



A Comparative Study of Vitamin D3 Status in Patients with Hair Loss

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Abstract

Background: Hair loss is a common problem faced by many younger people, which has a variety of risk factors. Among them, Vitamin D3 has a key role to play in various disorders. Some recent evidence indicates an inconsistent association between Vitamin D3 deficiency and hair loss. **Aim of the study:** The aim of this study was to compare the status of serum Vitamin-D3 levels between the patients with hair fall and healthy people, as case & control group. **Methods:** This was a prospective case-control study conducted in the Department of Dermatology & Venereology, Anwer Khan Modern Medical College, Dhaka, Bangladesh during the period from January 2019 to December 2020. In total 20 patients with hair loss were finalized as the case group and another 20 healthy people were selected as the control group participants. All the case group patients were subjected to detailed history taking and examination to detect a pattern, severity (SALT score) of hair loss. Blood samples were taken from both the group to complete blood count and to assess serum levels of Vitamin-D3, parathyroid hormone, random blood sugar, and calcium. All data were processed, analyzed, and disseminated by MS Office and SPSS version 20 as needed. **Result:** In analyzing the S. Vitamin D3 status of the case group (participants with hair loss) 71.43% of males and 61.54% of females were found with severe deficiency (<10 ng/ml). On the other hand, analyzing case and control group participants we observed, in case of a group, 65%, 30%, and 5% participants were with severe deficiency (<10 ng/ml), mild-moderate deficiency (10-24 ng/ml), and optimal (25-40) ng/ml Vitamin D3 levels respectively and their mean (\pm SD) S. Vitamin D3 level was 10.42 ± 2.2 mg/ml. (p-Value 0.021) On the other hand, in the control group, 0%, 35%, and 65% participants were with severe deficiency (<10 ng/ml), mild-moderate deficiency (10-24 ng/ml), and optimal (25-40) ng/ml vitamin D3 levels respectively and their mean (\pm SD) S. Vitamin D3 level was 12.35 ± 2.5 ng/ml. We found a significant correlation in serum Vitamin D3 levels between the patients with the hair loss case group and the control group. (p-Value was 0.033). **Conclusion:** Vitamin D3 deficiency may be a potential factor in hair fall. The status of serum Vitamin D3 level of patients with hair loss significantly differs from that of healthy people. Diagnostic findings regarding Vitamin D3 levels status of patients with hair fall may be considered as a potential marker of hair fall.

Keywords: Vitamin D3, Hair Loss

INTRODUCTION

In general hair loss is known as alopecia. Alopecia is a hair follicle-restricted disease that causes non-scarring & scarring hair loss due to auto immune diseases, hormonal dysregulation, nutritional deficiency & other systemic diseases affecting the scalp/any hair-bearing area causes generalized hair loss, localized patchy hair loss. Alopecia Areata Androgenetic Alopecia are most well-known hair loss. It affects 0.1-0.2% of the population with a lifetime risk of 2%.^[1] The immune-mediated destruction is triggered by environmental factors in genetically susceptible T cell infiltrates (CD4+ and CD8+) and Th1 cytokine production around anagen stage hair follicles.^[2] There is also an increased overall risk of other autoimmune disorders in patients of alopecia areata.^[3] Vitamin D (Vit D) is an important secosteroid hormone that is vital for the maintenance of calcium homeostasis, immune regulation, and cell growth and differentiation.^[4] The active form of vitamin D (1,25-dihydroxy vitamin D) plays a crucial role in cutaneous immune modulation targeting T lymphocytes and B lymphocytes, monocytes, dendritic cells and macrophages.^[5] 25-dihydroxy vitamin D plays an important role in the development of hair follicle and regulation of hair cycle via the Vit D receptors (VDR) expressed in dermal papillae and in the epidermis of the hair follicles.^[6] Studies have proposed a connection between few autoimmune diseases and Vit D deficiency, suggesting Vit D deficiency might be an environmental stimulus for induction of autoimmunity.^[7] Vitamin D is synthesized in the epidermal keratinocytes under the effect of UV-B lights (290–315 nm) or ingested in diet

