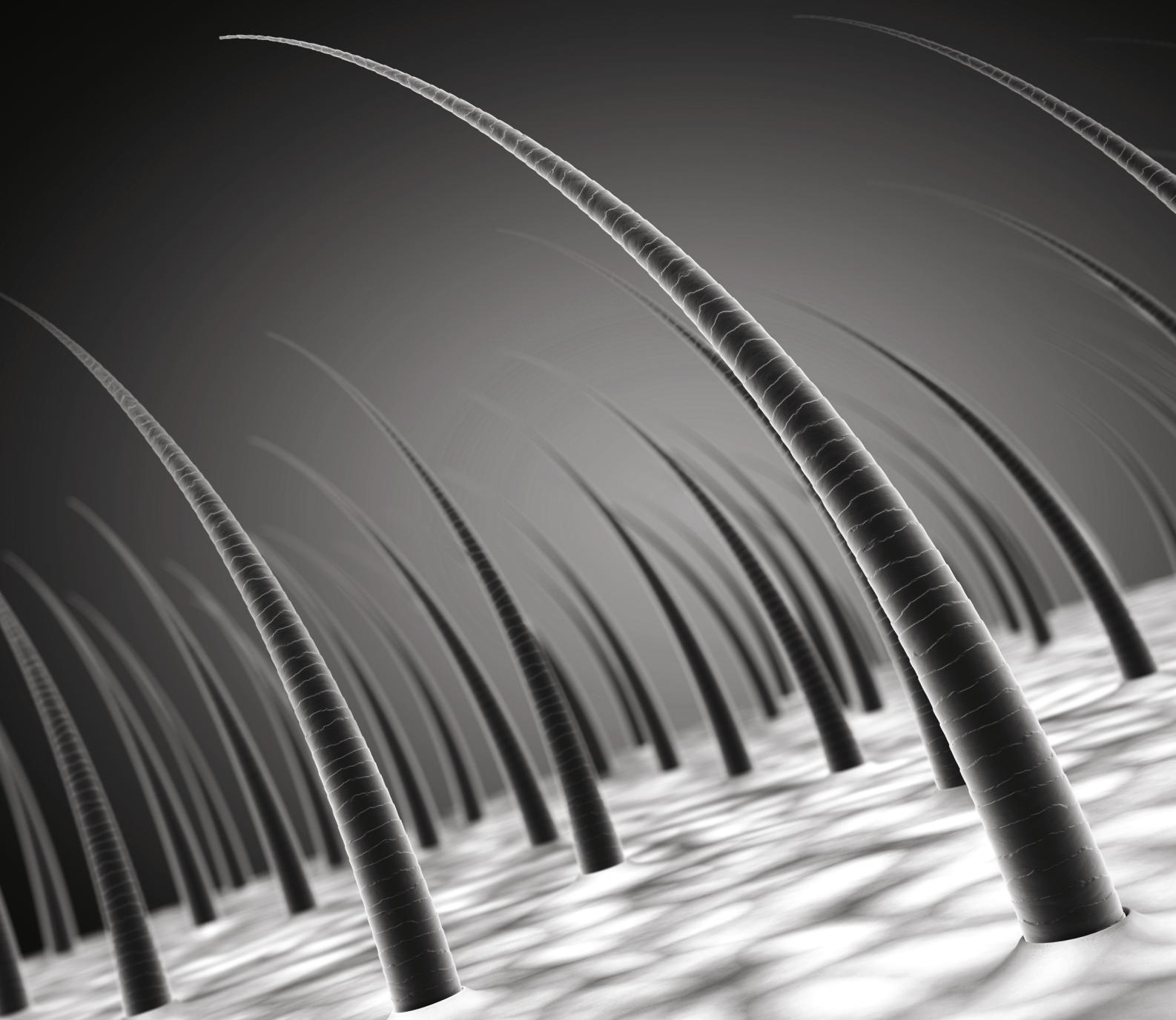


ISSUE 2, 2019

Cipla

Journal of

# Trichology



Cipla

For Androgenic Alopecia in Males

# Tugain Men

Minoxidil 5% & Finasteride 0.1% solution

— Designed For Men —



# Preface

*“Journal of Trichology” is an endeavor to provide a comprehensive discussion on trichology. Each issue includes review articles, conference highlights and therapy update to provide in-depth information pertinent to the clinical assessment, dermatopathology, and current practices in the management of hair and scalp disorders. The premise is to foster deeper and critical coverage of the subject and to present it as a consummately practical tool for specialists striving to achieve high-quality patient care. Each issue aspires to disseminate impartial and evidence-based information collected and compiled by distinguished practicing doctors from their clinical experience. It is anticipated that the readers will find the present issue as an indispensable addition to their clinical library!*

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# Delineating current therapeutic strategies in female pattern hair loss

## Female pattern hair loss: A prelude

Female pattern hair loss (FPHL) is a common condition leading to non-scarring alopecia in women. It is a chronic, progressive condition characterized by diffuse reduction in hair density over the crown and frontal scalp with retention of the frontal hairline. The prevalence of FPHL increases with advancing age and <45% women attain old age with a full scalp of hair. Its incidence is reported to be 12% in women around 30 years of age while it is estimated to increase upto 30-40% in women who are 60-69 years old. FPHL is associated with significant psychological and social morbidity.<sup>1,2</sup>

