

## The Causes of Hair Loss in Women 20-30 Years Old

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### Abstract

**Objective:** To investigate the role of vitamins, minerals, and hormones in the pathogenesis of hair loss in young women between the ages 20 – 30 years old.

**Methods:** We conducted a study based on young women who were referred to the Royal Wolverhampton NHS Trust, Wolverhampton (secondary care hospital) with hair loss and were investigated by requesting Full Blood Count, Serum Ferritin, B12, Folate, Zinc, Vitamin D, Thyroid Function Test, Luteinising hormone, Follicle stimulating Hormone, Testosterone, Sex hormone binding Globulin (SHBG) and Cortisol.

**Results:** 15 out of 16 patients (93.75 %) of all the female patients who presented with alopecia were investigated and found to be deficient of Vitamin D. 16 out of 17 patients were investigated for Zinc Levels. 7 out of 17 patients (43.7%) were found to have low zinc Levels and 2 out of the 3 patients with irregular periods were noted to have low SHBG levels (66.6%) . 10 out of 16 patients (62%) were found to have abnormal ferritin levels (<20 ng/ml) and 6 out of the 17 patients (35.2%) were found to have low haemoglobin levels .

**Conclusion:** Results from this study highlight the importance of early investigating the levels of vitamins, minerals and hormones in young women who present with alopecia and the need to conduct these blood tests as part of the routine treatment at primary care level.

**Key Words:** Hair loss, Androgenic Alopecia, Micronutrients

### Introduction

Three hair disorders, Androgenetic Alopecia (AGA), Telogen Effluvium (TE), and Alopecia Areata (AA) account for most of nonscarring alopecia cases in the female population [1].

In FPHL (Female Pattern Hair Loss), also known as Androgenetic Alopecia (AGA), females usually experience a diffuse apical hair loss with a characteristic maintenance of frontal hairline whereas in males, hair loss is most prominent in the frontotemporal and vertex regions [2]. Studies have proven that in androgenetic alopecia, excessive activation of the androgen receptor leads to follicular miniaturization by shortening the anagen phase (growth) and prolonging the telogen (rest) phase, resulting in shorter and thinner hair follicles [3]. Genetic predisposition such as androgen receptor (AR) gene coupled with the presence of circulating androgens are also found to determine the tendency to manifest AGA [4]. However, both Androgen-independent and androgen-dependent mechanisms are found to contribute to the phenotype as FPHL is also seen in women without elevated androgen levels [5].

Telogen effluvium (TE), which can be classified into acute TE

and chronic TE, is an abnormality of the hair cycle that results in excessive loss of telogen hairs due to certain physical or mental stressors such as psychological stress, fever, infection, pregnancy, childbirth, recent surgery, chronic medical conditions, autoimmune diseases, or malignancy [6]. On the other hand, Alopecia areata (AA) is an autoimmune condition in which inflammatory cells target the hair follicle preventing hair growth [7].

All of these three hair disorders have been proven to be an ongoing cause of psychosocial distress in both sexes. However, more recently, women from the age group of 20-30 have been presenting to dermatology clinic with hair loss. The young female population are known to be more psychologically vulnerable to the cosmetic affliction of alopecia as they tend to experience reduced self-esteem along with psychological distress, which in turn affects their quality of life [8]. Thus, it is important for dermatologists to identify the root causes of the various types of alopecia to be able to formulate a treatment plan tailored to every female patient.

Given that micronutrients play a major role in the normal hair follicle cycle and cellular turnover, it is essential to check these levels to help stop disease progression [9]. Despite deficiencies of micronutrients

having a strong link to the pathogenesis of alopecia, there is a paucity of studies highlighting the role and impact of nutrients (vitamins and minerals) in the progression and treatment of alopecia. This study aims to highlight the role of vitamins, minerals and hormones in alopecia in young women so as to improve the overall management of alopecia in this specific group of patients.

## Materials and Methods

### Study design

This is a cross-sectional study conducted with female patients who have experienced hair loss who were referred by their General Practitioners (Primary Care) to the dermatology outpatient department at The Royal Wolverhampton NHS Trust, United Kingdom (Secondary care). The patients were screened for blood tests including Full blood count (FBC), Serum Ferritin (Fe), B12, Folate, Zinc (Zn), Vitamin D levels (Vit D), Thyroid Function Tests (TFT) as well as Hormonal Essay (Luteinising hormone (LH), Follicle stimulating Hormone (FSH), Testosterone (T), Sex hormone binding Globulin (SHBG) and Cortisol). The latter 5 were requested only in women who presented with hair loss as the chief complaint with irregular periods or with difficulties conceiving.

