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ORIGINAL ARTICLE

Androgenic Alopecia and its Correlation with Serum Ferritin Level

ZAHRA BABAR[1], AYESHA KIRAN[2], AQSA NAHEED[3], BILQEES FATIMA[4], UROOJ MIRZA[5], AASHI AHMED[6], FARID UR REHMAN[7]
[1]*Consultant Dermatology, THQ Kahuta*
[2]*Consultant Dermatology, CIS Technology Park, Islamabad*
[3]*Asssociate Professor of Dermatology, HITEC-IMS (Heavy Industry Institute of Medical Science) Taxila*
[4]*Senior Registrar, Department of Dermatology, Fauji Foundation Medical University, Rawalpindi*
[5]*Consultant Dermatology, THQ Taxila*
[6]*Associate Professor of Community Medicine, HITEC-IMS (Heavy Industry Institute of Medical Science) Taxila*
[7]*Professor & HOD of Dermatology, Fauji Foundation Medical University, Rawalpindi*
Correspondence to: Dr. Zahra Babar, E-mail: zahra_babar@yahoo.com, Cell: 0306-7366339

ABSTRACT

Background: Serum ferritin is a good indicator of quantifying the risk of hair loss among women. Iron lead to low serum ferritin level; therefore, a low serum ferritin level can precisely point toward iron deficiency.
Objectives: To determine the mean serum ferritin levels in female patients with androgenetic alopecia.
Study Design: Descriptive cross-sectional study
Place and Duration of Study: Department of Dermatology, Fauji Foundation Hospital, Rawalpindi from 2nd October 2018 to 1st April 2019.
Methodology: One hundred female patients with androgenic alopecia of all ages after puberty were included. Patients with scarring and other non-scarring alopecia, who had taken iron, vitamin B12, folic acid or multivitamin supplements, anticoagulants, anti-thyroid drugs, antimitotic drugs and oral contraceptives were excluded. After aseptic measures,5 ml of venous blood was drawn, into sterile and disposable plastic syringes. Serum ferritin was measured by enzyme immunoassay (EIA) test, based on sandwich ELISA.
Results: Mean age was 33.94±6.29 years and 65 (65.0%) of patients ranged from 36 to 50 years. Average duration of disease was 6.25±2.43 months. Mean weight was 58.77±9.17 kg. Mean serum ferritin levels in female patients with androgenetic alopecia was 33.10±42.99ng/ml.
Conclusion: Serum ferritin levels in female patients with androgenetic alopecia are low.
Keywords: Androgenic alopecia, Serum ferritin levels

INTRODUCTION

Hair has no dynamic function in humans yet its aesthetic and psychological importance is immense, as is evident from the concern of a person who is losing hair.[1]In women the loss of hair from scalp is even more distressing than growth of the body or facial hair in excess of the culturally acceptable norms.[1] Androgenetic alopecia (AGA), is tremendously common hair loss seen in both men and women and follow a specific pattern.[2] Androgenetic alopecia is a genetic disorder and occur due to systemic androgen that causes follicular miniaturization. It is gradual in onset and usually noticed in 3rd and 4th decades, but the hair loss starts straight away after puberty and continues thereafter.[3] It adversely affect individual's quality of life by impairing psychological well-being and social connection. By age 50 almost half of all men develop androgenic alopecia, whereas by age 70, 40% of women are affected.[2]

Androgenic alopeciais, common disorders of hair loss in which both environmental and genetic factors are involved. There is gradual thinning of terminal hairs into indeterminate hairs and ultimately to vellus hairs. As a result, patients with androgenetic alopecia have abnormal terminal-to-vellus hair ratio, which is 4:1 in normal individuals. Size of the follicles decreases and finally fibrous streaks are left. Patients with this disorder have a well-defined hair loss pattern.[3]

Active or growing phase of each hair last for 3-5 years and during this time 10-15% of hair are in telogen phase. Hair cycle comprises of three stages of growth and shedding. growing or anagen (86%), transition or catagen (1%) and resting or telogen (13%) phase. Each phase has its own timeline.[4]

Androgenic alopecia is the uniform loss of hair over the scalp without inflammation or scarring. Skin like other organs, also require sufficient proteins and vitamins for healthy growth. Protein energy malnutrition is usually associated with thinning and loss of hair.[5] Similarly, various micronutrients have also been associated withhairloss.[6]

