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Original Article

Association of non-scarring alopecia and vitamin D levels: A case control study

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Abstract

Objective To determine the association between non scarring alopecia and vitamin D levels.

Methods 69 patients with non-scarring alopecia and 69 age matched controls were enrolled in the study using non purposive consecutive sampling, after taking informed consent. Serum vitamin D and haemoglobin levels were determined and compared for both groups.

Results The mean age of the case group was 26.35±8.96 years while that of the control was 31.36±9.6 years. 93% cases and 83% controls belonged to the female gender while only 17 individuals were males. There was no difference in dietary habits between the two groups, and about 15% individuals from both groups were vegetarians. The hair pull test was positive in 42% cases and 13% controls. The hemoglobin levels were comparable in both groups although about 7% cases and none of the controls had severe anemia. More than half the cases and controls had Vitamin D deficiency and almost one third had Vitamin D insufficiency with cases having a slightly lower mean Vitamin D level of 23.12±16.70 and controls having a mean of 23.75±18.63. The Chi square test for comparison of vitamin D levels between two groups has p value of 0.06 which is statistically not significant.

Conclusion Vitamin D deficiency is frequently associated with non-scarring alopecia. Vitamin D levels should be measured as routine investigation in patients of hair loss. However, we also found comparable prevalence of vitamin D insufficiency in the control population, so we recommend food fortification with vitamin D to alleviate this problem at community level.

Key words
Non scarring alopecia; Vitamin D deficiency; Diffuse hair loss.

Introduction

Non scarring hair loss is a common problem affecting all age groups and both genders. The prevalence of hair fall in adults is around 53.2%.[1] It is characterized by gradual hair thinning leading to reduction in hair volume. It includes androgenetic alopecia, female pattern hair loss, alopecia areata and telogen effluvium. Disturbances of hair follicle cycling may lead to hair follicle thinning and shedding. Many factors affect hair cycle such as genetics, hormonal dysregulation, autoimmunity and nutrient deficiencies.[2] Apart from iron deficiency, vitamin D has significant role in normal hair follicle cycle exerting its effects through vitamin D receptor (VDR).

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Vitamin D is synthesized primarily in skin under the influence of sunlight and smaller amounts are acquired through diet and nutritional supplements. 7-dehydrocholesterol is converted to pre-vitamin D upon exposure to ultraviolet B (UVB) radiation in sunlight within epidermal keratinocytes and dermal fibroblasts. This pre-vitamin D binds to carrier protein and transported to liver to be hydroxylated again to 25-hydroxyvitamin D (25(OH)D). Active form; 1,25-dihydroxyvitamin D (1,25(OH)D) is formed in kidneys.[3]

Physiologic action of vitamin D takes place through VDR which is expressed in two major types of cells in the hair follicle i.e. epidermal keratinocytes and mesodermal papillary cells. VDR is crucial for hair follicle integrity. Disturbances either in vitamin D levels or VDR expression can inhibit keratinocyte differentiation hence affects normal hair follicle cycling.[4] VDR is essentially required for initiation of anagen phase. It was demonstrated in VDR null mice that follicles in catagen phase become dystrophic and detach from dermal papillae leading to stoppage of anagen phase.[5,6] When VDR expression is inadequate, there is feedback rise in vitamin D levels.[7]

Since vitamin D has definitive role in hair follicle cycle, purpose of our study is to establish association between non scarring alopecia and vitamin D levels.

Materials and methods

This case control study was conducted at Outpatient Department of Dermatology, Allama Iqbal Memorial Teaching Hospital Sialkot from 1st March 2023 to 31st August 2023, after approval from ethical review committee of Khawaja Muhammad Safdar Medical College Sialkot (No. 110/REC/KMSMC dated February 15, 2023). A sample of 138 patients were calculated using *Win Pepiver* 11.5, level of significance 95% and power of study 80.

Sixty nine patients of both genders with non-scarring alopecia and 69 age matched controls were enrolled in the study using non purposive consecutive sampling, after taking informed consent. Data was analysed using SPSS 25. Chi square test was used for comparing mean vitamin D levels between two groups. *A p* value of <0.05 was considered significant.

