

ORIGINAL ARTICLE

Serum vitamin D, ferritin, and TSH in patients with telogen effluvium: a retrospective epidemiological study

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ABSTRACT

Background: Telogen effluvium (TE) is one of the most common causes of alopecia. It is a non-scarring type of hair loss. TE is mainly diagnosed clinically; however, it can be associated with laboratory abnormalities such as serum ferritin, vitamin D, and thyroid-stimulating hormone (TSH); thus, screening them in TE patients could potentially improve the treatment outcome. The present study is aimed at assessing serum vitamin D, ferritin, and TSH in patients with TE in the Saudi population.

Methods: A retrospective chart review study was carried out at Qassim University's dermatology clinics. The inclusion criteria included all female patients above the age of 18 years who were diagnosed with TE by one of the consultant dermatologists at Qassim University's clinics and who had at least one of the three laboratory tests: serum ferritin, vitamin D, and TSH level.

Results: Our results indicated that among patients who were diagnosed with TE, the percentage of TE patients with ferritin deficiency was found to be 35.4%. Besides, the percentage of TE patients with vitamin D deficiency was 34.2%, and 8.5% had an abnormal TSH, with 1.5% having a low TSH and 7.0% having high TSH.

Conclusion: Based on the findings of our study, we suggest that serum ferritin and vitamin D should be added to the screening panel of TE patients. The prevalence of hypothyroidism in our study was 7%, which is somewhat similar to the prevalence of hypothyroidism in the general population of about 5%-10%. Thus, we suggest that adding TSH to the TE screening panel is better to be individualized according to the patient's clinical presentation rather than a routine test in all TE patients.

Keywords: Alopecia, telogen effluvium, dermatology, ferritin, vitamin D, TSH.

Introduction

The most common types of non-scarring hair loss are androgenetic alopecia, telogen effluvium (TE), and alopecia areata [1,2]. Besides, TE is considered one of the most common causes of hair loss, especially in women [3]. TE is defined by an abnormal shift in the follicular cycle with diffuse shedding of telogen hairs, usually affecting less than 50% of the hairs [3,4]. Diagnosis of TE is mainly based on clinical examination, including hair pull test, and rarely requires a scalp biopsy to diagnose. Multiple studies have shown the association of TE with laboratory abnormalities, such as serum

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folate, zinc, ferritin, vitamin D, and thyroid-stimulating hormone [5-7]; hence, the correction of these laboratory abnormalities could potentially improve TE and prevent further hair loss. A retrospective cross-sectional study was carried out at the University of Pittsburgh Medical Center hair clinic that included 413 patients diagnosed with TE, and they found ferritin and vitamin D deficiency in 45.2% and 33.9% of the patients, respectively [4]. Moreover, Tamer et al. [5] reviewed 54 patients with hair loss and 55 healthy individuals, and they concluded that serum ferritin and vitamin D levels are generally lower in patients complaining of hair loss compared to healthy individuals. Another retrospective study was done in the China-Japan friendship hospital, which enrolled 193 patients with TE and 183 healthy people showing that serum ferritin level was significantly lower in TE patients compared to the healthy group [8]. Despite evidence of the association between TE and laboratory abnormalities, it is not established in Arab ethnicity yet. Therefore, our retrospective study aimed to review laboratory abnormalities, including serum ferritin, vitamin D, and TSH level in TE patients at Qassim University’s dermatology clinics, Saudi Arabia. Our primary objective was to know the prevalence of the above three laboratory abnormalities in TE patients in our study population and determine the potential benefit of screening laboratory tests for the evaluation of TE.

Subjects and Methods

We carried out a retrospective chart review of 407 patients diagnosed with TE by their dermatologists who were seen at Qassim University’s dermatology clinics from June 2016 to 2021. The data were obtained from electronic medical records. The inclusion criteria included all female patients above the age of 18 years who were diagnosed with TE by one of the consultant dermatologists at Qassim University’s clinics and who had at least one of the three laboratory tests: serum ferritin, vitamin D, and TSH level. Patients who had a previous diagnosis of iron deficiency anemia, vitamin D deficiency, or thyroid disease prior to TE onset were excluded from the study. Age, gender, body mass index (BMI), and laboratory values (vitamin D, ferritin, and TSH) were gathered from patients’ electronic medical records. The BMI level cut-offs were <18.5 (underweight), 18.5 to <25.0 (normal), 25.0 to <30.0 (overweight), and 30.0 or higher (obese). Normal levels of laboratory measures were defined as 10-120 ng/ml for serum ferritin, 25-70 ng/ml for serum vitamin D, and 0.4-4.5 mIU/l for TSH. The Python programming language was used for data preprocessing and obtaining descriptive results. Regression analyses

