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Efficacy of Oral Vitamin D₃ Therapy in Patients Suffering from Diffuse Hair Loss (Telogen Effluvium)

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Summary The aim of the present study was to estimate the prevalence of telogen effluvium (TE) and to evaluate the efficacy of vitamin D in the treatment of this problem in women belonging to various cities of south Punjab, Pakistan. In the present study, 40 adult women suffering from the problem of TE were included. Each woman was treated with oral vitamin D₃ (200,000 IU) therapy fortnightly and a total of 6 doses were given to each patient. After 15 d of the last dose, the condition of patients was assessed clinically. The mean age of female patients was 32.2 ± 1.5 y, 42.5% of the patients between 21–30 y of age were found to be more frequently affected with TE compared to 35% females of 31–40 y of age. Results showed significant improvement in hair growth in young ($r=0.457$ $p<0.003$) women and in those, which do not use sunscreen ($r=-0.331$ $p<0.037$) but commonly utilize milk or milk protein ($r=-0.311$ $p<0.051$). Vitamin D₃ therapy resulted in the improvement of the condition in 82.5% ($p<0.001$) patients of TE. The use of oral vitamin D₃ (200,000 IU, fortnightly) for 3 mo resulted in significant improvement in hair regrowth in the patient of TE. Results showed improvement in hair growth in young women those do not use sunscreen but commonly utilize milk or milk protein.

Key Words vitamin D₃, hair growth, diffused hair loss, prevalence, telogen effluvium

Telogen Effluvium (TE) is a common clinical problem, defined as loss of hairs at telogen phase of the hair cycling (1). It is a non-scarring alopecia and becomes acute when occurs at 2–3 mo after the triggering event like fever, starvation, surgical trauma, haemorrhage, or postoperative telogen gravidarum (2).

Micronutrients, including vitamins, play a very important role in cellular multiplication and development in the matrix cells in hair follicle bulb. Hair loss has significant impact on patient's quality of life and can be treated with supplementation of vitamins and minerals (3). In human body, skin is the only site where the action of UV-B radiation on 7-dehydrocholesterol present in the epidermal keratinocytes results in endogenous synthesis of 1,25(OH)₂D₃ or cholecalciferol (vitamin D₃) (4).

The problem of TE is being treated by the various modalities like zinc supplements, multivitamins and iron therapy, topical minoxidil along with removal of the causative factors, if known. However, existing liter-

ature suggest that cause of TE may be established after elicitation of patient history and proper laboratory investigations to exclude the possibility of endocrine, nutritional and autoimmune diseases (5). Recently, Ruiz-Tagle et al. reported association of TE with deficiencies of iron, zinc, and vitamin D and recommended supplementation of vitamin D at a dose rate of 50,000 IU/wk and 800 to 2,000 IU/wk as maintenance dose to avoid recurrence of CTE (6). Suad and Modawe reported successful decrease of hair loss in a woman treated with vitamin D₃ 50,000 IU/wk and 1,000 IU/wk as maintenance dose (7).

Based on these facts this study was conducted to see the beneficial effect of vitamin D₃ supplements in individuals after excluding the secondary causes of diffuse hair loss. However, there is relatively little information regarding demographical prevalence of TE in south Punjab, Pakistan. Therefore, the present study was planned to estimate the prevalence of TE among women living in south Punjab, Pakistan and to evaluate the efficacy of vitamin D in relieving the problem in patients suffering from this condition.

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Table 1. Cross tabulation of age, marital status, socio-economic status, type of skin, exposure to sunlight, use of sun-screen and use of milk/milk protein in respect of improvement in the hair growth in patients of telogen effluvium after vitamin D₃ therapy.