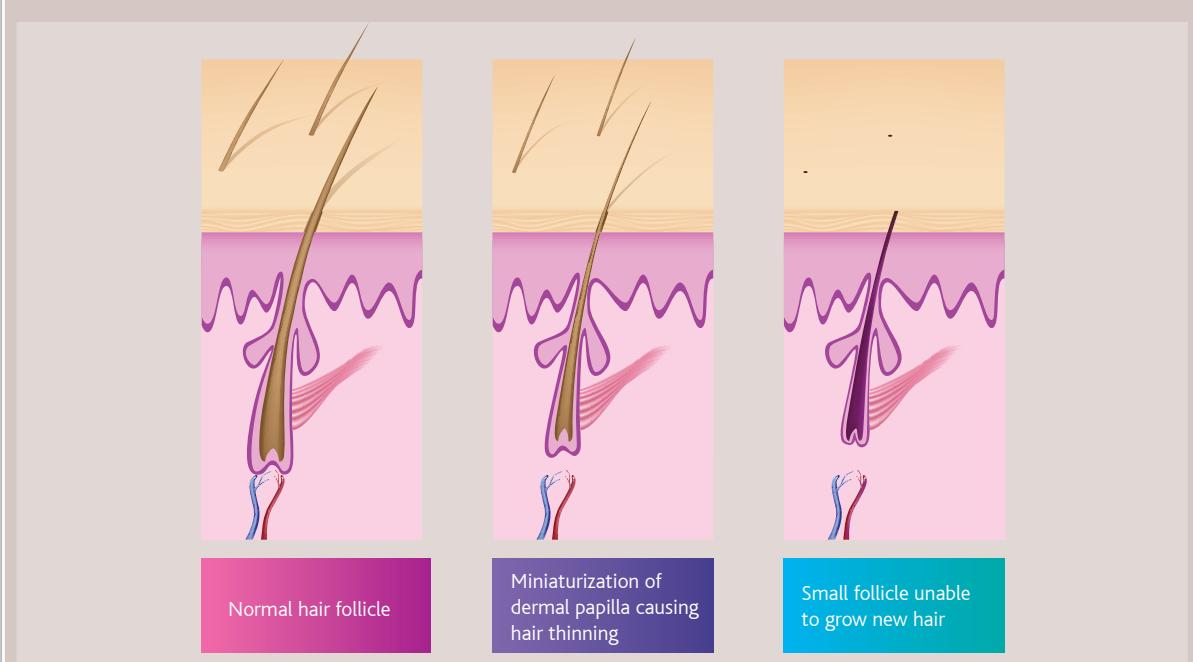
The pathophysiology of FPHL is still not completely understood and appears to be multifactorial. A variety of genetic, hormonal and environmental factors are possibly involved. The anagen phase of hair growth cycle is shortened and dermal papilla is miniaturized, leading to thinning of hair. Hence, there is gradual replacement of thick pigmented hairs with miniaturized hairs (Figure 1). In addition, it is marked by prolongation

of the time between end of telogen phase and beginning of new anagen phase. A gradual decrease in capillary density in the affected areas is further noted. Although androgens have been implicated, the involvement of androgen-independent mechanisms is evident from frequent lack of clinical markers of hyperandrogenism in women with FPHL. Furthermore, genetic polymorphisms involving the androgen and estrogen receptors are being increasingly recognized in its causation and predicting treatment response to anti-androgens.<sup>3</sup>

## Diagnosis and management of female pattern hair loss

Careful clinical evaluation may aid in the diagnosis of FPHL. The characteristic clinical feature of the condition is the pattern of hair loss. Diffuse thinning is observed over the mid-frontal scalp with relative sparing of the anterior hairline. The thinning can be best seen when hair is parted in the midline with the exposed scalp resembling a Christmas tree. Scalp examination reveals reduced hair density over the frontal scalp area; however, in some cases, global reduction in hair

**Figure 1** Mechanisms involved in female pattern hair loss



Adapted from: Ramos PM, Miot HA. Female Pattern Hair Loss: a clinical and pathophysiological review. *An Bras Dermatol.* 2015;90(4):529–543.

**Table 1** Diagnostic methods to evaluate hair loss

Category	Method
Non-invasive	Questionnaire, daily and 60-s hair counts, standardized and modified wash test, global photographs, dermoscopy, phototrichogram, Trichoscan, polarizing and surface electron microscopy
Semi-invasive	Trichogram and unit area trichogram
Invasive	Scalp biopsy

**Adapted from:** Singal A, Sonthalia S, Verma P. Female pattern hair loss. *Indian J Dermatol Venereol Leprol.* 2013;79:626-40.

density all over the scalp is also reported.<sup>1</sup> A history regarding menstruation, chronic diseases, nutritional deficiencies, metabolic and endocrine perturbations, and recent surgical and medical treatments may also be beneficial. Additionally, different types of evaluation methods may aid in determining the severity of hair loss, distinguish FPHL from other conditions and guide treatment approaches (Table 1).<sup>4</sup>

### Pharmacotherapies in the management of female pattern hair loss

Pharmacological treatment options available for the management of FPHL may be topical and oral. Additionally, they may have androgen-independent and androgen-dependent mechanisms of action (Table 2).<sup>4</sup>

