



Serum Ferritin and Body Mass Index in Chronic Telogen Effluvium among women attending the main dermatological outpatient clinics in Baghdad

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ABSTRACT

Background: Hair loss is a common distressing disease and challenging problem for many dermatologist. Telogen effluvium is the most common hair loss disease in which nutritional deficiencies may precipitate the disease through their effect on hair structure and growth.

Study Aim : Validating role of serum ferritin level and body mass index in Chronic Telogen Effluvium and analyzing association between these factors with socioeconomic, demographic, gynecological factors and weight loss effect. Establishing a nutritional preventive advice to improve treatment successfulness and decrease the disease occurrence.

Methods : A case series study on 327 chronic telogen effluvium patients (15-65 years old) main teaching dermatological outpatients' clinics in Baghdad. Data were collected by direct interview and questionnaire filling to analyze the associations between variables set in the data collection tool with serum ferritin level and body mass, which in turn may precipitate chronic telogen effluvium.

Results : Mean patients' age was 39 ± 9 years, 93.6% of patients had serum ferritin below normal for hair cycle requirement ($\leq 70 \mu\text{g/l}$). Serum ferritin significantly associated with age (p value= 0.002) and 41.1% of poor

socioeconomic patients had serum ferritin $\leq 20 \mu\text{g/l}$.

Nearly half of the patients with ≥ 3 pregnancies, 43.9% of patients on weight-losing diet and 52.7% of those who actually lost weight had low ferritin levels with statistically significant associations. Being obese is a risk factor for having low serum ferritin (OR= 0.297).

Conclusion : Serum ferritin found to be $\leq 70 \mu\text{g/l}$ in the majority of chronic telogen effluvium patients, which is significantly associated with patients' socioeconomic status, age, and weight status.

Key words: Chronic Telogen Effluvium, Serum ferritin level and Body Mass Index.

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INTRODUCTION

Hair is an ectodermal structure with great cosmetic importance. It helps an individual to maintain self-image and carry on fruitful social interactions. ⁽¹⁾ Femininity, sexuality, attractiveness and personality are symbolically linked to woman's hair rather than in men. Quality of life and social relations for women are more affected by hair loss as compared to men. However, hair loss becomes a matter of concern in all individuals irrespective of age and sex. ⁽²⁾

alopecia or hair loss is a common and distressing problem that has a significant impact on quality of life. It is often met with feelings of grief, loss of self-confidence, and low self-esteem. The burden of hair loss for some patients may be comparable to severe chronic diseases. ⁽³⁾

Normal hair cycle results in replacement of every hair on the scalp by 3-5 years. Telogen effluvium (TE) is the most common hair loss disease that presents to the dermatologist and it is seen in all races and ethnic groups. In which there is a premature conversion of anagen follicles to telogen follicles. ⁽⁴⁾ Studies have also reported potential associations between nutritional deficiency and chronic telogen effluvium (CTE). ⁽⁵⁾

Dermatologists commonly assess serum iron status in women because of the assumption that iron deficiency causes alopecia. ⁽⁶⁾ Observational data have suggested that alopecia in women may be associated with decreased body iron stores. Some studies have suggested that decreased body iron

stores (as measured by serum ferritin level (SFL)) may be associated with TE. ⁽⁷⁾

TE is an abrupt, rapid, and generalized shedding of normal hair, usually more than 150 in number, 2-3 months after a triggering events like parturition, high fever, major surgery, etc. In one-third of cases, no trigger can be identified. ⁽⁸⁾ A premature termination of anagen into catagen and telogen hair follicle is the main mechanism behind TE. ⁽⁹⁾

Chronic Telogen Effluvium (CTE)) is chronic diffuse hair loss persisting beyond six months, may be primary/idiopathic. The exact etiopathogenesis of disorders of hair loss is poorly understood. ⁽⁹⁾

Among the various triggering events, the most common ones are severe febrile illness (e.g., malaria), postpartum (telogen gravidarum), accidental trauma, major surgery, emotional stress, chronic systemic illness, large hemorrhage, and crash diet. ⁽⁸⁾

Aims of the study is to validate the role and estimate effect of serum ferritin level (SFL) and Body Mass Index (BMI) on chronic telogen effluvium.