According to Trost and colleagues[8], serum ferritin is a good indicator of quantifying the risk of hair loss among women. Iron deficiency is the primary cause of low serum ferritin concentrations. Ferritin is structurally a highly complex protein and the main iron storage site in non-erythroid cells.[7] Within the cell, smooth endoplasmic reticulum is responsible for the synthesis of ferritin. Usually, level of ferritin in serum is linked to intracellular level of ferritin, so reflects entire body ironstores.[7]

Among nutritional deficiency disorder, iron insufficiency is the most frequently seen, which is reflected in blood complete picture and ferritin levels directly linked with sum of body iron stock. One of the study done in 1963 by Hard, measured serum iron level to document the link between iron deficit as a consequence of which patient experience hair loss.[5] Rushton et al[6] revealed diffuse scalp alopecia in three-quarters of 50 women having ferritin level in blood<40mcg/L.

The overall nutritional status of the people in this part of the world is poor and frequency of overt deficiency of iron is high in overall population, especially in women. This study is proposed to determine mean ferritin levels of female case having androgenetic alopecia. No such study has been done before in our local population. Results of this study will pave the way for further research in this subject.

MATERIALS AND METHODS

After Ethical Approval from Hospital Ethical Committee, this is a descriptive, cross-sectional study done at Department of Dermatology, Fauji Foundation Hospital Rawalpindi from 2nd October 2018 to 1st April 2019 and 100 females with androgenetic alopecia were enrolled. Informed consent was taken and purpose of study was explained to them. Women of all ages were enrolled using non-probability consecutive sampling. Those females having history of scarring or non-scarring alopecia, congenital alopecia, hair shaft disorders, who had taken iron, vitamin B12, folic acid or multivitamin supplements for at least 3 months before inclusion in the study and patients on anticoagulants, anti-thyroid drugs, antimitotic drugs, and oral contraceptives were not included. Patients were evaluated by dermatologist through detailed history and clinical examination.

After aseptic measures5 ml of venous blood was drawn, into sterile and disposable plastic syringes. 2ml was sent in EDTA vial for CBC analysis and serum ferritin was measured by enzyme immunoassay (EIA) test, based on sandwich ELISA. Data was analyzed using computer program SPSS-26. Effect modifiers like age, grades of alopecia, marital status, weight of patient and

duration of hair loss were controlled by stratification and independent 't' test was applied post-stratification and p≤0.05 was considered as significant.

RESULTS

The mean age was 33.94±6.29 years and majority 65 (65.0%) of patients belonged to age 36-50 years. Average duration of disease was 6.25±2.43 months. Fifty three patients were unmarried and 47 were unmarried. Twenty five (25%) had grade I, 59(59%) had grade II and 16(16%) had grade III androgenic alopecia. Mean weight was 58.77±9.17 kg (Table 1). Stratification of serum ferritin levels with respect to age, duration of hair loss and weight of patients of androgenic alopecia (Table 2).

Table 1: Characteristics of patients with androgenic alopecia (n=100)

Variable	No.	%
Age (years)		
20-35	65	65.0
36-50	35	35.0
Mean±SD	33.94±6.29	
Marital status		
Married	47	47.0
Unmarried	53	53.0
Duration of hair loss (months)		
≤ 6	67	67.0
> 6	33	33.0
Mean±SD	6.25±2.43	
Grades		
I	25	25.0
II	59	59.0
III	16	16.0
Weight (kg)		
≤ 60	55	55.0
> 60	45	45.0
Mean±SD	58.77±9.17	

Table 2: Association of androgenic alopecia with independent variables

Variable	Serum ferritin levels	P value
Age (years)		
20-35	36.32±4.99	0.309
36-50	27.11±3.39	
Duration of hair loss (months)		
≤ 6	35.34±5.81	0.460
> 6	28.55±6.85	
Weight (kg)		
≤ 60	31.02±3.30	0.595
> 60	35.64±4.44	

DISCUSSION

In my study, mean serum ferritin levels in female patients suffering from androgenetic alopecia was 33.10±42.99 ng/ml. In a study by Chishti et al[1] showed mean serum ferritin levels were 20.47±17.50 ng/ml in female patients with non-scarring alopecia as compared to 27.87±17.51 ng/ml in controls. Kantor et al[8] also found that patients with alopecia areata and androgenetic alopecia have considerably lower serum ferritin level but not so in telogen effluvium cases.