Topical minoxidil is the only androgen-independent medication approved by the Food and Drug Administration (FDA) to treat FPHL; hence, it appears to be a first-line therapeutic option.<sup>2</sup> The exact mechanism of action of minoxidil remains elusive; however, it is thought to augment angiogenesis around the hair follicle by increasing expression of vascular endothelial and hepatocytic growth factors; thereby promoting hair growth. Additionally, it has been suggested that minoxidil prolongs the anagen phase by terminating the telogen phase prematurely. The use of minoxidil has been shown to result in increased hair count and weight.<sup>1,2</sup>

A multicenter 32-week trial<sup>5</sup> conducted in 256 women with FPHL revealed that the number of non-vellus hairs in a 1 cm<sup>2</sup> evaluation site was increased by an average of 23 hairs with minoxidil (2%) versus 11 hairs with placebo. Overall moderate hair growth was reported to be significantly higher in patients treated with minoxidil than placebo (13% vs. 6%). Likewise, minimal hair growth was reported in 50% patients treated with minoxidil as compared to 33% patients receiving placebo (Figure 2). Furthermore,

**Topical minoxidil is the only androgen-independent medication approved by the Food and Drug Administration to treat female pattern hair loss; hence, it appears to be a first-line therapeutic option**

minoxidil was well-tolerated with no incidence of serious medical adverse effects. Similar results were obtained in other placebo-controlled trials conducted in women with FPHL wherein 2% minoxidil was shown to be associated with significantly higher increase in hair growth rate than placebo.<sup>6,7</sup>

Likewise, androgen-dependent pharmacological options such as finasteride have been found to be effective in arresting hair loss in FPHL. It acts as an inhibitor of 5 $\alpha$ -reductase type II enzyme which suppresses systemic as well as hair follicular androgen activity by inhibiting conversion of testosterone to its more active form 5-dihydrotestosterone. These agents are generally well-tolerated in patients with FPHL.<sup>1</sup>

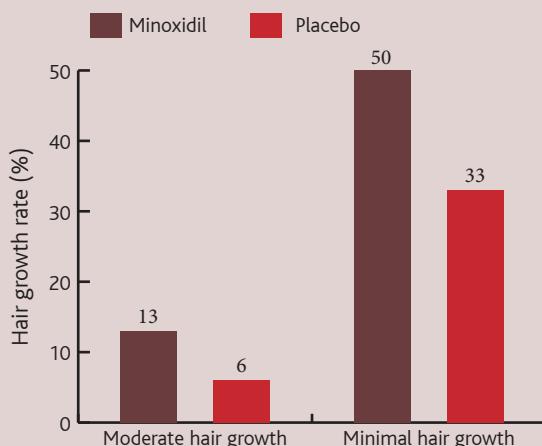
Other androgen-dependent medications that have been found to be effective in FPHL include cyproterone acetate, spironolactone and flutamide.<sup>1</sup> A study<sup>8</sup> conducted in 25 subjects aged between 31 and 35 years with FPHL showed that cyproterone acetate used for 6-9 months caused noticeable reduction in hair loss and hair thinning. Likewise, Sinclair and colleagues<sup>9</sup> reported spironolactone

**Table 2** Mechanisms responsible for the beneficial effects of minoxidil and finasteride

Agent	Mechanisms
Minoxidil	<ul style="list-style-type: none"> <li>Augments angiogenesis around the hair follicle by increasing expression of vascular endothelial and hepatocytic growth factors</li> <li>Prolongs anagen phase by terminating telogen phase prematurely</li> <li>Results in increased hair count and weight</li> </ul>
Finasteride	<ul style="list-style-type: none"> <li>Suppresses systemic as well as hair follicular androgen activity by inhibiting conversion of testosterone to 5-dihydrotestosterone</li> </ul>

**Adapted from:** 1. Dinh QQ, Sinclair R. Female pattern hair loss: Current treatment concepts. *Clin Interv Aging.* 2007;2(2):189-199.  
2. Herskovitz I, Tosti A. Female Pattern Hair Loss. *Int J Endocrinol Metab.* 2013;11(4):e9860.

**Figure 2** Hair growth rates in patients with female pattern hair loss following treatment with minoxidil versus placebo



**Adapted from:** DeVillez RL, Jacobs JP, Szpunar CA, Warner ML. Androgenetic alopecia in the female. Treatment with 2% topical minoxidil solution. *Arch Dermatol.* 1994;130(3):303-7.

200 mg/day to be as efficacious as cyproterone acetate in either restoring hair growth or preventing further progression of hair loss in women with FPHL. similarly, 1 year of treatment with flutamide has also been shown to cause satisfactory results in improving alopecia in hyperandrogenic females.<sup>10</sup> However, androgen-dependent medications may cause abnormalities of the external genitalia of a male fetus. Thus, they are contraindicated during pregnancy, and oral contraceptives are often prescribed along with these drugs.<sup>1</sup>

### Other treatment options

Apart from drug treatments, several other alternative therapies are being currently used in patients with FPHL. Camouflaging products such as hair building fibers, scalp spray thickeners, alopecia masking lotion and topical shading are effective in covering exposed areas on scalp and adding volume to hair. Another treatment option in FPHL is hair transplantation indicated in women having high hair density in the donor site over the occipital scalp and extensive thinning of the frontal scalp. The procedure is carried out in a number of sessions depending on degree of hair loss and availability of donor sites.<sup>1</sup> Likewise, laser therapy is also considered to be effective and safe in FPHL as it promotes graft survival, facilitates healing process after hair transplant surgery, increases anagen hairs and reduces inflammation associated with androgenetic alopecia.<sup>11</sup> More recently, the clinical utility of platelet-rich plasma is also being explored

Detailed history, physical examination and clinical evaluation methods may aid in the diagnosis of female pattern hair loss. Pharmacological therapeutic options comprising of androgen-independent and -dependent medications are widely used in its management

as a treatment option in FPHL due to its positive therapeutic effects.<sup>12,13</sup>

### Summary points

- Female pattern hair loss is the commonest cause of hair loss in women and its prevalence increases with advancing age
- Women with FPHL may experience psychological distress and impaired social functioning
- Detailed history, physical examination and clinical evaluation methods may aid in the diagnosis of FPHL
- Pharmacological therapeutic options comprising of androgen-independent and -dependent medications are widely used to manage FPHL
- Agents such as minoxidil and finasteride have been shown to be effective in treating FPHL in both pre- and post-menopausal women.