Subjects with history of chemotherapy, radiation therapy within last 3 months, polycystic ovarian disease, thyroid dysfunction, scalp disorders such as psoriasis, seborrheic dermatitis, lichenplanopilaris and discoid lupus erythematosus were excluded from study. Those with use of certain medications such as antidepressants, retinoid, steroids, vitamin D supplements or multivitamins containing vitamin D within the last three months were also excluded from case and control groups.

Non scarring alopecia excessive hair shedding (>100 per day) or thinning leading to widening of hair parting and visibility of scalp areas.

Hair pull test measures severity of active hair loss. Small section (almost 40 hair strands) of hair are gently tugged from different parts of scalp. If six or more strands fall out then it depicts active hair loss.

Vitamin D level will be measured using venous blood samples by radioimmunoassay.

Normal Adult 30-100ng/ml.

Insufficiency 20-30ng/ml

Deficiency <20ng/ml

Anemia haemoglobin concentration below a specific cut off point.

Normal adult male 13-16g/dl, female 12-14g/dl

Mild anemia 10g/dl to lower normal limit

Moderate anemia 8-9.9g/dl

Severe anemia 6.5-7.9g/dl

Serum vitamin D levels and haemoglobin were determined and compared for both groups.

Results

The present case control study was conducted on a total of 138 subjects (69 cases with hair fall and 69 controls with no hair fall). Among these there was a significant female majority with 64 cases (93% cases) and 57 controls (83% controls) belonging to the female gender while only 17 individuals were males **(Table 1)**. The mean age of the case group was 26.35±8.96 years while that of the control group was slightly higher at 31.36±9.6 years.

There was no difference in dietary habits between the two groups, and about 15% individuals from both groups were vegetarians **(Table 2)**. The hair pull test was positive in 42% cases and 13% controls.

The hemoglobin levels were comparable in both groups although about 7% cases and none of the controls had severe anemia **(Table 3)**.

More than half the cases and controls had Vitamin D deficiency and almost one third had mild Vitamin D insufficiency **(Table 4)**.

Vitamin D levels observed in both the groups were comparable with cases having a slightly lower mean Vitamin D level of 23.12±16.70 and controls having a mean of 23.75±18.63.

Table 1 Gender distribution of study groups.

	Gender of patient		*Total*
	Male	*Female*	
Case	5 (7.3%)	64 (92.7%)	69
Control	12 (17.4)	57 (82.6%)	69
Total	17	121	138

Table 2 Nutritional status of study groups.

	Vegetarian	*Non-vegetarian*	*Total*
Case	10(14.5%)	58 (85.5%)	69
Control	9 (14.5%)	59 (85.5%)	69
Total	19	117	138

The Chi square value for comparison of vitamin D levels between two groups shows *p* value of 0.06 which is statistically not significant.

Discussion

Non scarring alopecia is a common problem affecting 60% of population aged 18 to 60 years.[8] It varies with age, gender, nutritional status, hormonal dysregulation and underlying health conditions.[9] Vitamin D is an essential vitamin and a hormone due to its immunomodulatory activity and regulation of keratinocyte differentiation and proliferation.[10] It is intricately involved in various signalling pathways of hair growth and differentiation.[11] This carries an important implication in hair regrowth and hair health and vitamin D deficiency results in increased incidence of various types of hair loss such as androgenetic alopecia, female pattern hair loss, alopecia areata and telogen effluvium.[12]

Vitamin D deficiency affects over one billion population worldwide. Riaz *et al;* found

Table 3 Haemoglobin levels.

	Haemoglobin					*Total*
	Normal	*Mild*	*Moderate*	*Severe*	*very severe*	
Case	30 (43.48%)	21 (30.43%)	13 (18.84%)	4 (5.80%)	1 (1.45%)	69
Control	32 (46.38%)	26 (37.68%)	11 (15.94%)	0	0	69
Total	62	47	24	4	1	138

Table 4 Vitamin D levels.

