ORIGINAL ARTICLE
Year: 2019 • Volume: 2 • Issue: 2 • Page: 47-50

EVALUATION OF SERUM ZINC, IRON PROFILE AND VITAMIN D IN FEMALES OF REPRODUCTIVE AGE GROUP WITH DIFFUSE HAIR LOSS: A CASE CONTROL STUDY

Malakar Surit [1], Singh STP Bhabani[2], Jena K Ajaya[2], Kar R Bikash[2]
[1] Rita skin foundation, Kolkata
[2]IMS and SUM Hospital, Bhubaneswar
Corresponding Author:
Dr Bhabani STP Singh
Email: drbstp@gmail.com

Abstract

Context: Female pattern hair loss (FPHL) and chronic telogen effluvium (CTE) are two common causes of diffuse hair loss in females. Although nutritional deficiencies have been implicated in the etiopathogenesis of diffuse alopecia, the results from various studies have been conflicting. **Aims:** To compare the serum levels of iron, ferritin, vitamin D and zinc in patients of diffuse alopecia with a control population. **Settings and Design:** Case control study conducted at a tertiary care centre. **Methods and Material:** 102 female patients with diffuse hair loss, in form of 58 FPHL, 44 CTE cases and 49 healthy age-matched female controls were included in the study. Serum levels of iron, ferritin, vitamin D and zinc were estimated in both the groups. **Statistical analysis used:** Chi square test was applied for the qualitative variables and independent t test was used for comparing means of quantitative data. Non parametric tests were applied for analysis of qualitative and quantitative data as appropriate. **Results:** Only CTE cases had significantly lower levels of serum zinc when compared to controls (p=0.029). Ferritin deficiency was associated with cases of diffuse alopecia versus the control population (p=0.047) and in cases of FPHL vs controls (p=0.016). There were no significant differences of serum Iron and serum vitamin D levels, between cases and controls. **Conclusions:** Diffuse alopecia in females needs laboratory evaluation. Chronic telogen effluvium is associated with low levels of serum zinc. Ferritin deficiency is significantly associated with female pattern hair loss.

Key Words : Female pattern hair loss, iron, vitamin D, Zinc, Telogen effluvium, diffuse hair loss.

Key Messages: Micronutrient deficiencies like zinc and protein like ferritin status should be assessed in all cases of diffuse hair loss.

Introduction

Telogen effluvium and female pattern hair loss are the two most commonly seen causes of non-scarring hair loss in females.[1] Various nutritional deficiencies such as that of iron, vitamin D and zinc have been found to be associated with hair loss.[2,3,4,5] There can be regional differences in socio cultural habits like dietary and environmental exposures reflected in the nutritional status of patients. So, this study was undertaken to evaluate the association of serum iron, ferritin, vitamin D and zinc levels in females with diffuse alopecia compared to control in a subset of population from eastern India.

Subjects and Methods

A case control study was conducted in the Dermatology outpatient clinic of a tertiary care centre in eastern India from December 2016 to May 2018. Institutional Ethical Committee approval was obtained prior to study. Considering the prevalence of diffuse hair loss in our outpatient department the sample size of the study for a confidence interval of 95% and 5 % margin of error was calculated to be 105 using Raosoft software.[6] Half the number of healthy age matched females were chosen as controls.

Inclusion criteria:

All female patients with complaints of diffuse hair loss of duration more than 6 months visiting our OPD were screened. Patients of 18 to 45 years of age with a clinico-dermoscopic diagnosis of chronic telogen effluvium (CTE), Female pattern hair loss (FPHL) were included.

Exclusion criteria

Patients with known systemic illness and other scalp and hair cycle disorders causing hair loss were excluded. Patients on medications that could cause alopecia and patients receiving supplements containing vitamin D, iron, and zinc were also excluded.

Methodology

A thorough history about onset, duration, concurrent and past medical illness and drugs was obtained from the patients. Clinical examination including a hair pull test was conducted. A trichogram examination was done and anagen to telogen ratio was calculated. All the patients were evaluated by a Dermlite DL4 3 Gen® dermoscope. Hair diameter diversity more than 20% was diagnostic of FPHL [Figure 1]. In CTE, empty follicles and short regrowing hairs were considered diagnostic after excluding all other non cicatricial causes of hair loss [Figure 2]. FPHL was graded according to the Ludwig scale.

Serum levels of iron, ferritin, vitamin D levels and zinc were measured in all cases as well as controls.