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# Nutritional deficiencies and hair loss: A close association

## Overview

Nutritional inadequacy appears to be an important factor contributing to hair loss.<sup>1</sup> Potential association between nutritional deficiencies and different hair loss conditions such as telogen effluvium, diffuse alopecia, androgenetic alopecia, female pattern hair loss and alopecia areata have been reported.<sup>2</sup> Rasheed *et al*<sup>3</sup> demonstrated low concentration of vitamin D2 in serum of women aged 18-45 years with prolonged or telogenetic hair loss. Furthermore, Trüb RM<sup>4</sup> in his study showed that biotin deficiency was found in 38% of women complaining of hair loss. Of those, 24% had diffuse telogen effluvium in trichograms, 35% had evidence of associated seborrheic-like dermatitis. About 11% of patients with biotin deficiency were found to have a positive personal history of risk factors for biotin deficiency. Thus, patients presenting with hair loss should be screened by medical history, dietary history and physical examination to assess risk factors for nutrient deficiency.

The negative effects arising from the deficiency of various nutritional elements along with the underlying mechanisms and benefits or adverse effects associated with supplementation have been discussed in the following section.<sup>5</sup>

## Iron

Evidence suggests that there is an association between iron deficiency and hair loss seen in alopecia areata, androgenetic alopecia, and telogen effluvium.<sup>6</sup> Kantor *et al*<sup>7</sup> evaluated 106 women with alopecia and reported significantly lower mean ferritin levels in patients with androgenetic alopecia and alopecia areata as compared to women without hair loss (Figure 1). Similar results were obtained in another study<sup>8</sup> wherein mean serum ferritin levels were significantly reduced in patients with diffuse telogen hair loss than those without the condition ( $16.3 \pm 12.6$  vs.  $60.3 \pm 50.1$  ng/mL,  $p < 0.0001$ ).

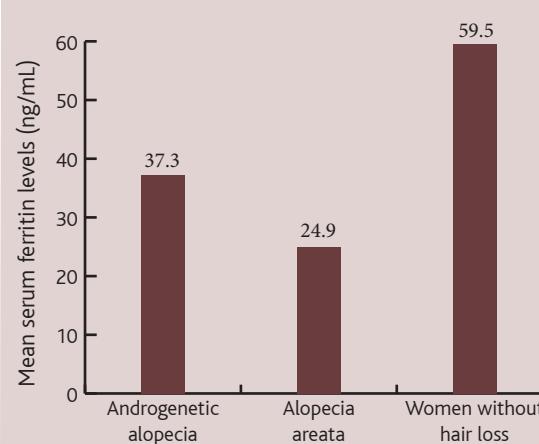
The exact mechanism of action by which iron affects hair growth is not known; however, iron is considered to be an important component in division and differentiation of hair follicle matrix cells which leads to hair production. Besides, iron's role as a cofactor for ribonucleotide reductase, the rate-limiting enzyme for DNA synthesis, suggests that its deficiency may contribute to hair loss.<sup>9</sup>

As hair follicle cells require a good nutritional supply for normal metabolism, deficiency of several macro- and micronutrients in diet can promote hair loss

## Micronutrients

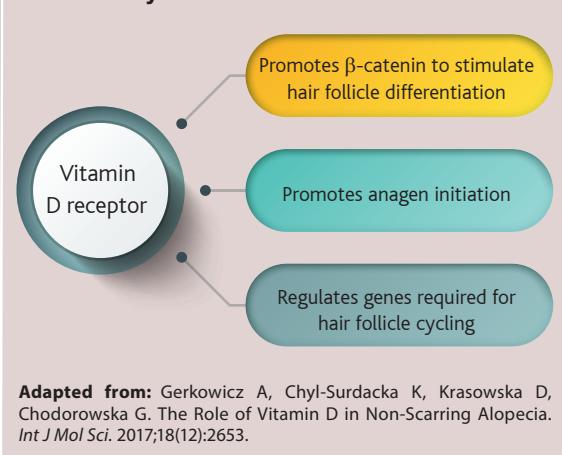
Vitamins play a significant role in the hair growth and development cycle. An optimal concentration of vitamin D is considered necessary to prevent hair loss. It has been shown that vitamin D receptor (VDR) promotes the ability of  $\beta$ -catenin to stimulate hair follicle differentiation. VDR activation plays an important role in the hair follicle cycle, specifically anagen initiation. Furthermore, recent data suggested that VDR regulates directly or indirectly the expression of genes required for hair follicle cycling, including the hedgehog signaling pathway (Figure 2). Alterations in serum 25(OH)D levels in patients with different types of non-scarring alopecia such as alopecia areata, female pattern hair loss and telogen effluvium have been reported, thereby suggesting that vitamin D

**Figure 1** Low serum ferritin levels in patients with androgenetic alopecia and alopecia areata



Adapted from: Kantor J, Kessler LJ, Brooks DG, Cotsarelis G. Decreased serum ferritin is associated with alopecia in women. *J Invest Dermatol.* 2003;121(5):985-8.