and dietary supplements.^[8] Vitamin D was found to have immune-regulatory effects. 1,25-Dihydroxy vitamin D₃ (1,25(OH)₂ D₃) which is the active form of vitamin D, is one of the regulators of both innate and adaptive immune responses as it modulates immune functions and activities of both T-lymphocytes and B-lymphocytes.^[9] Vitamin D receptors (VDR) expression in epidermal keratinocytes and the mesenchymal dermal papilla cells were detected.^[10] Expression of the VDR in keratinocytes is necessary for the preservation of the normal hair cycle.^[11] Lack of the VDR is related to reduced epidermal differentiation and hair follicle growth. In addition, patients with 1, 25(OH)₂ D₃-resistant rickets type II and VDR knockout mice exhibit phenotypes that include AT.^[12] Assessment of Vitamin D level is not based on measurement of serum 1,25(OH)₂ D₃ serum levels as they are firmly regulated and relatively low. Vitamin D status is evaluated by measurement of 25-hydroxy vitamin D (25(OH)D), which is an indicator of supply rather than function. Most people have about 100,000 scalp hair among which 10%–15% are in the telogen phase.^[13] Loss of 100–150 telogen hair is considered normal,^[14] but hair loss in the anagen phase is abnormal. Diffuse hair loss is triggered by many factors such as dietary deficiencies, physiological stress, emotional stress and various medical conditions. With diffuse hair loss, deficiency of Vitamin D might be correlated.^[15]

Objectives:

General Objective:

- To compare the status of serum vitamin-D₃ levels between the patients with hair fall and healthy people.

Specific Objective:

- To collect information regarding major complaints & history of participants.
- To collect information regarding the clinical features and findings among participants.

MATERIALS & METHODS

This was a prospective case-control study which was conducted in the Department of Dermatology & Venereology, Anwer Khan Modern Medical College, Dhaka, Bangladesh during the period from January 2019 to December 2020. In total 20 patients with hair fall were finalized as the case group and another 20 healthy people were selected as the control group participants. All the case group patients were subjected to detailed history taking and examination to detect a pattern, severity (SALT score) of hair loss. On the other hand, to assess serum levels of vitamin-D3, parathyroid hormone, random blood sugar, and calcium, blood samples were taken from both the group participants for a blood count. According to the inclusion criteria, patients with any type of hair loss not receiving any treatment for hair loss for at least 6 months were included in the study. On the other hand, according to the exclusion criteria patients taking Vitamin D supplementation, iron preparations, Vitamin B, folic acid, or calcium (Ca) supplementations in the last 6 months, treated with topical vitamin D3 analog, with known to have a state of Vitamin D3 deficiency and with any associated disease that alter the blood 25(OH) D level as vitiligo, psoriasis, SLE, renal disease, liver disease, cancers, and autoimmune diseases were excluded from this study. History was taken from all participants. To exclude, general examination of systemic

diseases done which could affect the blood, Vitamin D3 level, dermatological examination including skin, hair, nail, oral mucosa, and clinical assessment of the degree of hair loss of all participants properly recorded. To visually determining adding the numbers with a maximum score of 100%, the percentage of scalp hair loss in each quadrant, the extent of scalp hair loss was determined by dividing the scalp into 4 quadrants. This was determined according to the Severity of Alopecia Tool or SALT score.¹⁶ Collected all data were processed, analyzed, and disseminated by MS Office and SPSS version 20.0.

RESULT

In this study, in case group 5%, 45%, 35% and 15% participants were from 10-17, 18-25, 26-30 and >30 year's age groups respectively. On the other in control group 5%, 65%, 25% and 5% participants were from 10-17, 18-25, 26-30 and >30 year's age groups respectively. In the case group student, service holders and housewives were 50%, 35%, and 15% respectively whereas in the control group that was 65%, 10%, and 5% respectively. In this study in the case group, male participants were 35% (n=7) and female participants were 65% (n=13). In the control group, this ratio was maintained. In analyzing the major complaints of the case group participants (patients with hair fall), we observed, among male patients, the major complaints were bitemporal hair loss, diffuse hair loss, and patchy hair loss. Separately every 28.57% of male patients mentioned those 3 complaints. On the other hand, among female patients, the most frequent complaints were hair loss from the scalp (53.85%) and diffuse hair loss (15.38%). Family history was 100% negative in male group patients whereas