Parameter	Improvement in TE			Patient (No.)	Patients (%)
	Not satisfied	Satisfied	Highly satisfied		
Age 20–50 y					
≤20	0	0	2	2	5
21–30	0	11	6	17	43
31–40	2	7	5	14	35
41–50	4	2	1	7	18
Total	6	20	14	40	
Marital status					
Un-married	0	2	5	7	18
Married	6	18	9	33	83
Total	6	20	14	40	
Socio-economic status					
Poor	3	9	6	18	45
Low middle class	0	0	1	1	3
Middle class	3	10	7	20	50
Upper class	0	1	0	1	3
Total	6	20	14	40	
Skin types					
IV	6	15	10	31	78
V	0	5	4	9	23
Total	6	20	14	40	
Exposure to sunlight					
No	3	11	10	24	60
Yes	3	9	4	16	40
Total	6	20	14	40	
Use sun-screen					
No	4	16	14	34	85
Yes	2	4	0	6	15
Total	6	20	14	40	
Using milk and milk protein					
No	3	5	0	8	20
Occasional (<7 d a week)	0	0	3	3	8
Frequent (7 d a week)	3	15	11	29	73
Total	6	20	14	40	
Overall improvement		34/40=(85%)			

Materials and Methods

Target area. This study was approved (GHU/98/BVH/2018) by Institutional Review Board of Bahawal Victoria Hospital and executed according to the Helsinki's declaration about human use in research. A total of 40 adult women, suffering with TE were included in the present study. These women belonged to various localities of the South Punjab, Pakistan, including Multan ($n=24$), Khanewal-Kabir wala ($n=3$), Muzaffar-Ghar, Jatoi, Ghazi Ghat, Kot Addu, Ali Pur ($n=5$), DG Khan-Taunsa Sharif, Choti ($n=3$), Layyah-Chowk Azam ($n=1$), DI Khan ($n=3$) and Sadiqabad ($n=1$).

Clinical diagnosis. The presence of TE in the females was confirmed clinically by the loss of hair between 50–100/d for about 3 mo (1). The exclusion criteria were presence of secondary causes of the disease, like anemia, hypo and hyper thyroid function, mal-nutrition, acro-dermatitis, entero-pathica (3), squamous lupus erythema, chronic illness, telogen gravidum, androgenic alopecia, alopecia areata, pregnancy and lactation. The inclusion criteria were non-use of drugs like hormones, corticosteroids, immune-suppressive and contraceptives for more than 3 mo (1). Type of skin was recorded and assigned the score of 1–5 according

Table 2. Correlation between improvement in hair growth with age, economic status, marital status, type of skin, exposure to sun, use of sunscreen, use milk in the patients suffering with telogen effluvium.

Parameter	Improvement in hair growth			
	Pearson correlation	Significance	Chi-square value	Significance
Age	-0.46**	0.01	16.80**	0.01
Economic status	0.01	0.97	2.91	0.82
Marital status	-0.35*	0.01	5.27	0.05
Skin type	0.19	0.23	2.11	0.35
Exposure to sun	-0.17	0.31	1.22	0.54
Use sunscreen	-0.33*	0.04	4.44	0.11
Use milk	0.31*	0.05	11.83*	0.02

* Significant ($p < 0.05$), ** significant ($p < 0.01$).

to the criterion established by Fitzpatrick (9).

Therapeutic intervention. Each patient was given oral Vitamin D₃ (200,000 IU) therapy fortnightly for 3 mo (in total 6 treatments per woman). After 15 d of the last therapeutic dose, patients were examined clinically and level of satisfaction to treatment was recorded (9). Hair growth was quantified by hair pull test. In this approach, 20–60 hairs are firmly grasped between thumb and fore-finger from base of hair near scalp, but not forcefully tugged away from scalp. If 6 or more than 6 hairs are pulled away, it constitutes positive pull test that implies active hair shedding. No adverse signs were reported by any patient during and after the therapy.

Statistical analysis. Frequencies for age, marital and socio-economic status, skin types; exposure to sun light, use of sunscreen, using milk or milk protein by the TE affected patients and improvement of hair growth after oral vitamin D₃ therapy were determined by descriptive analysis using computer software (SPSS-17), and results are presented in cross-tabulations. Correlations of improvement in hair growth with various variables were computed, Chi-square test was applied to draw the inference. If hair loss is less than 10% in hair-pull test, it suggests that there is improvement in hair growth.