were carried out using Statsmodels, version 0.13, an open-source Python library [9]. All descriptive results were presented as mean, median, standard deviation (std), minimum, and maximum, along with 5%, 25%, 75%, and 95% percentiles. Pearson’s correlation and simple linear regression analysis were carried out to examine potential associations. An alpha level of 0.05 was used for statistical inference in all statistical tests. Ethical approval was obtained from the Health Research Ethics committee, Deanship of Scientific Research, Qassim University, with IRB approval number 210205 (Approval date: October 14, 2021).

Results

Out of the 407 participants, 276 patients met the inclusion criteria and had undergone all 3 laboratory tests, and thus included in the final analysis. The mean age of patients was 31.9 years, and the mean BMI was 29.1 (Table 1). Totally, 71 (35.0%) patients were in normal BMI range, 65 (32.0%) were obese, 58 (28.6%) were overweight, and 9 (4.4%) were underweight (Table 2).

Among the 226 patients with ferritin measured, 144 (63.7%) had a normal level, 80 (35.4%) had a low level, and two (0.9%) had a high level of ferritin. Of the 225 patients with available vitamin D, 136 (60.5%) had a normal level, 77 (34.2%) had a low level, and 12 (5.3%) had a high level of vitamin D. Of the 258 patients with available TSH, 236 (91.5%) had a normal level, 18 (7.0%) had a high level, and 4 (1.5%) had a low level of TSH (Table 3).

There was no significant correlation between demographic characteristics (age and BMI) and laboratory values of serum ferritin, vitamin D, and TSH. However, age had a weak positive correlation with both serum ferritin and vitamin D levels (Table 4).

There were statistically significant associations between age and serum ferritin (*p*-value = 0.003), age and vitamin D (*p*-value = 0.014), and BMI and ferritin (*p*-value < 0.001). However, none of the fitted regression lines had *R*² values greater than 0.1, which indicates no or subtle linear correlation between the measures (Table 5 and Figure 1).

Discussion

TE is a common dermatological condition that patients seek treatment for. Aside from major stresses that can contribute to TE, such as major surgery, strict diet, or psychological stress, deficiency in some vitamins and minerals can contribute to the progression of the

Table 1. Age and BMI distribution of female patients in whom the age, weight and height were available.

	Count	Mean	std	Min	5%	25%	Median	75%	95%	Max
Age	276	31.9	10.5	7.0	19.0	24.0	29.0	39.0	51.0	65.0
BMI	203	29.1	25.1	15.6	19.0	23.3	27.1	31.0	37.8	374

Table 2. Age distribution of patients among different BMI groups.

BMI group	Count	Mean	Std	Min	5%	25%	Median	75%	95%	Max
Normal	71	27.9	7.5	7.0	19.0	23.0	26.0	32.5	41.0	44.0
Obese	65	37.2	11.7	20.0	22.0	27.0	37.0	42.0	61.0	65.0
Overweight	58	33.1	9.2	17.0	23.0	26.0	30.5	40.5	49.4	54.0
Underweight	9	21.0	5.9	10.0	12.0	18.0	21.0	26.0	27.2	28.0

Table 3. Ferritin, vitamin D, and TSH distribution of female patients in whom the ferritin, vitamin D, and TSH were measured.

Laboratory measure	Count	Mean	Std	Min	5%	25%	Median	75%	95%	Max
Ferritin	226	20.9	23.8	1.6	4.1	7.4	15.2	25.9	53.7	254.0
Vitamin D	225	32.8	18.9	8.1	14.5	22.3	28.9	37.7	72.0	141.5
TSH	258	2.434	3.737	0.010	0.573	1.228	1.840	2.856	5.332	57.100

Table 4. Pearson's correlation grid of the study parameters.