84.62% negative in female group patients. In this study, in analyzing the pattern of hair loss we observed in the male group 28.57%, 28.57%, and 42.86% were with diffuse, bitemporal hair recession and alopecia hair patches respectively. This ratio was 61.54%, 23.08%, and 15.38% respectively in the female group. Thinning of hair was found 57.14% in the male group and 46.15% in the female group. Shortening of hair was found 14.29% in the male group and 7.69% in the female group. Besides this, scaling dandruff on the scalp was found 14.29% in the male group and 15.38% in the female group. The nail changes were not found in any patient among both groups. In analyzing the clinical types of hair loss, we observed 43% of male and 69% of female patients were with androgenetic alopecia. On the other hand, 57% male and 23% female patients were with alopecia areata. In analyzing the serum Vitamin D3 status of case group participants (participants with hair loss) we observed severe deficiency Vitamin D3 (<10 ng/ml) was found among 71.43% female and 61.54% was male participants. Besides this, mild-moderate deficiency (10-24 ng/ml) Vitamin D3 was found among 30.57% male

and 21% female participants. On the other hand, in optimal (25-40 ng/ml) Vitamin D3 was found among 7.69% of female participant. But no one of the male participants had optimal (25-40 ng/ml) Vitamin D3 level. The mean (\pm SD) level of Vitamin D3 was 13.64 \pm 3.68 ng/ml in male group patients and 9.40 \pm 2.24 ng/ml in female group participants. (p-Value was 0.021). Finally, in analyzing the S. Vitamin D3 status of case and control group participants we observed, in case of a group, 65%, 30%, and 5% participants were with severe deficiency (<10 ng/ml), mild-moderate (10-24 ng/ml), and optimal (25-40 ng/ml) Vitamin D3 levels respectively and their mean (\pm SD) S. Vitamin D3 level was 10.42 \pm 2.2 ng/ml. On the other hand, in control group, 0%, 35% and 65% participants were with severe deficiency (<10 ng/ml), mild-moderate 10-24 ng/ml, and optimal (25-40 ng/ml) Vitamin D3 levels respectively and their mean (\pm SD) S. Vitamin D3 level was 12.35 \pm 2.5 mg/ml. We found a significant correlation in Serum Vitamin D3 levels between the patients with hair fall (Case group) and healthy people (Control group) where the p-Value was 0.033.

Table I: Demographic status of participants (N=40)

Variable	Case		Control		p- Value
	(n=20)		(n=20)		
	n	%	n	%	
Age distribution in year					
10-17	1	5.0	1	5.0	0.096
18-25	9	45.0	13	65.0	
26-30	7	35.0	5	25.0	
>30	3	15.0	1	5.0	
Occupational status					
Student	10	50.0	13	65.0	0.338
Service	7	35.0	2	10.0	
Housewife	3	15.0	1	5.0	

