International Journal of Research in Dermatology
Sambangi J et al. Int J Res Dermatol. 2022 Jan;8(1):90-95
http://www.ijord.com

DOI: https://dx.doi.org/10.18203/issn.2455-4529.IntJResDermatol20214470

Original Research Article

Significance of iron levels in patients with non-cicatricial alopecias: a cross sectional study

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Received: 21 October 2021
Accepted: 03 November 2021

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ABSTRACT

Background: Among all the nutritional causes of hair loss, iron levels are found to be important key nutrient. Synthesis of hair involves many steps which require iron as a cofactor. The intention of present study is to evaluate relationship between iron and hair loss. The objectives of the study are to study the clinical patterns, demographic and epidemiological factors associated with hair loss and to find association between iron study parameter (Hb, serum iron, serum ferritin, TIBC) and hair loss.
Methods: The study was a cross section- observational study, conducted among the patients with diagnosed non-cicatricial alopecias from June 2018 to April 2019. A total of 50 study participants were recruited. Specific investigations like hair pull test and trichogram were done. Chi square test was applied and $p<0.05$ was considered significant.
Results: Among the total 50 participants 35 (70%) were males and 15 (30%) were females. Mean (±SD) age was 44 (±9.5) years. Mean (SD) of haemoglobin, serum iron, TIBC and ferritin are 9.6 (±2.6), 75.5 (±50), 365 (±54) and 106 (±87) respectively. Trichogram result proves telogen hair- 22 (44%), dystrophic hair loss- 14 (28%) and anagen hair loss-14 (28%). Hair pull test was positive in 27 (54%). Higher proportion of male pattern hair loss was associated with lower haemoglobin and low serum ferritin levels. (p value -0.046, 0.031)
Conclusions: Significant association was found between the diagnosis of non cicatricial alopecia and mean values of haemoglobin and serum ferritin with lower haemoglobin and low serum ferritin was mostly associated with male pattern hair loss.

Keywords: Hair loss, Alopecia, Iron deficiency, Trichogram

INTRODUCTION

Hair is an important ectodermal appendage which is of cosmetic significance. It contributes self-image and contribute to confident social interactions.[1] Regardless age and gender loss of hair is an important matter of concern to any individual.[2] Approximately every three to five years, every hair on the scalp is replaced.[3] hair requires continuous blood supply as hairs are one of the rapidly proliferating organ. Many studies have assessed the relation between hair loss and micronutrient deficiencies since 1960s.[4]

Among all the nutritional causes of hair loss, iron levels are found to be important key nutrient for metabolism of our body. Iron deficiency has been associated with lot of pathological conditions due to its diverse functions. However, the role of iron deficiency is not well established.[5]

Alopecia can be either inherited or acquired. Acquired is the most common type of alopecia which is broadly classified into diffuse, focal and patterned. Each of these types are further divided in to cicatricial (scarring) and non-cicatricial (non-scarring). Diagnosis of hair loss is clinical, though hair pull test, video-dermoscopy and histopathology are other additional techniques which are done in addition to history and examination. The treatment involves supplement of zinc and iron supplements which is empirical rather than strong evidence based.[6] Synthesis of hair involves many steps which require iron as a cofactor.[7] Ribonucleotide reductase is essential for the hair growth which requires iron as a cofactor. Problems with iron dependant enzyme stearyl CoA desaturase contribute to hair loss. Thus, non anemic low stores is considered as an etiological factor.[8-10]

Serum ferritin levels are very specific and early marker for iron deficiency. They are a marker of storage of iron and when iron reserves go down serum ferritin is also decreases.[11-14] Though studies have not established relationship between iron deficiency and hair loss, the intention of present study is to evaluate relationship between iron and hairloss.[15-19]

At this scenario, our study was planned to find factors determining hair loss and measurement of iron parameters. Our study also assessed association of hair loss with iron levels of body.

Objectives

The objectives of the study are to study the clinical patterns, demographic and epidemiological factors associated with hair loss and to find association between iron study parameter (Hb, serum iron, serum ferritin, TIBC) and hair loss.

METHODS

Study site

The study was conducted at Department of Dermatology, GMERS medical college, Gandhinagar, Gujarat.

Study design

The study was a cross section- observational study.

Study population

Study population constituted the patients with diagnosed non-cicatricial alopecias during the study period. The study participants who fulfilled inclusion criteria were included in the study. Consecutive sampling method was followed for recruiting the patients.

Inclusion criteria

The inclusion criteria was- age >18 years, both males and females.

Exclusion criteria

Patients with active infection/inflammation. Patients currently taking iron supplements due to other causes. Patients on medications causing hair loss. Pregnant women and post-menopausal women. Patients with any systemic illness. Patients with dermatitis affecting scalp.

Study duration

The study was conducted from June 2018 to April 2019.

Sample size determination

Sample size calculation for the study = Z2×p×q÷ L2

Z= standard deviation

P= prevalence

Q= 1-prevalence

L= relative error

As per previous literature, the prevalence of poor iron store in patients with non cicatricle alopecia in India, is 6.7 % 20, relative error =7%, and Z=1.96,

$$Sample\ size = (1.96)^2 \times 6.7 \times 93.3 \div 7 \times 7$$

= 3.8416 x 625.11/49

= 2401/49

=49

Total sample size =50

Thus, for the present study, a total of 50 study participants were recruited.