Statistical Analysis:

Data were analysed using (Statistical Package for Social

Scientists) SPSS Version 20.0, IBM, USA. Chi square test was applied to compare categorical data. Independent sample t test was used to analyse continuous variables between two groups. Mann Whitney test was applied to compare means of nonparametric data. A 'p' value of ≤0.05 was considered significant.

Figure 1: Dermoscopy of FPHL Ludwig grade III showing hair diversity more than 20 %. (DermLite DL4; 3Gen; polarized mode, 10x)

Figure 2: Empty hair follicles and short regrowing hair in CTE. (DermLite DL4; 3Gen; polarized mode, 10x)

Results

A total of 102 females with diffuse hair loss met the inclusion criteria and were analysed [Figure 3].49 healthy age matched females were taken as controls in the study. The mean age of the patients and controls were 28.9 ± 8.0 and 28.8 ± 7.2 years respectively (Table 1). Fifty eight patients were diagnosed with FPHL [Figure 4]. The cause of alopecia was found to be CTE in 44 (43.13 %) cases [Figure 5]. Among patients of FPHL, maximum number of patients (70 % cases) had LUDWIG grade 1 disease. Age and grade wise distribution of FPHL is

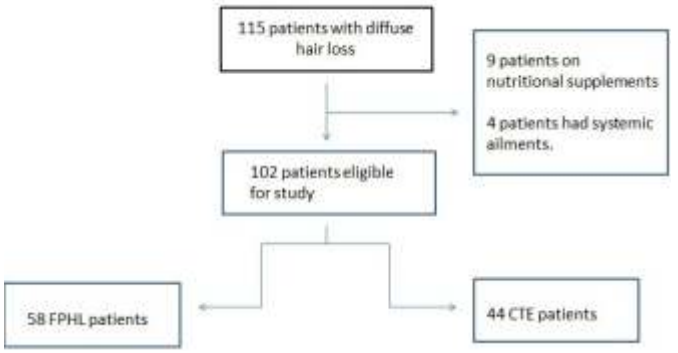

Figure 3: Flow chart of cases in the study

summarized in (Table 2). Biochemical parameters of cases and controls are presented in (Table 3).

The mean serum zinc level in cases was 85.76 ± 47.32 and 137.26 ± 203.97 µmol/L in controls. Though the cases had a lower value than controls, this difference was not statistically significant (p=0.087).Only CTE cases had significantly lower levels of serum zinc when compared to controls (p=0.029). The study did not reveal any association between grades of FPHL and serum zinc levels. (p=0.862).

The study did not show statistically significant difference in the serum vitamin D levels in patients of CTE and controls (p=0.455), FPHL and controls (p=0.455).Across LUDWIG grades of FPHL, there was no significant difference in serum levels of vitamin D (p = 0.255).On analysis of vitamin D deficiency status, we did not find significant difference between cases and controls (p=1.00).

Figure 4: FPHL Ludwig grade III.

Figure 5: Chronic Telogen Effluvum.

Mean serum iron level did not vary significantly across CTE and controls (p=0.90).Mean serum iron level in CTE cases was 79.39 ± 50.66 and that of controls was 70.48 ± 29.08 micro gm/dl. According to severity of condition, mean serum iron level was not significantly associated with change in LUDWIG score (p =

Table 1: Age-wise distribution of cases and controls.

Age groups	CONTROL	CTE	FPHL
18 -30	32(65.3 %)	24(61.5 %)	41(70%)
31 -45	17(34.6%)	20(38.5%)	17(29.3%)
Total	49(32.5%)	44(38.2%)	58(56.8%)

Table 2: Distribution of severity of FPHL (n = 58)

AGE GROUP	LUDWIG 1	LUDWIG 2	LUDWIG 3	TOTAL NO. OF CASES(%)
18-30 YEARS	37	4	0	41(70.6)
31-45 YEARS	4	8	5	17(29.4)

0.267). There was no significant difference in serum iron deficiency status among cases and controls (p=0.75).

Serum ferritin levels did not vary significantly across CTE and FPHL. No significant difference was seen between cases and that of controls. (p=0.37) There was no significant difference in serum ferritin levels observed in cases of FPHL and controls (p = 0.073), CTE and controls (p =0.617).However, serum ferritin deficiency was significantly associated with cases when compared to controls as seen in our study (p=0.047).Table 4.