Religion				
Islam	19	85.71	18	90.0
Others	1	14.29	2	10.0

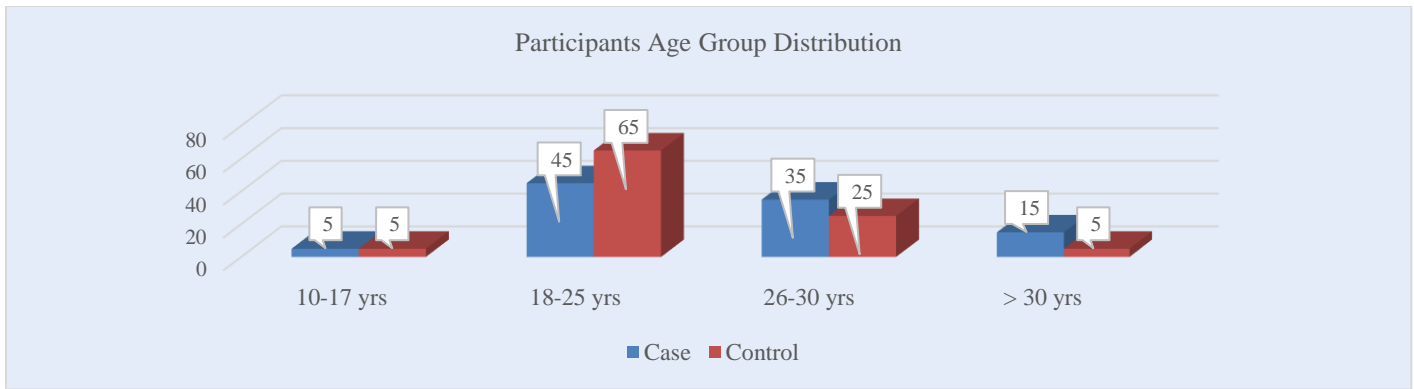


Figure 1: Participants age group distribution

Table II: Major complaints & history of male and female patients of case group (n=20)

Variable	Male	Female	p- Value
	%	%	
Major complaints			
Massive hair loss	14.29	1.5	0.339
Regular hair loss	28.57	53.85	
Hair loss from the temporal sides of head	28.57	15.38	
Hair loss from scalp	0.0	7.69	
Thinning of hair	4.5	9.69	
Patchy hair loss(Alopecia)	28.57	7.69	

Table III: Clinical features and findings of male and female patients of case group (n=20)

Characteristics	Male		Female		p- Value
	(n=7)		(n=13)		
Pattern of hair loss					
Diffuse	2	28.57	8	61.54	0.140
Bitemporal hair recession	2	28.57	3	23.08	
Alopecia hair patches	3	42.86	2	15.38	
Thinning of hair					
Present	4	57.14	6	46.15	
Absent	3	42.86	7	53.85	
Shortening of hair					
Present	1	14.29	1	7.69	
Absent	6	85.71	12	92.31	

Scaling dandruff on scalp				
Present	1	14.29	2	15.38
Absent	6	85.71	11	84.62
Nail Findings				
Nil	7	100.0	13	100.0
Clinical types of hair loss				
Androgenetic Alopecia	3	42.86	9	69.23
Alopecia areata	4	57.14	3	23.08
Others came of hair loss	0	0.0	1	7.69

Table IV: S. Vitamin D3 status of male and female patients of case group (n=20)

Levels	Male (n=7)		Female (n=13)		p- Value
	n	%	n	%	
Severe deficiency (>10 ng/ml)	5	61.54	8	71.43	0.021
Mild-moderate deficiency (10-24 ng/ml)	2	38.57	4	21.0	
Optimal (25-40 ng/ml)	0	0.0	1	7.69	
Total	7	100	13	100	