**Figure 2** Role of vitamin D receptor in hair cycle



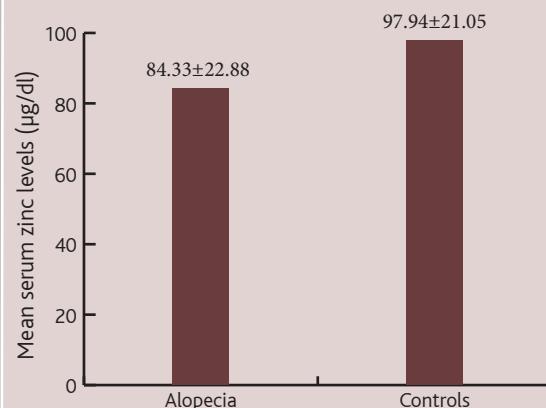
supplementation may be a potential therapeutic option in these patients.<sup>10</sup>

Other vitamins such as niacin, vitamin B5, vitamin B12 and folic acid play a key role in maintaining healthy hair by rebuilding hair follicle cells, adding moisture and exerting anti-inflammatory properties. Therefore, it is essential to include adequate amounts of these vitamins in diet so as to promote hair growth and development.<sup>9</sup>

Likewise, hair loss is also a symptom of biotin deficiency. Although biotin deficiency is a rare disorder, decreased levels of the compound are reported in people with biotinidase or carboxylase deficiency, and with antibiotic or antiepileptic overuse. Despite limited data on the value of oral biotin for treatment of hair loss that is not due to an inborn error of biotin metabolism or deficiency, it is a popular nutritional supplement given for treating hair loss.<sup>5</sup>

Vitamins such as niacin, vitamin B5, vitamin B12 and folic acid play a key role in maintaining healthy hair by rebuilding hair follicle cells, adding moisture and exerting anti-inflammatory properties. Therefore, it is essential to include adequate amounts of these vitamins in diet so as to promote hair growth and development

**Figure 3** Mean serum zinc levels in patients with alopecia as compared to controls



**Adapted from:** Kil MS, Kim CW, Kim SS. Analysis of Serum Zinc and Copper Concentrations in Hair Loss. *Ann Dermatol.* 2013;25(4):405–409.

As oxidative stress has been associated with hair loss, antioxidants are considered to play a beneficial role in its prevention. Antioxidants such as vitamin C, vitamin E, green tea and flavonoids are thought to promote hair growth and prevent the follicle from shrinking by lengthening the anagen phase.<sup>5,9</sup>

Zinc is considered to be another essential element that influences hair follicles and hair growth. It is responsible for inhibiting hair follicle regression and accelerating hair follicle recovery. It is an essential component of numerous metalloenzymes involved in protein synthesis and cell division that may potentiate hair growth. Furthermore, it acts as a catagen inhibitor and regulates hair growth via the hedgehog signaling pathway. Zinc deficiency has been reported in patients with alopecia areata, telogen effluvium and male and female pattern hair loss. Mean serum zinc levels were reported to be significantly lower in patients with all types of hair loss as compared to controls ( $84.33\pm22.88$  vs.  $97.94\pm21.05$   $\mu\text{g}/\text{dl}$ ,  $p=0.002$ ) (Figure 3).<sup>11</sup> Oral supplementation with zinc has been shown to arrest hair loss in patients with telogen effluvium and zinc deficiency.<sup>12</sup> Similar results were obtained in another case wherein oral zinc therapy caused improvement in hair loss in a patient with dry brittle hair, alopecia and zinc deficiency.<sup>13</sup>

Additionally, other minerals which are considered to influence hair growth, shine and strength are copper, selenium, silicon, magnesium and calcium.<sup>9</sup>

## Macronutrients

### Proteins and amino acids

Protein malnutrition can result in hair changes such as fragility, brittleness and weakness, thereby resulting in thinning and loss of hair. In addition, sulphur-containing amino acids such as cysteine and methionine act as precursors in keratin synthesis which is an essential component in the development of hair and maintaining its elasticity, shine and continuity. Deficiency of these amino acids may reduce the production of keratin and result in hair breakage or loss. Furthermore, cysteine is also responsible for enhancing hair diameter and growth.<sup>9</sup>

Another essential amino acid playing a major role in the hair cycle is L-lysine. It is responsible for giving shape and adding volume to hair. Deficient levels of L-lysine may contribute to hair thinning and brittleness. Additionally, L-lysine may play a significant role in iron and zinc uptake (Table 1).<sup>9</sup> Addition of L-lysine to iron supplementation resulted in a significant increase in mean serum ferritin concentration in some women with chronic telogen effluvium who failed to respond to iron supplementation alone.<sup>14,15</sup>

### Fatty acids

Fats may also participate in maintaining the hair growth cycle. Deficiency of lipid complexes such as fatty acids may contribute to decreased hydration in hair or even hair loss due to improper state of hair bulbs. Decreased levels of polyunsaturated fatty acids and linoleic/linolenic acid in diet cause loss of scalp hair.<sup>9</sup> Unsaturated fatty acids may modulate androgen inhibition of 5α-reductase, similar to the drug finasteride, thereby potentiating benefits in hair loss.<sup>16</sup> Furthermore, arachidonic acid, an omega-6 fatty acid, have been shown to promote hair growth by enhancing follicle proliferation.<sup>17</sup>

Thus, it is evident that nutrient deficiencies are prevalent in hair loss conditions. However, further research on the role of supplementation is warranted.