	Normal	*Insufficiency*	*Deficiency*	*Total*
Case	10 (14.5%)	22 (31.9%)	37 (53.6%)	69
Control	9 (13%)	22 (31.9%)	38 (55.1%)	69
Total	19	44	75	138

prevalence of vitamin D deficiency in 84.3% of his study population.[13] Vitamin D insufficiency can be due to genetic variation, personal characteristics, environmental factors and level of sun exposure.[14]

In this case control study, both the cases and control group had female predominance. This could be due to the reason that women are more concerned about hair related problems and seek consultation earlier and more frequently to maintain hair growth. Conic *et al;* also found female predominance in their study with males comprising only 9.8% of total patients.[15]

The mean age of cases in our study was 26.35±8.96 years while that of control group was 31.36 years±9.6 years. Moneib *et al.* conducted a study on female pattern hair loss and found mean age around 26.4±4.51 years and that of controls 25.85±4.49 years.[16] Rasheed *et al;* had similar age distribution in his study.[17] Banihashemi *et al.* found age presentation in same range as that in our study.[18]

Majority of subjects from both cases and control groups were non vegetarian and belonged to suburban areas. Their diet mostly consisted of meat and dairy products. Despite this fact, vitamin D deficiency was prevalent proportionately in cases as well as control group. Baig *et al.* found vitamin D insufficiency in both vegetarian and non-vegetarians although in his study, deficiency was more severe in vegetarian group.[19]

Hair pull test was positive in 42% of cases and 13% of controls although none of the controls complained of hair loss. Both anemia and vitamin D insufficiency are the causative factors for this finding.[20]

The haemoglobin level was normal in 30 (43.48%) cases and 32 (46.38%) controls. Majority of affected subjects had mild anemia while only 5 patients among cases had severe anemia. Iron deficiency leads to increased incidence of telogen effluvium and female pattern hair loss.[20]

Only 10 patients among cases and 9 subjects among controls had normal vitamin D levels. 31.90% of cases and controls had mild vitamin D deficiency. Most of the cases and controls belonged to moderate to severe vitamin D deficiency although cases had slightly lower mean vitamin D levels as compared to controls.

Conic RZ *et al.* conducted study on vitamin D status in various forms of alopecia and found 64.8% of study subjects with low vitamin D levels.[15]

Our study revealed comparable status of vitamin D deficiency in cases and control groups despite having similar dietary habits and well matched age and gender characteristics. The possible explanation could be the fact that subjects belonged to predominantly type IV Fitzpatrick skin. Increased melanin pigment absorbs ultraviolet rays and reduces the production of pro-vitamin D in skin.[21] Different geographical areas and ethnic groups have vitamin D level variations. Asians have 6.1 fold greater odds of developing severe vitamin D deficiency as compared to Europeans.[15]

Low vitamin D levels in our population could

also be related to type of clothing worn. Cultural and religious implications lead to covering body and wearing veils in females. Skin coverage impairs formation of pro-vitamin D in skin by reducing area for penetration of ultraviolet radiation.[22]

All these factors play significant role in vitamin D insufficiency in our population which in turn increases various hormonal and immunological alterations as well as prevalence of hair loss.

Conclusion

Vitamin D deficiency is frequently associated with non-scarring alopecia. We recommend vitamin D level measurement as routine investigation in all patients with hair loss. Larger scale studies should be performed to evaluate effect of vitamin D replacement in correction of hair loss.

As vitamin D insufficiency was found equally prevalent in control group, we recommend Food and Drug Authority (FDA) regarding food fortification with vitamin D to alleviate this problem at community level.

Limitations It is a single centre study with small sample size.

Declaration of patient consent The authors certify that they have obtained all appropriate patient consent.

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Conflict of interest Authors declared no conflict of interest.

Author's contribution

ZSS: Substantial contribution to study design, acquisition of data, manuscript writing, has given final approval of the version to be published.

RK: Substantial contribution to analysis and interpretation of data, critical review, has given final approval of the version to be published.

SNK, HSS: Substantial contribution to analysis and interpretation of data, critical review, has given final approval of the version to be published.

AK: Substantial contribution of acquisition of data, drafting of manuscript, has given final approval of the version to be published.

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