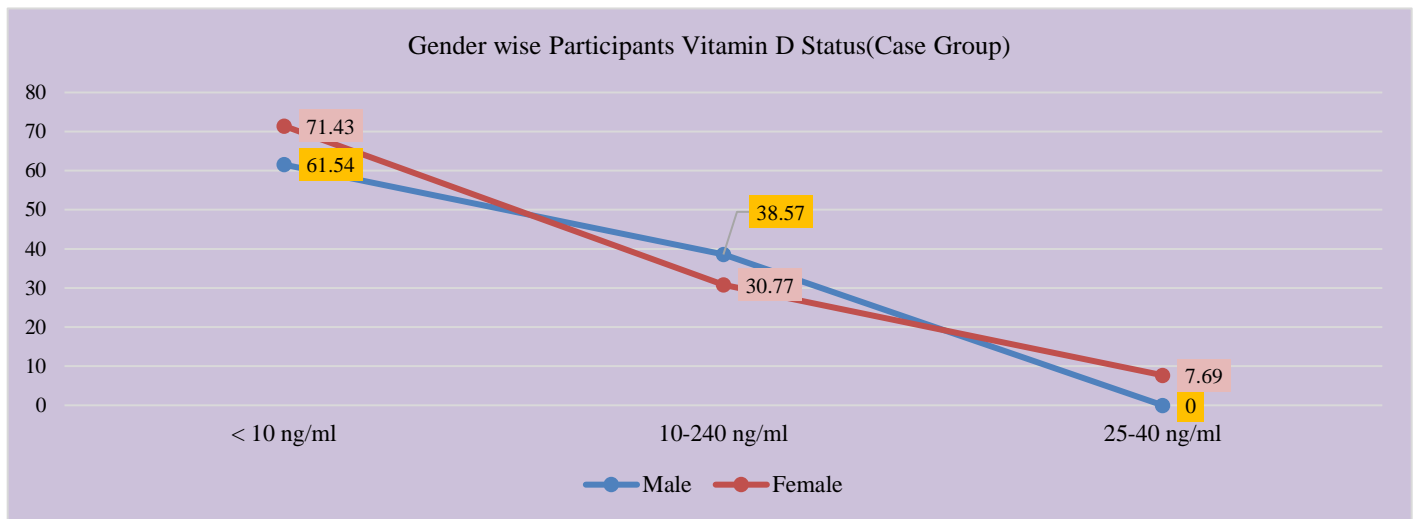


Figure 2: Gender wise Vitamin D Status (Case Group, n=20)

Table V: S. Vitamin D3 status of case and control group participants (N=40)

Vitamin D3 Levels	Case (n=20)		Control (n=20)		p- Value
	n	%	n	%	
Severe deficiency (>10 ng/ml)	13	65.0	0	0.0	0.033
Mild-moderate deficiency (10-	6	30.0	7	35.0	

24 ng/ml)					
Optimal(25-40 ng/ml)	1	5.0	13	65.0	

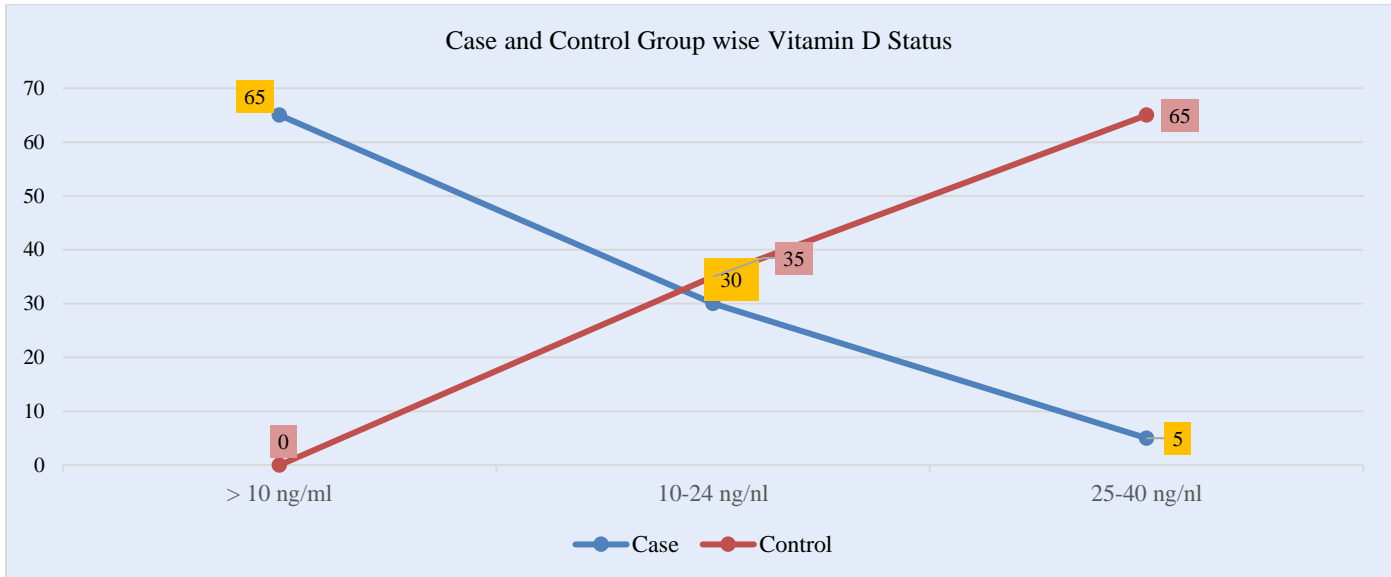


Figure 3: Group wise Vitamin D Status (Case & Control Group, N=40)