**Deficiency of several macro- and micronutrients, such as proteins, minerals, essential fatty acids, and vitamins, can lead to hair loss. Correction of nutritional deficiencies is warranted so as to improve hair structure and growth**

**Table 1 Benefits of amino acids in hair cycle regulation**

Amino acid	Beneficial effect
Cysteine	<ul style="list-style-type: none"><li>• Keratin precursor</li><li>• Enhances hair diameter and growth</li></ul>
Methionine	<ul style="list-style-type: none"><li>• Keratin precursor</li></ul>
L-lysine	<ul style="list-style-type: none"><li>• Gives shape and adds volume to hair</li><li>• Role in iron and zinc uptake</li></ul>

**Adapted from:** Goluch-Koniuszy ZS. Nutrition of women with hair loss problem during the period of menopause. *Prz Menopauzalny*. 2016;15(1):56–61.

### Summary points

- A caloric deprivation or deficiency of several macro- and micronutrients, such as proteins, minerals, essential fatty acids, and vitamins, can lead to hair loss
- Telogen effluvium and alopecia areata have been associated with lower iron, zinc and vitamin D levels
- Androgenetic alopecia has been associated with lower iron and vitamin D levels
- If detected, correction of these nutritional deficiencies is warranted so as to improve hair structure and growth.

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# An update on the classification methods of pattern hair loss

## Overview

Depending on extent and severity, there are several stages of hair loss between the phases of early frontotemporal recession and later residual occipital band. Based on such evolutionary stages of hair loss, researchers proposed a range of classification systems for patterned hair loss in both males and females.<sup>1</sup>

## Classification systems in males

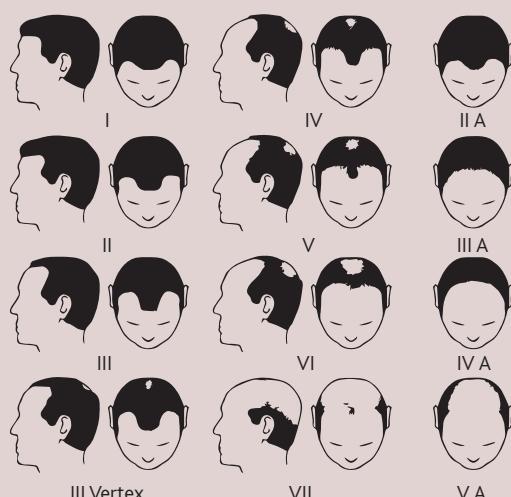
### Hamilton-Norwood's classification

The Hamilton-Norwood classification system is one of the most detailed and widely accepted hair loss classification system in males and includes 12 different categories (Figure 1). However, this system failed to include peculiar types of hair loss and considerable overlap in types IV, V and VI with 'a' variants further complicating the classification system.<sup>1,2</sup>

### Koo's classification

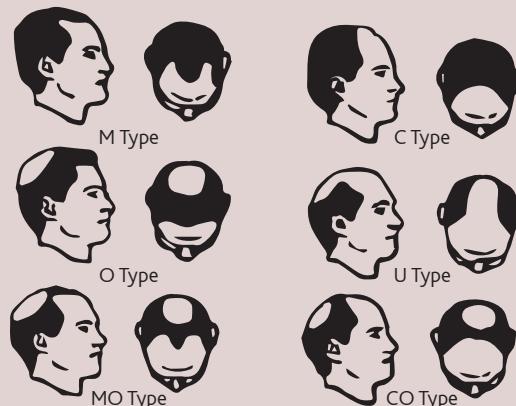
Koo et al<sup>3</sup> developed a system in which they classified male pattern alopecia into six types based on the English alphabetical letter shape of the hair loss area (Figure 2). This classification system is advantageous

**Figure 1** Stages of Hamilton-Norwood's classification system



**Adapted from:** 1. Gupta M, Mysore V. Classifications of Patterned Hair Loss: A Review. *J Cutan Aesthet Surg.* 2016;9(1):3-12. 2. Wirya CT, Wu W, Wu K. Classification of Male-pattern Hair Loss. *Int J Trichology.* 2017;9(3):95-100.

**Figure 2** Koo's classification of male pattern hair loss



**Adapted from:** Koo SH, Chung HS, Yoon ES, Park SH. A new classification of male pattern baldness and a clinical study of the anterior hairline. *Aesthetic Plast Surg.* 2000;24(1):46-51.

as it is simpler, easy to apply, does not require complex measurements, and is useful in planning surgery.<sup>1</sup>

## Classification systems in females

### Ludwig's classification

Ludwig classified female pattern hair loss into the following three grades of severity:

**Grade I:** Perceptible thinning of hair from the anterior part of the crown which is limited in the front by a line situated 1-3 cm behind the frontal hairline.