Park et al[9] found that patients with androgenetic alopecia have considerably lower serum ferritin levels. But in contradiction, to our result Moeinvazir et al[10] showed that patients with telogen effluvium have low serum ferritin level. However, study done in 5110 women by Deloche et al[11] concluded that in pre-menopausal women having low iron store is a risk factor for hair loss. The lower limit<40 µg/L was taken. In contrast to this, Oslen et al[12] showed that low ferritin values not found in cases having hair loss, considering two lower limit values, ferritin level as 15 µg/L and other one 40 µ/L. However, Rushton et al[13] disapproved the study of Olsen et al[12] in that it appears to have concerns and flaws like use of non-standardized estimation in blood sampling and no quantitative hair assessment in control group.

Majority of the studies concentrated on association between different types of non-scarring alopecia and measurement of serum ferritin including androgenetic alopecia, considering value of hair iron level. Rasheed et al[14] showed low serum levels of ferritin in patients having telogen effluvium also in androgenetic alopecia than in controls. They anticipated a proposal, that lower iron stores in body could trigger the progression of various types of hair loss. Instead, in of the case-control study stated no change as far as frequency of androgenetic alopecia patients with decreased iron stores when compared with controls.[15] Sahin et al[16] proposed that hair iron level is a useful parameter, as serum ferritin for estimating long-term iron storage in body.

Aydingoz et al[17] in a case control study showed no significant difference in the prevalence of decreased iron store in diffuse or female pattern alopecia with the total subjects (32.5% vs. 45.6%). Rushton and Ramsay[18] found that treatment result was remarkable in women with androgenetic alopecia having serum ferritin level above 40ng/ml when treated with hormonal therapy.

Besides, iron hair loss in women is also associated with other micronutrients. Bregy and Trueb[19] showed that serum zinc and selenium levels were considerably lower but no substantial difference was found in copper and ferritin in serology of alopecia areata cases.

In a descriptive study by Bregy and Trueb[19], 181women participated. Based on serum ferritin levels, patients were then further split in to 3 groups: first consist of 14 females (<10 µg/l), second consist of 55 females [10-30µg/l], and third consist of 112 females (>30 µg/l) group. Among the first and second groups no marked dissimilarity was found in the resting phase. Moreover, the first group with level slow levels (<10 µg/l) was not enough to support statistically significant conclusion.

A large population based study, Deloche et al[11] studied 5110 female participants and evaluated association between ferritin and haemoglobin levels with the volume of hair loss. In these women, the perception of hair loss was closely associated with low serum ferritin levels. Excessive hair loss was reported in 10.2% and 12.3% of the females having low level of ferritin i.e. <15 µg/l and between 15 and 40 µg/l respectively, in contrast, only few (6.8%) females within normal value of ferritin i.e. >70 µg/L. At the same time, anaemia was found in 19.6%, 3.4% and 1% in females having ferritin value <15 µg/L, 15 to 40 µg/L and more than 70 µg/L respectively. In postmenopausal females, a paralleled rifting was perceived but not closed to statistical significance.

Currently, the precise mechanism by which iron deficiency affects hair cycle and it biology is not completely understood. It is thought that the proliferating cells need higher levels of ferritin so division of the follicular matrix cells is affected by decreased iron bioavailability. This imbalance between cellular ferritin and free iron has been assumed as a probable cause of abnormal hair cycle. In 2008, Du et al[20] identified mutation in iron-dependent genes in the hair follicle bulge that causes elevated levels of hepcidin, a liver protein that reduce iron absorption.

Another probable mechanism is iron act as metabolic cofactor for ribonucleotide reductase, the rate-limiting enzyme for DNA synthesis on hair growth stem cells. The diminution of iron could impair working of this enzyme, resulting in inhibition of proliferation.[21] Similarly, stearoyl-CoA desaturase iron-dependent enzymes which if mutated, causes hair loss in mice. Human hair follicle also have this enzyme could also add onto hair loss.[22]

CONCLUSION

Females with androgenetic alopecia have low serum ferritin levels. So, detection, prevention and treatment of the underlying iron deficiency should become an important approach for the reduction of androgenic alopecia in general population. Therefore, we recommend that there should be public screening and public awareness programs on national and regional levels for timely detection of low serum ferritin levels in order to improve the morbidity of community.

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