DISCUSSION

The aim of this study was to compare the status of serum vitamin-D3 levels among patients with hair loss. A study was done on telogen effluvium (TE) showed findings contrary to our study, who found those with hair fall due to TE had a higher level of Vitamin D. However, they attributed these high Vitamin D levels to the excess exposure to sunlight among that population.^[17] Thus, level of hair-fall and Vitamin D levels share complex association and are affected by several factors. The difference in Vitamin D levels median among the male cases and controls of our study was not significant (P=1.000) which is in accordance with the study done on male pattern baldness showing no significant relationship between the severity of baldness and Vitamin D (P=0.60).^[18] On the other hand the median value of Vitamin D of females of this study was significantly lower for the case

group with comparing the control group (P=0.006), In a study, Vitamin D level in females with chronic TE or female pattern hair loss came out to be significantly lower among case compared to control group for both the conditions (P< 0.001).^[19] A connection between some autoimmune diseases, including type I DM, RA, SLE, vitiligo, psoriasis, multiple sclerosis (MS), inflammatory bowel disease (IBD), and vitamin D deficiency has been reported.^[20] This finding suggests that vitamin D deficiency might be an environmental trigger for the induction of autoimmunity.^[21] Vitamin D inhibits the synthesis of dendritic cells which in turn reduces the activation of T-cells and the T-cells mediated immune response. Vitamin D, also acts on T-cells themselves, regulating the differentiation and initiation of TH1 and TH2. It inhibits Th1 cells which produce interferon- and interleukin (IL)-2 and activates macrophages, and TH17 cells which produce IL17 and IL22.^[22] In our study

in analyzing the S. Vitamin D3 status of case and control group participants, we observed, in case of a group, 65%, 30%, and 5% participants were with sever deficiency (<10 ng/ml), mild-moderate deficiency (10-24 ng/ml) and optimal (25-40 ng/ml) Vitamin D3 levels respectively and their mean (\pm SD) S. Vitamin D3 level was 10.42 ± 2.2 mg/ml. On the other hand, in control group, 0%, 35% and 65% participants were with sever deficiency (<10 ng/ml), mild-moderate (10-24 ng/ml) and optimal (25-40 ng/ml) Vitamin D3 levels respectively and their mean (\pm SD) S. Vitamin D3 level was 12.35 ± 2.5 mg/ml. We found a significant correlation in Serum vitamin D3 levels between the patients with hair fall (Case group) and healthy people (Control group) where the P-value was 0.033. In contrary to our results, other studies reported that serum levels of vitamin D were lower in female A patients and controls, they explained this by the limited exposure of females to sunlight due to religious and social concerns.^[23,24] In addition, it was found that when serum 25(OH) D is low, serum PTH is relatively high, but often still in the normal range, and the

REFERENCES

1. Gilhar A, Kalish RS. Alopecia Areata: a tissue specific autoimmune disease of the hair follicle. *Autoimmun Rev.* 2006; 5:64-9.
2. Gregoriou S, Papafragkaki D, Kontochristopoulos G, Rallis E, Kalogeromitros D, Rigopoulos D. Cytokines and other mediators in alopecia areata. *Mediators Inflamm.* 2010; 2010:928030.
3. McElwee KJ, Tobin DJ, Bystryn JC, King LE, Sundberg JP. Alopecia areata: An autoimmune disease? *Exp Dermatol.* 1999; 8:371-9.
4. Rook A, Dawber R, editors. *The comparative physiology, embryology and physiology of human hair.*

increase of serum PTH is blunted in many patients as in the present study.^[25] Another study also found no significant differences among the patients with different patterns of hair loss and their serum concentrations of 25(OH) D.²³ On the contrary a recent study by Cerman et al.^[24] found a significant inverse correlation between low 25(OH) D levels and severity of AA according to SALT scores. Vitamin D3 deficiency may be a potential factor of hair fall. The status of serum vitamin D3 level of patients with hair fall significantly differs from that of healthy people.

CONCLUSION

Vitamin D3 deficiency may be a potential factor in hair fall. The status of serum vitamin D3 level of patients with hair fall significantly differs from that of healthy people. Diagnostic findings regarding Vitamin D3 levels of patients with hair fall may be considered as a potential marker of hair fall. For getting more reliable information we would like to recommend conducting more studies in several places with a large sample size.