Data collection techniques and tools

A structured questionnaire was used to collect patient's details including demographic data, general examination, detailed clinical history, past history, family history. Demographic data such as age, marital status, sex, height, weight, occupation, habits were collected. Detailed clinical history was taken regarding complaints like diffuse or patchy hair loss, thinning, decrease in hair density, duration, onset and course of hair loss, association of systemic features like chronic blood loss, thyroid, chronic illness like diabetes or hypertension, any menstrual complaints, history of any prior medications. Local examination included visual assessment of pattern, extent of hair loss and signs of inflammation. Clinical photographs will be taken. Depending on the history and clinical examination, patients were diagnosed as patterned hair loss, telogen effluvium, alopecia areata, anagen

effluvium. Specific investigations like hair pull test and trichogram were done.

Hair pull test

Hair pull test also known as "traction test", "Sabouraud's sign" or "pull-out sign". Approximately 20-60 hairs are grasped between the thumb, index and middle fingers from the base of the hair near the scalp and firmly, but not forcefully, tugged away from the scalp. If more than 10% hairs are pulled away from the scalp, this constitutes a positive pull test and implies active hair shedding. The patient must not shampoo for atleast a day prior to the pull test. This is based on the concept of "gentle" pulling of hair to bring about shedding of telogen hairs.

Trichogram

Trichogram is done to study the hair cycle more accurately. 50-100 hairs from different parts of the scalp are taken for evaluation. Patients are asked to wash hair three to five days before coming to clinic. 5-10 hair are selected from different parts of scalp. Then holding in artery forceps with rubber tubing; hair are pulled in direction of natural hair growth. Hair pulled are cut 1 cm away from bulb and are arranged on slide and examined under microscope to determine percentage of hairs in anagen, catagen and telogen. Ratio of anagen to telogen (A/T ratio) is calculated.

Data entry and analysis

Data entry was done with Statistical Package for Social Sciences (SPSS IBM) version 21.0 and data entry checks was done at regular intervals to ensure valid entries. Analysis of data was done with SPSS IBM version 21.0. Both univariate and bivariate analysis will be done. Proportions were calculated for qualitative variables and mean with standard deviation were done for quantitative variables. Required tests of significance were applied. Independent t test and chi square tests were applied. Significance of p value is taken as $p<0.05$.

Ethical permission

Ethical committee approval was obtained from ethics Committee for Post Graduate Studies, Tata Main Hospital. The confidentiality of the study participants was ensured.

RESULTS

Among the total 50 participants 35 (70%) were males and 15 (30%) were females. The age of the study participants ranged from 30-58 years with mean (±SD) age was 44 (±9.5) years (Table 1).

Mean (SD) hemoglobin of participants was 9.6 (±2.6) gms. Mean (SD) of serum iron, TIBC and ferritin are 75.5 (±50), 365 (±54) and 106 (±87) respectively. Mean haemoglobin, TIBC was much lower among our study participants (Table 2).

Table 1: Demographic profile of the study participants with non-cicatricial alopecia. (n=50).

Baseline characteristics	N (%)
Gender	
Male	35 (70)
Female	15 (30)
Age group	
18-30	1 (2)
31-45	26 (52)
46-60	23 (46)
Residence	
Urban	28 (76)
Rural	12 (24)
Occupation	
Skilled worker	6 (12)
Semi-skilled worker	8 (16)
Unskilled worker	24 (48)
Business/ clerk/ shop keeper	2 (4)
Unemployed/ housewife	10 (20)

Table 2: Blood parameters of study participants (n=50).

Blood parameter	Mean (±SD)	Min	Max
Hemoglobin (gms/dl)	9.6 (±2.6)	6.1	13
Serum iron (µg/l)	75.5 (±50)	11	163
TIBC (µg/l)	365 (±54)	302	490
Ferritin (µg/l)	106 (±87)	5	269

Alopecia- description

The duration of hair loss is varied. It varies from <1 month- 2 (4%), 1 month to 6 months- 7 (14%), 6 months to 1 year -16 (32%) and >1 year in 25 (50%). Female pattern hair loss was found in 5 (10%), male pattern hair loss in 36 (72%), alopecia areata and telogen effluvium in 6 (12%) and 3 (6%) respectively. Diffuse hair loss was found in 31 (62%), patchy hair loss found in 6 (12%), visible thinning and decreased hair density was found in 43 (86%) and 44 (88%) respectively. Trichogram result proves telogen hair- 22 (44%), dystrophic hair loss- 14 (28%) and anagen hair loss-14 (28%) (Table 3).

Hair pull test

Hair pull test was positive in 27 (54%) of study participants. Negative in 23 (46%) study participants.

Association between iron study parameters and diagnosis of alopecia

Various types of alopecia was analysed with criteria of haemoglobin, ferritin, serum iron and TIBC. It was found from the analysis that higher proportion of male pattern hair loss was associated with lower haemoglobin and low serum ferritin levels. This was found to be significant. (p value -0.046, 0.031) (Table 4 and 5).