**Grade II:** Pronounced rarefaction of the hair on the crown within the area seen in Grade I.

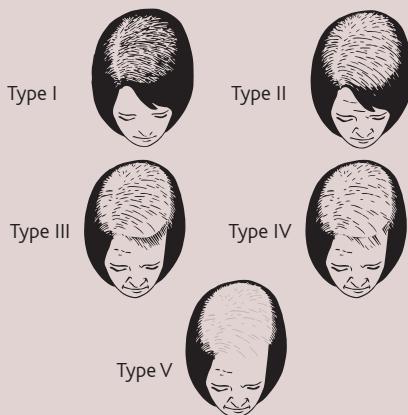
**Grade III:** Full baldness or total denudation within the area seen in Grades I and II (Figure 3).<sup>4</sup>

**Figure 3** Categories of Ludwig's classification system



**Adapted from:** Ludwig E. Classification of the types of androgenetic alopecia (common baldness) occurring in the female sex. *Br J Dermatol.* 1977;97(3):247-54.

**Figure 4 Ebling and Rook's classification**



**Adapted from:** Gupta M, Mysore V. Classifications of Patterned Hair Loss: A Review. *J Cutan Aesthet Surg.* 2016;9(1):3–12.

### Ebling and Rook's classification

It is a 5-stage classification system for female pattern hair loss. The first two stages are similar to the Ludwig system. In type III, there is additional loss of hair from the frontotemporal hair line. Type IV is characterized by continuation of this diffuse loss and frontotemporal recession while Type V is marked by complete loss of hair on top of the scalp similar to baldness in males (Figure 4).<sup>1</sup>

### Sinclair's classification

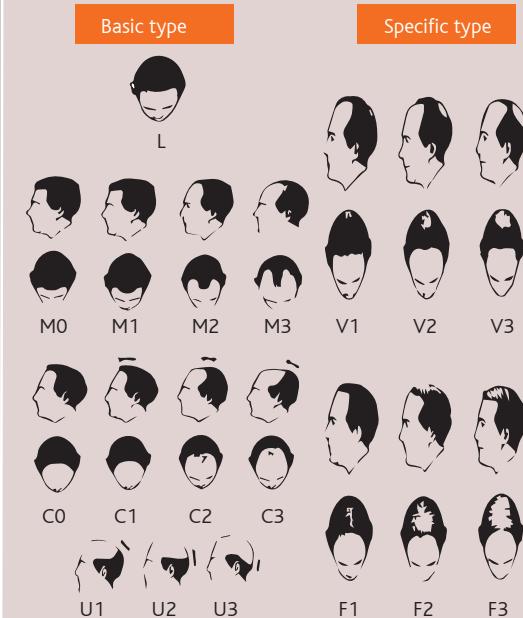
It is a self-reporting photographic measure to assess female pattern hair loss based on patients' perception regarding the severity of their hair loss. There are 5 colored photographs of women's scalps with central hair parting and women are required to circle the number of the photograph which they feel most closely resembles the appearance of their own hair when parted in a similar manner. In stages 1 and 2, there is hair shedding accompanied with a reduction in volume while in stages 3, 4 and 5, there is shedding along with widening of the central part.<sup>1</sup>

### Other classification systems

#### Bouhanna's classification

It is a multifactorial classification for both male and female pattern hair loss based on parameters such as extension of bald and hair-bearing areas, elasticity, density of scalp, and hair characteristics such as diameter, length, shape and color. This system proved effective in assessing changes in hair parameters while receiving medical therapy and determining indications of surgical therapy.<sup>1,5</sup>

**Figure 5 Basic and specific classification**



**Adapted from:** Lee WS, Ro BI, Hong SP, et al. A new classification of pattern hair loss that is universal for men and women: basic and specific (BASP) classification. *J Am Acad Dermatol.* 2007;57(1):37–46.

### Basic and specific classification

This system was developed on the basis of observed patterns of hair loss including the shape of the anterior hairline and density of hair on the frontal and vertex areas. This classification system is considered to be easy to learn and apply in routine clinical practice. In addition, it is comprehensive, systematic and can be used irrespective of gender (Figure 5).<sup>6</sup> However, further classification systems are warranted so as to ensure better monitoring and treatment planning.

### Summary points

- Numerous hair loss classification systems are available
- The classification system should be chosen according to convenience and requirement.

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# American Hair Research Summit, 2018

May 14-16, 2018, Orlando, FL, USA

## Minoxidil-mediated activation of K<sub>ATP</sub> channel as a novel therapeutic target for the management of androgenetic alopecia

Takada H, Furuya K, Osada Y, et al.

Topical minoxidil is widely used for the treatment of androgenetic alopecia (AGA). Minoxidil appears to increase the ATP-mediated production of intracellular Ca<sup>2+</sup> and vascular endothelial growth factor which are essential for maintaining human growth; however, the mechanisms involved in human dermal papilla cells (HDPCs) remain elusive. With an objective to determine the cellular response on ATP release and on the level of K<sup>+</sup> channel gating in HDPCs with the addition of an ATP-sensitive K<sup>+</sup> (K<sub>ATP</sub>) channel opener minoxidil sulfate and a K<sub>ATP</sub> channel blocker, U-37883A, a study was conducted. Bioluminescence real-time imaging, fluorescence based assays and fluorescence microscopy were employed for detection of ATP release, opening of K<sup>+</sup> channels and Ca<sup>2+</sup> influx, respectively. Results demonstrated that minoxidil sulfate induced continuous and slow extracellular ATP release. In addition, minoxidil sulfate stimulated K<sup>+</sup> channel opening; however, this process was prevented in the presence of U-37883A (10 µM), the K<sub>ATP</sub> channel blocker.