Results and Discussion

Frequency distribution in respect of age, marital and socio-economic status, skin types, exposure to sun light, use of sunscreen, using milk or milk protein and improvement of hair growth after oral vitamin D₃ therapy in TE affected patients are presented in Table 1. Results of statistical analysis showed that females aged 21–30 y were found to be more frequently (42.5%) suffered with the TE compared to females of aged 31–40 y (35%). Similarly, females aged ≤ 20 y and 41–50 y showed lower frequency being suffered with TE compared to above two age groups (5.0 and 17.5%, respectively). A previous study conducted on Pakistani females has already reported severe deficiency (vitamin D level < 10 ng/mL), mild to moderate deficiency (vitamin D level 10–25 ng/mL), and normal level of vitamin D (vitamin D level > 25 ng/mL) in 24%, 44%, and 30% of the respondents, respectively (10). On the other hand,

mean age of the patients included in the study was 32.2 ± 1.5 y. According to the data 82.5% females were married and 17.5% were un-married. Results showed that higher number of middle class ($n=20$) and lower class ($n=18$) females complained about the problem of TE compared to females belonging to upper and low-middle-classes status. These results are in line with the findings that TE was more commonly recorded in women aged 21 to 40 y (mean age 29.8 y), and most of the patient were in their productive state (4). Previous studies have shown that during the age of 20 to 40 y, females are mostly in their active menstruating and productive state, when they suffer with vitamin D and iron deficiency (1). TE is a multifactorial disease and about 78% of women having diffuse hair loss suffer with acute or chronic form, however, supplementation of vitamin D₃ is needed during treatment of TE (5). There may be multiple factors such as personality complex, which are responsible for high frequency of TE affected women of the middle class and lower class. The psychosocial impact of life in women is greater than that in men, which may have negative impact on quality of their life. Women between 20 to 50 y old are more concerned about their hair changes. They also feel changes in their personality due to their social or job status (8).

Results showed that 77.5% patients bare skin type IV (light brown skin), while 22.5% were of skin type V (brown skin). Most of the patients (60%) avoid exposure to sunlight and 85% patients did not use sunscreen. Majority of patients 72% were using milk and milk proteins and among them 89.7% (26 out of 29) showed satisfactory response, 20% were not using any milk or milk proteins in their diet out of which 62.5% (5 out of 8) were satisfied with the results and only 8% occasionally used milk and milk proteins and they showed 100% (3 out of 3) response. During the present trial, vitamin D₃ therapy resulted in significant ($p < 0.001$) improvement (72.5%) in TE affected patients those were using milk and milk protein (Table 1), which might be due to the deficiency of vitamin D in TE affected females with other reported deficiencies of ferritin (45.2%), followed by vitamin D (33.9%) and zinc (9.6%) in large popula-

tion of patients suffering with TE (3).

Analysis of data revealed improvement in hair growth was significantly and negatively correlated with age, marital status and use of sunscreen ($r = -0.457$, -0.349 , -0.330 , respectively), while it was positively correlated with use of milk ($r = 0.311$) (Table 2). Chi-square test revealed highly significant effect of age and use of milk or milk proteins on the improvement of hair growth after vitamin D₃ therapy (Table 2). Results showed that improvement in hair growth was ($p < 0.003$) better than of later age. Similarly, non-use of sunscreen resulted in significantly higher improvement in hair growth after vitamin D therapy in TE patients. The non-use of sunscreen results in absorption of UV light, resulting in increased synthesis of vitamin D in the skin, which might improve hair growth (2). The results also indicated that patients having skin type IV and V showed high tolerance against exposure to sun burns and availed the opportunity for the synthesis of vitamin D by their skin.

Conclusion

The females of middle and poor socio-economic status (50 and 45%, respectively) and those aged 21–40 y showed high prevalence of TE. The overall response to oral vitamin D₃ therapy was satisfactory (85%) in terms of hair regrow. Results showed improvement in hair growth in young women those do not use sunscreen but commonly utilize milk or milk protein. Large double-blind placebo-controlled studies are required to determine the role of vitamin D supplementation and its relation-ship with micronutrients necessary to avoid occurrence of TE.

Authorship

Research conception and design: FS, UA, AA, and GM; experiments: FS, UA, and AA; statistical analysis of

the data: MKS, SA, and MSNK; interpretation of the data: FS, UA, AA, MKS, and SA; writing of the manuscript: FS, NAI, MSNK, and GM.

Disclosure of state of COI

No conflicts of interest to be declared.

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