Methods

A case series study conducted on 327 patients suffering from CTE who attended the main teaching dermatology outpatient clinics in Baghdad during the period from June to Dec. 2018 who are diagnosed as having CTE by the dermatologists at these clinics:

- Medical City Department (Dermatological Diseases' Center) in Baghdad Teaching Hospital.
- Al-Kindy Teaching Hospital.
- Al-Kadhimiya Teaching Hospital (Imamain Kadhimain Medical City).
- Al-Yarmook Teaching Hospital.

The data were collected by direct interview and arranged on the data collection tool (questionnaire form) then subjected to analysis.

Study population and inclusion criteria

The target population included women from 15 to 65 years old who presented suffering from CTE to the clinics. The patients

included in the study were newly diagnosed and have no previous therapy for their complain, have been complaining from hair fall more than 6 months ago and diagnosed by the consultant dermatologist .

Exclusion criteria:

- Severe medical disease (Malaria, HIV, Syphilis).
- Autoimmune disease as SLE, Vitiligo etc.
- chronic diseases as Diabetes mellitus, Hypertension
- Smoker
- Pregnancy, delivery or recent surgery in the last year
- Oral contraceptive pills.
- psychiatric disease or on psychiatric treatment.
- Previously diagnosed as having a Hematological disorder; Thalassemia, Hemochromatosis and Sickle Cell Anemia.
- Malignancy, chemotherapy or radiotherapy

Ethical consideration

The research was approved by the Iraqi Board Scientific and Ethical Committee. The oral consents for participating in the study were taken from all patients prior to interview after gaining approval from the hospitals' administrations.

The questionnaire form contains three parts:

Part one:

1. Age categorized into two categories: <35 years or ≥ 35 years.
2. Socioeconomic status (SES) assessed according to score in Omer W. and Al-Hadithi T. study in 2017 ⁽¹⁰⁾ and then categorized into poor, fair and good (in the original score, SES is categorized into low, middle, high respectively to our categories) composed of the following questions:
 - Occupation
 - Educational level:
3. Marital status.
4. Family history of CTE.

Part two:

Included BMI calculation after measuring the patients weight and height the formula $\text{weight (kg)}/\text{Height (m}^2\text{)}$. underweight (BMI < 18.5), normal weight

(BMI: 18.5 - 24.99), overweight (BMI: 25 - 29.99) and obese (BMI \geq 30).⁽¹²⁾

Serum ferritin level (SFL) measurement

Measured in the hospital laboratories by using the Mini VIDAS full-automated technique, which is a quantitative test for the determination of ferritin in human serum or plasma using the Enzyme Linked Fluorescent Assay technique.

Measured SFL categorized into four groups⁽¹²⁾:

- ✓ <12 μ g/l indicator for (iron deficiency)
- ✓ 12- 20 μ g/l indicator for (iron depletion)
- ✓ >20-70 μ g/l indicator for (serum ferritin level lower than required for normal hair cycle)
- ✓ >70 μ g/l indicator for (normal ferritin level)

For statistical analysis and association test, the first two groups were categorized into (Low SFL category) and the last two into (Fair SFL category).

Statistical analysis

Data were collected, and analyzed.

Descriptive Statistics: have been presented through frequency distribution, means, standard deviation, tables and graphs.

Analytic Statistics: Chi square test was used to find the significance of the association between the related variables under study (in the questionnaire) with the main measurable variables (SFL and BMI) in the CTE patients. P value of \leq 0.05 was considered statistically significant.

Results

1. Distribution of the patients according to sociodemographic characteristic

Table 1 shows that the mean age was 39 \pm 9 years, 206 of them were in age group < 35 years old, which constitutes about 63% of the sample.

The percentages of SES were 27.52%, 31.8%, and 40.68% for poor, fair and good respectively. Regarding the marital status, 28.44%, 65.14% and 6.42% of the patients are single, married and widowed or divorced respectively.