Table 3: Distribution of study participants according to alopecia (n=50).

Variables	N (%)
Duration of hair loss	
<1 month	2 (4)
1 month to 6 months	7 (14)
6 months to 1 year	16 (32)
>1 year	25 (50)
Alopecia- types	
Female pattern hair loss	5 (10)
Male pattern hair loss	36 (72)
Alopecia areata	6 (12)
Telogen effluvium	3 (6)
Clinical presentation*	
Diffuse hair loss	31 (62)
Patchy hair loss	6 (12)
Visible thinning	43 (86)
Decreased hair density	44 (88)
Trichogram	
Telogen hair	22 (44)
Dystrophic hair loss	14 (28)
Anagen hair loss	14 (28)

Table 4: Association between haemoglobin levels and ferritin and types of alopecia (n=50).

Type of alopecia	Hemoglobin levels		P value	Ferritin levels		P value
	≤10 gm/dl N (%)	>10 gm/dl N (%)		<50 µg/l N (%)	≥50 µg/l N (%)	
Female pattern	4 (80)	1 (20)	0.046	4 (80)	1 (20)	0.031
Male pattern	20 (56.6)	16 (44.4)		15 (41.7)	21 (58.3)	
Alopecia areata	6 (100)	0		3 (50)	3 (50)	
Telogen effluvium	1 (33.3)	2 (66.7)		0	3 (100)	

Chi square test, p value <0.05 is significant

Table 5: Association between serum iron levels and types of alopecia (n=50).

Type of alopecia	Serum iron levels		P value	TIBC levels		P value
	<50 µg/l N (%)	≥50 µg/l N (%)		<450 µg/dl N (%)	≥450 µg/dl N (%)	
Female pattern	4 (80)	1 (20)	0.141	2 (40)	3 (60)	0.252
Male pattern	14 (38.3)	22 (61.1)		26 (72.2)	10 (27.8)	
Alopecia areata	2 (33.3)	4 (66.7)		5 (83.3)	1 (16.7)	
Telogen effluvium	0	3 (100)		3 (66.7)	0	

Chi square test, p value <0.05 is significant

DISCUSSION

In the present study, female pattern hair loss was found in 5(10%), male pattern hair loss in 36 (72%), alopecia areata and telogen effluvium in 6 (12%) and 3 (6%) respectively. Mean (SD) hemoglobin of participants was 9.6 (±2.6) gms. Mean (SD) of serum iron, TIBC and ferritin are 75.5 (±50), 365 (±54) and 106 (±87) respectively. Mean haemoglobin, TIBC was much lower among our study participants. Similar findings were reported in previous studies.

Kantor et al reported that alopecia areata, FPHL and telogen effluvium patients under 40 year old showed lower serum ferritin concentration than controls without hair loss.[21] Rushton et al also demonstrated that there was significant decrease of hair loss and increase of FC in patients with telogen effluvium who received oral iron therapy.[22] These results are supported by Moeinvaziri et al study which reported that serum FC and transferrin saturation is lower in patients with telogen effluvium based on the case control study design.[23]

Also, total iron binding capacity was much higher in patients when compared to control group (367.8±58.2 versus 319.2±60.1 microg/dl; (p=0.004). Out of nine patients diagnosed with iron deficiency anemia (Hb <12 g/dL), eight patients reported to have telogen hair loss (odds ratio: 10.5, 95%CI: 1.2-90.7; (p=0.013). Odds ratio (95% CI) calculated for diffuse telogen hair loss was 21.0 (4.2-105.0) at serum ferritin levels at and below 30 ng/ml. Another study by Park et al found that serum ferritin concentration (FC) was found to be lower in patients with FPHL (49.27±55.8 µg/l), compared with normal counterparts.[24] (77.89±48.32 µg/l) (p<0.001). Among MPHL patients, 22.7% of them found to have serum FC lower than 70 µg/l, while none had serum FC lower 70 µg/L in healthy age matched males. These results suggested that iron could have played a certain role in FPHL.

However, a study by Gowda et al reported that a relatively higher proportion of participants with TE had iron deficiency when compared to group with androgenic alopecia (p=0.069).[25]

Similar to our study findings, as study done by Deo et al has reported that neither low hemoglobin (<12 gm%, 73.4%) nor low serum ferritin (<12 µg/l, 6.7%) was found to be statistically significant.[20] Thus from our study findings supported by other studies, it could be concluded that though there has not been much difference within the subtypes of non cicatricial alopecia, patients with non cicatricial alopecia has been associated with low hemoglobin, ferritin, TIBC and serum iron values.

CONCLUSION

It was found from our study that mean hemoglobin, serum ferritin, serum iron and TIBC were much lower compared to normal values. Significant association was found between the diagnosis of non cicatricial alopecia and mean values of haemoglobin and serum ferritin with lower haemoglobin and low serum ferritin was mostly associated with male pattern hair loss.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Sambangi J, Padhiar B. Significance of iron levels in patients with non-cicatricial alopecias: a cross sectional study. Int J Res Dermatol 2022;8:90-5.