	Age	TSH	Vitamin D	Ferritin	Weight	Height	BMI
Age	1	0.0864	0.1689	0.1593	0.4204	0.1196	0.0277
TSH	0.0864	1	0.0946	-0.0085	0.1118	0.018	0.0846
Vitamin D	0.1689	0.0946	1	0.0152	0.0045	0.0094	-0.0137
Ferritin	0.1593	-0.0085	0.0152	1	0.1399	0.0262	-0.0009
Weight	0.4204	0.1118	0.0045	0.1399	1	-0.0326	0.5607
Height	0.1196	0.018	0.0094	0.0262	-0.0326	1	-0.6747
BMI	0.0277	0.0846	-0.0137	-0.0009	0.5607	-0.6747	1

Table 5. Linear regression models summary.

Dependent variable	Independent variable	Degree of freedom	Coefficient	p-value	R-squared
Ferritin	Age	220	0.34	0.003	0.04
Vitamin D	Age	221	0.31	0.014	0.03
TSH	Age	253	0.01	0.331	0.01
Ferritin	BMI	167	0.77	<0.001	0.06
Vitamin D	BMI	158	-0.38	0.090	0.02
TSH	BMI	183	0.02	0.241	0.01

condition. Yorulmaz et al. [10] studied laboratory abnormalities in 3,028 patients with TE and showed evidence of significant associations between deficiencies in vitamin D and ferritin and the development of TE, with vitamin D deficiency being present in 72% of the patients included in the study. Vitamin D receptors play a role in activating the hair follicle cycle [11]. This role of vitamin D in the hair cycle is supported by the fact that patients with vitamin D-dependent rickets have hair loss [11]. Kemeriz et al. [12] studied vitamin D deficiency in 291 patients with TE and compared the result to 258 healthy individuals. They found a statistically significant deficiency in serum vitamin D in patients with TE compared to healthy individuals with vitamin D deficiency seen in 82% in the TE patient group compared to only 12.4% in the healthy group [12]. Cheung et al. [4] studied 115 patients diagnosed with TE and found that

vitamin D deficiency was seen in 34% of the patients, and ferritin was deficient in 45% of the patients included in the study. Gürel et al. [13] reviewed vitamin D and ferritin levels in 80 patients with TE and compared the result to 80 control patients with no hair loss and showed a statistically significant increase in vitamin D deficiency among the TE group compared to the control group, whereas the difference in levels of serum ferritin between the two groups was not statistically significant. Deo et al. [14] studied thyroid dysfunction in 84 patients with TE and found that 16.6% of these patients have thyroid dysfunction. There is a considerable variation in the prevalence of laboratory abnormalities in TE patients among different studies. One study reported vitamin D deficiency in 82% of TE patients, while another study showed a prevalence of 34% [4,12]. This variation between different studies is likely attributed