Characteristics	Variables	No	%
Age	Mean \pm SD years	39 \pm 9	
	<35 years	206	63.0%
	\geq 35 years	121	37.0 %
Socioeconomic Status	Poor	90	27.52 %
	Fair	104	31.80 %
	Good	133	40.68 %
Marital status	Single	93	28.44 %
	Married	213	65.14 %
	Widow /divorce	21	6.42 %

SFL is found to be low (\leq 20 μ g/l) in 31% of the patients (figure 1)

Serum ferritin levels of the participant has found to be:

- 41 patients (12.5%) have SFL <12 μ g/l (iron deficiency).
- 62 patients (19.0%) have SFL between 12-20 μ g/l (iron depletion).
- 203 patients (62.1%) have SFL >20-70 μ g/l (SFL is inadequate for the hair cycle to occur).
- Only 21 patients (6.4%) have SFL >70 μ g/l (adequate SFL)

For statistical analysis, the first two groups of patients' SFL are gathered into one category labeled as Low SFL ($\leq 20\mu\text{g/l}$) and the last two groups of patients' SFL are gathered into Fair SFL category ($>20\mu\text{g/l}$).

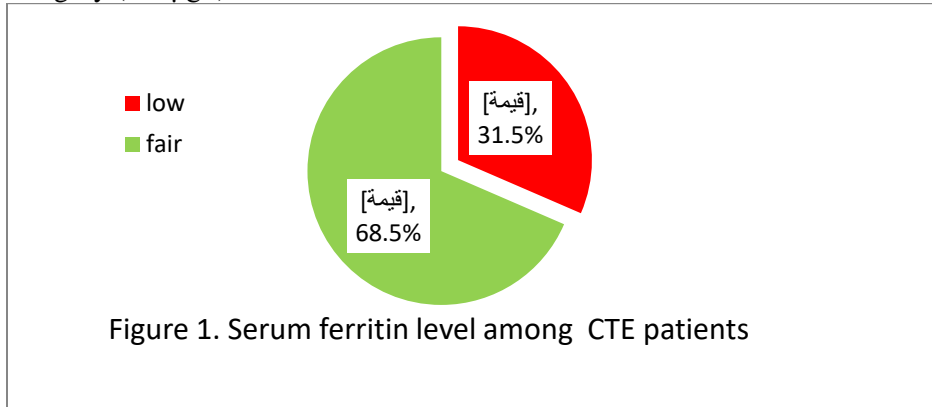


Figure 1. Serum ferritin level among CTE patients

2. Distribution of the patients according to weight status

The mean weight (BMI) of the patients was 25.76 Kg/m^2 ($\text{SD} \pm 4.02$) distributed as 46.8%, 38.8% and 14.7% normal, overweight and obese respectively as shown in figure 2.

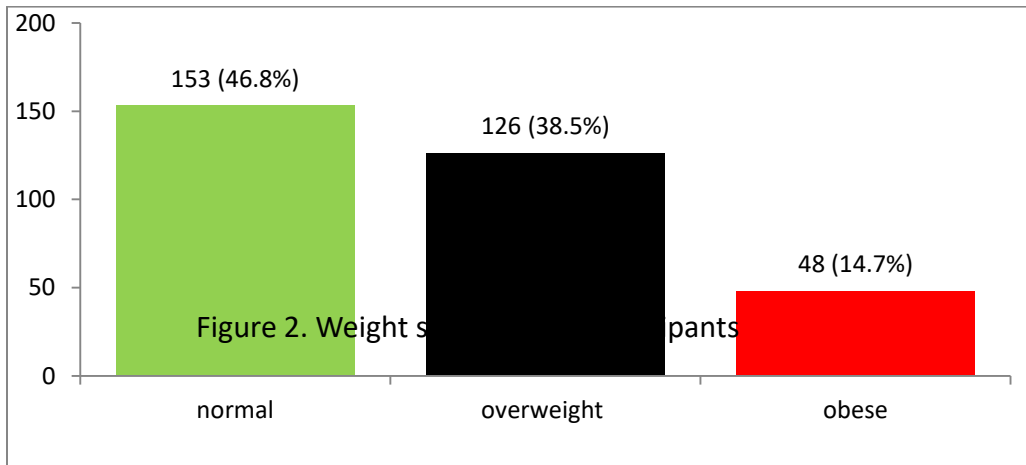


Figure 2. Weight status of patients

3. Association between BMI and SFL

Table (2) shows that 22.9 % of low SFL patients had normal BMI in comparison with 77.1 % of fair SFL with normal BMI. A significant association was found between SFL and BMI status (p value=0.001).