Minoxidil-mediated K<sub>ATP</sub> channel activation may emerge as an effective therapeutic target in the management of androgenetic alopecia

Thus, the study findings revealed K<sub>ATP</sub> channel responses to be involved in minoxidil sulfate-induced HDPCs. K<sub>ATP</sub> channel opening by minoxidil sulfate is responsible for its therapeutic potency in hair growth. Hence, amplification of signaling via K<sub>ATP</sub> channel activation may emerge as an effective therapeutic target in the management of AGA.

## Effectiveness of platelet-rich plasma in the management of scarring and non-scarring alopecia

Mesinkovska N.

Platelet-rich plasma (PRP) appears to be an elixir for treating various skin disorders, including alopecia. A wide plethora of evidence suggests the positive effects of PRP in hair loss. However, it is thought to have a limited potential in scarring alopecias. In this context, a study was conducted in patients with non-scarring and scarring alopecia to determine hair growth by assessing hair follicle density and diameter at various locations on scalp using optical coherence tomography (OCT) imaging at baseline and after PRP procedure.

Platelet-rich plasma technique appears to be beneficial in treating both scarring and non-scarring alopecias, and it causes marked improvement in hair follicle count, hair shaft diameter and reduction of inflammation

A total of 30 patients with non-scarring (n=20) and scarring (n=10) alopecia were administered 3 standardized PRP injection treatments at an interval of 4 weeks. Non-invasive OCT measurements were used to quantify hair growth at baseline and after 12 weeks of treatment. Results demonstrated significant reduction in inflammatory parameters and hair regrowth after PRP treatment even in certain cases of scarring alopecia along with reduction in symptoms of pruritus and scaling.

Thus, the PRP technique appears to be beneficial in treating both scarring and non-scarring alopecias, and it results in marked improvement in hair follicle count, hair shaft diameter and reduction of inflammation. Furthermore, OCT is found to be an appropriate method for assessing hair regrowth following PRP treatment.

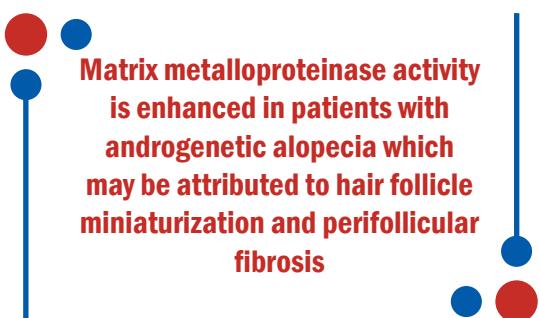
## Increased levels of matrix metalloproteinases in patients with androgenetic alopecia

Endo H, Leung G, McElwee KJ.

Matrix metalloproteinases (MMPs) are associated with degradation of extracellular matrix proteins in skin and hair follicles. Evidence suggests that activity of MMPs may increase in cases of autoimmune disease development and elevated levels are reported in patients with rheumatoid arthritis, multiple sclerosis, and psoriasis. The current study aimed at determining MMP levels in patients with alopecia.

The study participants included 79 patients with alopecia areata (AA), 66 subjects with AGA and 36 individuals as controls with no hair loss (NHL). Results demonstrated a significant increase in mean plasma MMP activity in patients with AGA as compared to controls. Increased activity was reported in both male and female patients with AGA; however, MMP activity was significantly higher in males as compared to females. MMP3 and MMP9 were found to be the predominant MMPs. In contrast, the MMP levels were found to be comparable among AA patients and controls.

In conclusion, MMP activity is enhanced in patients with AGA which may be attributed to hair follicle miniaturization and perifollicular fibrosis; however, elevated activity of plasma MMPs is not obtained in AA although it is considered to be an autoimmune disease.



Matrix metalloproteinase activity is enhanced in patients with androgenetic alopecia which may be attributed to hair follicle miniaturization and perifollicular fibrosis

## Current concepts in the pathogenesis of frontal fibrosing alopecia

Frontal fibrosing alopecia (FFA) is a form of scarring alopecia with an increasing incidence globally. The exact pathogenic mechanisms underlying FFA remain unknown. An array of immune-mediated, genetic, hormonal and environmental factors has been implicated. The mechanisms that have been thought to cause permanent hair follicle damage in FFA include Th1-mediated inflammation with collapse of immune privilege in the hair follicle and bulge epithelial stem cell destruction, peroxisome proliferator-activated receptor gamma (PPAR- $\gamma$ ) depletion and epithelial-mesenchymal transition.

The condition is mostly sporadic; however, several genetic and epigenetic factors are thought to be involved. The onset of FFA is frequent in postmenopausal women. In addition, the condition has a pattern similar to female pattern hair loss and both disorders often coexist. Moreover, patients with FFA are reported to respond well to 5 $\alpha$ -reductase inhibitors, thereby suggesting the role of sex steroid hormones. With the rising incidence, the role of environmental elements such as sun exposure and topical allergens as risk factors of FFA has also been speculated but not proven.

To conclude, many mechanisms have been proposed to explain the pathogenesis of FFA; however, further research is warranted so as to discover effective therapeutic targets for its management.

**Adapted from:** Photiou L, Nixon RL, Tam M, et al. An update of the pathogenesis of frontal fibrosing alopecia: What does the current evidence tell us? *Australas J Dermatol*. 2018.



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