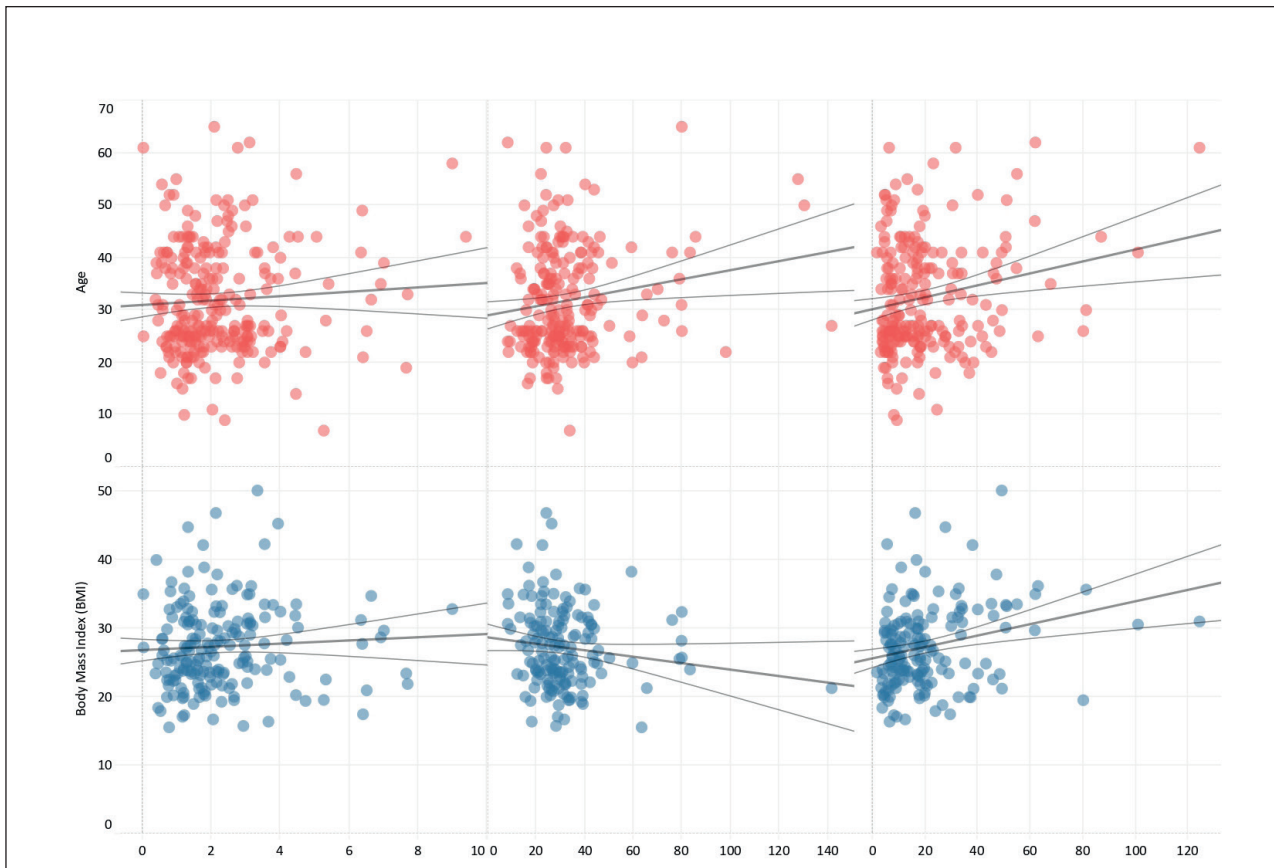


Figure 1. Linear regression models fitted on age and BMI versus serum ferritin, vitamin D, and TSH.

to multiple factors, including geographic, genetic, and laboratory-related factors. These factors, among others that may play a role was one of the reasons we wanted to do this study in the Qassim region of Saudi Arabia as it is the first study of its kind conducted in this region, and it will enable us to know the prevalence and the significance of abnormalities in serum ferritin, vitamin D, and TSH in the Arab population. This will enable us to choose appropriate tests for this subset of patients and to manage them accordingly. Our research showed a prevalence of vitamin D deficiency in 34.2% of the patients diagnosed with TE, similar to the prevalence of 34% reported by Cheung et al. [4] but much less than the prevalence of 82% reported by Kemeriz et al. [12]. We did not have a control group, but we compared our result to the prevalence of vitamin D deficiency in the general population, which is in the range of 20%-25% [15]. Low serum ferritin in our study population was the most common laboratory abnormality being present in 35.4% of the patients, which was less than the prevalence of 45% reported by Cheung et al. [4]. Hypothyroidism was seen in 7% of our study patients, which is somewhat close to the prevalence reported by Yorulmaz et al. [10], who studied 3,028 patients with TE and found that 3.9% had hypothyroidism and 1.8% had hyperthyroidism.

The prevalence of hypothyroidism in our study population was somewhat close to the prevalence of

hypothyroidism in the general population in the United States, reported to be 4.6% [16]. Therefore, we suggest that screening for thyroid dysfunction in TE patients is better to be individualized according to the patient's clinical presentation rather than a routine test in all TE patients.

There were a few limitations in our study, including the retrospective nature of the study, the fact that it was a single-center study, and the relatively small sample size. We did not have a control group, but we compared our findings to the prevalence in the general population published in the literature. We excluded male patients since females represented less than 93% of our study sample, and that is why we wanted to limit our study to the female gender to avoid the generalization of our results in both genders. A multicenter, more extensive study would give more robust evidence to support our findings.

Conclusion

Based on the findings of our study, we suggest that vitamin D and serum ferritin should be included in the screening panel of TE patients. The prevalence of hypothyroidism in our study population was 7%, which is somewhat similar to the prevalence of hypothyroidism in the general population. We suggest that the testing

for hypothyroidism in TE patients is better to be individualized according to the patient's clinical presentation rather than a routine test in all TE patients.

List of Abbreviations

BMI	Body mass index
TE	Telogen effluvium
TSH	Thyroid-stimulating hormone

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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None.

Consent to participate

Written informed consent was obtained from all the participants.

Ethical approval

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