Odd ratio showed that increased BMI (obese) is found to a risk factor for having low SFL, Odd Ratio = 0.297 (95% CI = 0.150-0.585).

4. Association between sociodemographic characteristics and SFL

	SFL				P value	Odd Ratio	95% CI
	Low		Fair				
	No	%	No	%			
Normal	35	22.9 %	118	77.1 %	0.001	Reference	
Overweight	44	34.9 %	82	65.1 %		0.553	0.327-0.935
Obese	24	50.0 %	24	50.0 %		0.297	0.150-0.585

More than a quarter of the patients who are less than 35 years old had low SFL versus 42.1% in older patients, a significant association was found between age and SFL, p value = 0.002. Regarding SES, 41.1%, 32.7%, 24.1% of poor, fair and good SES respectively showed low SFL, a significant

association was found between poor SES and low SFL, p value = 0.026. As in table 3, 30.1% of the single, 32.4% of married and 28.6% of widows or divorced have low SFL, no significant association was seen between marital status and SFL, p value = 0.884.

Characteristics	Variables	Serum ferritin				P value
		Low		Fair		
		No	%	No	%	
Age in years	<35 years old	52	25.2%	154	74.8%	0.002
	≥35 years old	51	42.1%	70	57.9%	
Socioeconomic Status	Poor	37	41.1%	53	58.9%	0.026
	Fair	34	32.7%	70	67.3%	
	Good	32	24.1%	101	75.9%	
Marital status	Single	28	30.1%	65	69.9%	0.884
	Married	69	32.4%	144	67.6%	
	Widow /divorce	6	28.6%	15	71.4%	

5. The association between sociodemographic characteristics and weight status

Table 4. illustrates that, 52.9% of patients < 35 years old and 36.4% of older patients had normal body weight versus 10.2% of < 35 years old patients and 22.3% of older patients were obese, a significant association is noticed between young age and weight status (being on normal weight) , p value=

0.002. Good SES is found to be significantly associated with normal weight status, p value=0.001.

The table also shows that 63.4% of single patients were found to be of normal weight versus 39.9% of married and 42.9% of widowed or divorced patients, the association between marital status and weight status is significant as single women have normal BMI, p value= 0.004.

		Normal		Overweight		Obese		P value.
		No	%	No	%	No	%	
		Age in years	<35 years old	109	52.9%	76	36.9%	
	≥35 years old	44	36.4%	50	41.3%	27	22.3%	
Socioeconomic Status	Poor	26	28.9%	47	52.2%	17	18.9%	0.001

	Fair	47	45.2%	43	41.3%	14	13.5%	
	Good	80	60.2%	36	27.1%	17	12.8%	
Marital status	Single	59	63.4%	22	23.7%	12	12.9%	0.004
	Married	85	39.9%	95	44.6%	33	15.5%	
	Widow /divorce		42.9%	9	42.9%	3	14.3%	

DISCUSSION

TE is one of the most common hair loss diseases encountered in daily clinical practice.⁽¹³⁾ Usually affects women 30–60 years old and starts abruptly with or without the presence of a recognizable initiating factor and for unknown reasons. CTE seems to mostly affect women and it is less common than its acute form.⁽¹⁴⁾ Accordingly, in this study, a sample of females only has been taken with age range 15–65 years and after data analysis the mean age was 39 ± 9 years, which is compatible with Whiting DA study in Texas in USA in 1996 who concluded that the age of CTE patients between 30 to 60 years of age.⁽¹⁴⁾

However, the disease may occur in any age and in either sexes, TE is a common type of diffuse non-scarring alopecia, it is a multifactorial disease with long list of triggers such as nutritional causes, fever, medications, rapid weight loss and others that can precipitate TE.⁽¹⁵⁾ In this study, patients with proved precipitating factors that cause TE had been excluded in order to figure out factors that may affect SFL and weight status that in turn may precipitate TE.^(16, 17)

Iron deficiency causes low serum ferritin concentrations. However, normal SFL does not mean optimal for the hair cycle to occur. Optimal level for both men and women is $> 70 \mu\text{g/l}$, although, some patients with TE have normal SFL but still have hair fall due to its multifactorial nature.^(10, 14) This relationship between iron stores and TE had been addressed in many studies. In women without systemic inflammation or other underlying disorders, $\text{SFL} \leq 30 \mu\text{g/l}$ is strongly associated with telogen hair loss.⁽¹⁹⁾