Discussion

The mean age of presentation of patients in our study was 28.9 ± 8.0 years [7].In the present study, FPHL was seen mostly among women of age 18 to 30 years. The possible cause could be the increased cosmetic concern among the younger women and early consultation compared to women in higher age groups. CTE is common in females in their forties, and presents with sudden hair loss in large number. Two third of CTE patients were in the 18-30 age group in our study similar to a observation made by Fatani et al.[8]

Serum Zinc acts as co-enzyme in the synthesis of protein and nucleic acids, and consequently plays an important role in cellular functions.[9] In FPHL, zinc acts as a strong inhibitor of hair follicle involution, thus helps in recovery of hair follicle. Kil et al noticed significantly lower zinc in FPHL in comparison to alopecia areata and telogen effluvium.[9] Abdel studied zinc levels in cases of chronic telogen effluvium and control population and didn't find any significant difference in the levels between them.[21]We found significantly lower levels of serum zinc in cases of chronic telogen effluvium as compared to controls.

Table 3: Biochemical parameters in women with FPHL, CTE and controls

	CTE cases	Controls	P value	FPHL cases	Controls	P value
Zinc (µmol/dl)	73.0±39.5	137±203	0.029	95.39±50.71	137±203	0.876
Iron (µgm/dl)	79.39± 50.66	70.48±29.08	0.908	72.50±43.61	70.48±29.08	0.985
Ferritin (ng/ml)	58.41±80	47.9±46.4	0.617	56.03±37.91	47.9±46.4	0.073
VitaminD (ng/ml)	17.41±11.3	17.63±8.57	0.455	17.86±11.4	17.63±8.57	0.455

In animal models, Vitamin D was shown to play a vital role in the hair follicle cycle, specifically anagen initiation.[11] Recent studies reveal that vitamin D2 receptor regulates the expression of hair cycle genes which includes the hedgehog pathway.[12] Nayak et al and Rashid et al have found Vitamin D levels in females with CTE and FPHL to be significantly lower as compared to the controls.[18,19] However, different studies have variable results of vitamin D levels in cases of telogen effluvium. Karadag et al found higher levels of vitamin D among patients of telogen effluvium compared to controls.[20] We did not observe any significant difference in serum vitamin D levels among patients and controls. Complex biochemical pathways governing vitamin D levels in body and variable sun exposure could possibly be the explanation for different results obtained in our study.

Table 4: Deficiency status in cases vs controls.

Deficiency	Cases(102)	Controls(49)	P value
zinc	36	14	0.463
Iron	9	3	0.752
Ferritin	56	37	0.047
Vitamin D	45	92	1.000

Role of a low serum ferritin in diffuse alopecia has been debatable.[13] Deloche et al demonstrated an association between low serum ferritin and diffuse alopecia.[14] Bregy and Trueb found no significant difference in rate of telogen hair loss among groups of women with low and high serum ferritin.[15] Kantor found that the mean ferritin level in patients with androgenetic alopecia and alopecia areata were statistically significantly lower than in healthy controls without hair loss in their study.[5] Different authors have considered varying levels of serum ferritin as low to study hair loss association. Elise studied ferritin levels in patients of FPHL and CTE across pre and postmenopausal groups of women and observed no statistically significant increase in the incidence of iron deficiency in these cases versus control subjects. [17] We considered serum values of ferritin lower than 50 ng/ml to be the cut off value for deficiency. It was significantly associated with cases of diffuse alopecia than that of controls. Ferritin being a sensitive and specific indicator of iron deficiency warrants iron supplementation in patients of diffuse alopecia.

Iron is postulated to upregulate certain genes like NDRG1, ALAD, RRM 2 present in bulge region of the hair follicle which promote hair regrowth.[16] Iron depletion retards the optimum functioning of the enzymes where it acts as a cofactor leading to inhibition of proliferation of hair follicle. State of iron deficiency may not be reflected as low serum iron in the initial stages when serum ferritin serves as a sensitive index for the same. Our study did not show significant difference in serum iron between subjects with alopecia and controls.

Serum iron, zinc and vitamin D level were not significantly associated across different Ludwig grades of FPHL. Banihashemi did not find any significant difference in vitamin D levels across Ludwig grades of FPHL.[22]

Limitations

Active screening of systemic diseases causing diffuse alopecia was not done in the cases. Higher age groups of patients including post-menopausal women were not included.

Conclusion

Early age for consultation for diffuse alopecia is possibly due to

increased cosmetic awareness. In our study population, FPHL outnumbered other types of diffuse non scarring alopecia; Ludwig type 1 being most common. CTE cases had significantly lower levels of serum zinc when compared to controls. Serum ferritin deficiency was significantly associated with all cases of diffuse alopecia and FPHL. Micronutrients like zinc and serum proteins like ferritin as a representative of iron should be screened in patients presenting with diffuse alopecia.

How to cite this article:

Malakar S, BSTP Singh, Jena K A, Kar RB. Evaluation of serum zinc, iron profile and vitamin D in females of reproductive age group with diffuse hair loss: A case control study. JDA Indian Journal of Clinical Dermatology. 2019;2:47-50.