In: *Diseases of the Hair and Scalp.* Oxford, UK: Blackwell Science Publications; 1982. p. 1- 17.

5. Paus R, Cotsarelis G. The biology of hair follicles. *N Engl J Med* 1999; 341:491- 7.
6. Bergfeld WF, Mulinari- Brenner F. Shedding: How to manage a common cause of hair loss. *Cleve Clin J Med* 2001; 68:256- 61.
7. Holick MF. Sunlight and Vitamin D for bone health and prevention of autoimmune diseases, cancers, and cardiovascular disease. *Am J Clin Nutr.* 2004;80: 4. 678S-88S.



8. Amor KT, Rashid RM, Mirmirani P. Does D matter? The role of vitamin D in hair disorders and hair follicle cycling. *Dermatol Online J* 2010;16(2).
9. Baeke F, Takiishi T, Korf H, Gysemans C, Mathieu C. Vitamin D: modulator of the immune system. *Curr Opin Pharmacol* 2010;10(4):482-96.
10. Yilmaz N, Serarslan G, Gokce C. Vitamin D concentrations are decreased in patients with alopecia areata. *Vitamins Trace Elements* 2012;01(03):1-4.
11. Chen CH, Sakai Y, Demay MB. Targeting expression of the human vitamin D receptor to the keratinocytes of vitamin D receptor null mice prevents alopecia. *Endocrinology* 2001;142(12):5386-9.
12. Akar A, Orkunoglu FE, Ozata M, Sengul A, Gur AR. Lack of association between Vitamin D receptor FokI polymorphism and alopecia areata. *Eur J Dermatol* 2004;14(3):156-8.
13. Kennel KA, Drake MT, Hurley DL. Vitamin D deficiency in adults: when to test and how to treat. *Mayo Clin Proc* 2010;85(8):752-7. quiz 757-758.
14. d'Ovidio R, Vessio M, d'Ovidio FD. Reduced level of 25-hydroxyvitamin D in chronic/relapsing Alopecia Areata. *Dermatoendocrinology* 2013;5(2):271-3.
15. Antico A, Tampoia M, Tozzoli R, Bizzaro N. Can supplementation with vitamin D reduce the risk or modify the course of autoimmune diseases? A systematic review of the literature. *Autoimmun Rev* 2012;12(2):127-36.
16. Olsen EA, Hordinsky MK, Price VH, Roberts JL, Shapiro J, Canfield D, et al. Alopecia areata investigational assessment guidelines-Part II. National Alopecia Areata Foundation. *J Am Acad Dermatol* 2004;51(3):440-7.
17. AksuCerman A, SarikayaSolak S, KivancAltunay I. Vitamin D deficiency in alopecia areata. *Br J Dermatol* 2014; 170:1299- 304.
18. Karadag AS, Ertugrul DT, Tural E, Akin KO. The role of anemia and Vitamin D levels in acute and chronic telogen effluvium. *Turk J Med Sci* 2011; 41:827- 33.
19. Bolland MJ, Ames RW, Grey AB, Horne AM, Mason BH, Gamble GD, et al. Does degree of baldness influence Vitamin D status? *Med J Aust* 2008; 189:674- 5.
20. Hewison M. An update on vitamin D and human immunity. *Clin Endocrinol (Oxf)* 2012;76(3):315-25.
21. Arnson Y, Amital H, Shoenfeld Y. Vitamin D and autoimmunity: new aetiological and therapeutic considerations. *Ann Rheum Dis* 2007;66 (9):1137-42.
22. Oyoshi MK, He R, Kumar L, Yoon J, Geha RS. Cellular and molecular mechanisms in atopic dermatitis. *Adv Immunol* 2009; 102:135-226.
23. Nassiri S, Saffarian Z, Younespour S. Association of vitamin D level with alopecia areata. *Iran J Dermatol* 2013;16(1):1-5.
24. Cerman AA, Solak SS, Altunay IK. Vitamin D deficiency in alopecia areata. *Br J Dermatol* 2014;170(6):1299-304.
25. Lips P. Relative value of 25(OH)D and 1,25(OH)2D measurements. *J Bone Miner Res* 2007;22(11):1668-71.

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