In this study, Only 6.4% of the patients found to have SFL which is adequate for the hair cycle to occur normally ($> 70 \mu\text{g/l}$), while the rest of cases have $\text{SFL} \leq 70 \mu\text{g/l}$ (31.5% have $\text{SFL} \leq 20 \mu\text{g/l}$) which is proved to be inadequate for hair cycle to occur, these results are fairly compatible with Fatani et al. study in Saudi Arabia in 2015, which included 279 TE patients for a period of three years,⁽²⁰⁾ and near to the conclusion of a case control study in Razi hospital in Tehran in 2009 on the association between iron status in women with TE. Furthermore, both studies had concluded that SFL below $30 \mu\text{g/l}$ is a significant risk for developing TE.⁽⁷⁾

Few studies have assessed the associations between weight status and SFL, yielding controversial results. A double-blinded placebo controlled cohort study on 9917 subjects carried out in Paris in 1995, concluded consistent results with this study finding in that BMI is significantly associated with SFL.⁽²¹⁾

A study in Spain in 1998, revealed that BMI is correlated with ferritin,⁽²²⁾ which is consistent with the present study findings of a significant association between SFL and BMI (P value= 0.001), odd ratio shows that being obese is a risk factor for having low SFL (table 2). Which is may be related to wrong eating habit, diet and lifestyle among those obese individuals.

A study in United States in 2001 found a significant association between BMI and SFL⁽²³⁾ and Shattnawi KK et al. study in Jordan in 2018, which was a descriptive cross-sectional study, concluded a positive association between obesity and plasma ferritin level, especially among obese adolescents.⁽²⁴⁾ Recognition of these results

suggests considering this association when assessing iron deficiency for obese and overweight adolescents.

About quarter of patients (25.2%) who are < 35 years old had low SFL, while 42.1% of older patients have low SFL, a significant association was found between young age and having fair SFL and between older age and low SFL (p value= 0.002), which may be related to the diet type and presence of chronic disease in elderly, this finding does not consist with a study on 226 subjects between 20 to 93 years old published in International journal of British geriatric society and showed an age related tendency to rise in SFL, these findings considered to be a result of activation of reticuloendothelial system and increase iron storage with ageing.⁽²⁵⁾

Of the participant 40.68 % have good SES, however, a cross sectional Egyptian study on 305 patient in the reproductive age published in 2018, concluded that there is no significant relation between TE and SES.⁽¹⁹⁾

Regarding the relation between SES of the participants and SFL which in a consequence may precipitate the hair fall presentation, a significant association between poor SES and low SFL was found (p value= 0.026), which is compatible with Kim et al. study on 1312 girls in Korea, who reported a significant correlation between these two variables. As it is expected that female with poor SES may have less nutritious diet than the one with good SES.⁽²⁶⁾

In the present study, the relation between marital status and SFL in seems to be not significantly associated (p value= 0.884) that goes with what is concluded in a Danish study on 2235 individual in 1996.⁽²⁷⁾

More than half of the CTE sample of patients are obese and overweight and the majority of participant are younger than 35 years old of age. The present study found a significance in association between normal BMI and young age <35 years old in CTE patients (and between high BMI and old age) (p value= 0.002) which goes with Gallagher et al. study done on 706 individuals in 1996 in New York City, concluded that overall BMI increases with

age up to the fifth or sixth decade after that it declines.⁽²⁸⁾

The majority of the collected CTE sample of patient have fair and good SES, adding to that more than half of the participant have above normal BMI. Maraee AH et al study in 2018, concluded that there is no significant relation between TE and SES.⁽¹⁹⁾

Conclusions

1. The mean age of the patients is 39±9 years old and majority of the patients 93.6% have SFL below what is considered normal for the hair cycle to occur properly ($\leq 70\mu\text{g/l}$) and it may be the precipitating cause for the disease.
2. Weight status of the patients is significantly associated with SFL. Increasing BMI is a risk factor for having low SFL (50% of obese patients have SFL $\leq 20\mu\text{g/l}$).

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