Reference

1. Torres F, Tosti A. Female pattern alopecia and telogen effluvium: figuring out diffuse alopecia. Semin Cutan Med Surg 2015;34:67-71
2. Poonia K, Thami GP, Bhalla M, Jaiswal S, Sandhu J. NonScarring Diffuse Hair Loss in Women: a Clinico-Etiological Study from tertiary care center in North-West India. J Cosmet Dermatol. 2019;18:401-7
3. Moeinvaziri M, Mansoori P, Holakooee K, SafaeeNaraghi Z, Abbasi A: Iron status in diffuse telogen hair loss among women. Acta Dermatovenerol Croat 2009;17:279-84.
4. Deloche C, Bastien P, Chadoutaud S, Galan P, Bertrais S, Hercberg S, de Lacharrière O. Low iron stores: a risk factor for excessive hair loss in non-menopausal women. Eur J Dermatol 2007;17:507-12.
5. Kantor J, Kessler LJ, Brooks DG, Cotsarelis G. Decreased serum ferritin is associated with alopecia in women. J Invest Dermatol 2003;121:985-88.
6. http://www.raosoft.com/samplesize.html
7. Malkud S. A Hospital-based Study to Determine Causes of Diffuse Hair Loss in Women. J Clin Diagn Res. 2015;9:WC01-4.
8. Fatani MI, Bin Mahfoz AM, Mahdi AH, Alafif KA, Hussain WA, Khan AS et al. Prevalence and factors associated with telogen effluvium in adult females at Makkah region, Saudi Arabia: a retrospective study. J Dermatol Dermatol Surg 2015;19:27–30.
9. Min SeongKil, Chul Woo Kim, Sang Seok Kim. Analysis of Serum Zinc and Copper Concentrations in Hair Loss. Ann Dermatol 2013;25:405-9.
10. Abdel Aziz AM, Sh Hamed S, Gaballah MA. Possible Relationship between Chronic Telogen Effluvium and Changes in Lead, Cadmium, Zinc, and Iron Total Blood Levels in Females: A Case-Control Study. Int J Trichology. 2015 ;7:100-6.
11. Hamad WA, Said AF, Hamid A. Role of some trace elements in the pathogenesis of telogen effluvium in Egyptian females. J Egypt Women Dermatol 2010;7:44-8.
12. Demay MB. The hair cycle and Vitamin D receptor. Arch Biochem Biophys 2012;523:19-21.
13. Teichert A, Elalieh H, Bikle D. Disruption of the hedgehog signaling pathway contributes to the hair follicle cycling deficiency in Vdr knockout mice. J Cell Physiol. 2010;225:482–89.
14. Nayak K, Garg A, Mithra P, Manjrekar P. Serum vitamin D3 levels and diffuse hair fall among the student population in South India: A case–control study. Int J Trichol 2016;8:160-4.
15. Rasheed H, Mahgoub D, Hegazy R, El Komy M, Abdel Hay R, Hamid MA, et al. Serum ferritin and Vitamin D in female hair loss: Do they play a role? Skin Pharmacol Physiol 2013;26:101-7.
16. Karadag AS, Ertugrul DT, Tutal E, Akin KO. The role of anemia and Vitamin D levels in acute and chronic telogen effluvium. Turk J Med Sci2011;41:827-33.
17. Rushton DH. Decreased serum ferritin and alopecia in women. J Invest Dermatol 2003;121:xvii-iii.
18. Deloche C, Bastien P, Chadoutaud S, Galan P, Bertrais S, Hercberg S, et al. Low iron stores: a risk factor for excessive hair loss in non-menopausal women. Eur J Dermatol 2007;17:507-12.
19. Bregy A, Trueb RM. No association between serum ferritin levels >10 microg/l and hair loss activity in women. Dermatology 2008;217:1–6.
20. Olsen EA, Reed KB, Cacchio PB, Caudill L. Iron deficiency in female pattern hair loss, chronic telogen effluvium, and control groups. J Am Acad Dermatol.2010 ;63:991-99.
21. St Pierre SA, Vercellotti GM, Donovan JC, Hordinsky MK. Iron deficiency and diffuse nonscarring scalp alopecia in women: more pieces to the puzzle. J Am Acad Dermatol 2010;63:1070–6.
22. Banihashemi M, Nahidi Y, Meibodi NT, Jarahi L, Dolatkhah M. Serum vitamin D3 level in patients with female pattern hair loss. Int J Trichol 2016;8:116-20