### Study population

A total of 17 female patients from the age of 20 to 30 were investigated in this study. Out of the 17 female patients, 13 were Asians and 4 were Caucasians.

### Study variables

Various blood tests such as Full blood count, Serum Ferritin, B12, Folate, Zinc, Vitamin D, TFT levels. In three patients out of the 17 (17.6%) the following were also requested Hormonal Essay (LH, FSH, Testosterone, Sex Hormone Binding Globulin (SHBG) and Cortisol) were used as study variables.

### Statistical analyses

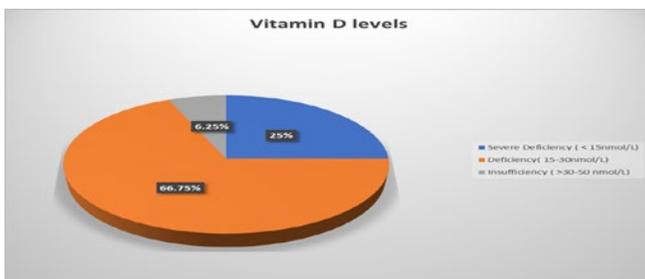
Descriptive statistics have been used to describe study data with Microsoft Excel. The data was then collated and entered into a spreadsheet ready for analysis. Descriptive statistics were reported for scale scores in the sample population.

## Results

### Vitamin D Levels

Vitamin D levels were investigated in 16 patients out of the 17 female patients. Out of the 16 patients, 4 were found to be severely deficient of Vitamin D (25%), 11 patients were found to be deficient with Vitamin D levels between 15-30 nmol/L (66.75%) and 1 patient was found to have Vitamin D insufficiency with levels between 30-50 nmol/L (6.25%). Overall, 15 out of 16 patients (93.75%) of all the patients investigated were found to be deficient of Vitamin D. (Figure 1)

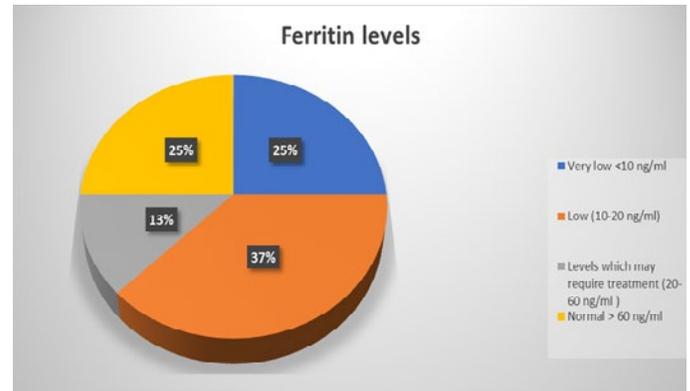
(Figure 1)



### Ferritin levels (Fe)

Out of the 16 female patients who were investigated for ferritin

levels, 4 patients were noted to have very low ferritin levels (<10 ng/ml) 25%, 6 were found to have low ferritin levels from (10-20 ng/ml) 37%, 2 were found to have ferritin levels from (20- 60 ng/ml) (levels which may require treatment) 13% and 4 patients had ferritin levels (> 60 ng/ml) 25%. Overall, 62% showed low or severe deficiency in Ferritin and arguably if add those who may require treatment between (20 and 60 ng/ml) 13% this will take the figure to 75% of female who presented with hair loss in this category required Ferritin supplement. (Figure 2)



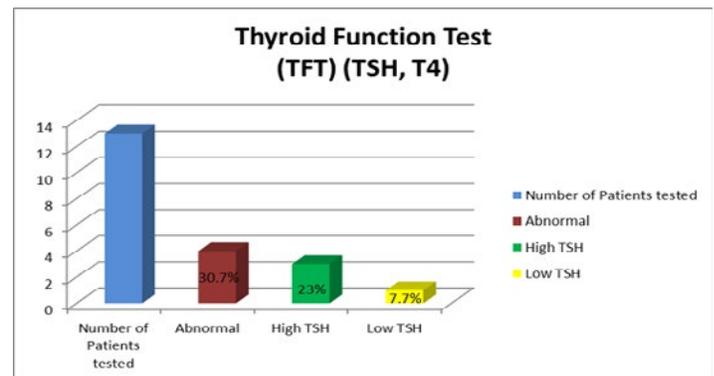
(Figure 2)

### Haemoglobin Levels (Hb)

Furthermore, 6 out of the 17 (35.2%) patients who had full blood count investigated were found to have low haemoglobin levels.

### Thyroid Function Test (TFT) (TSH, T4)

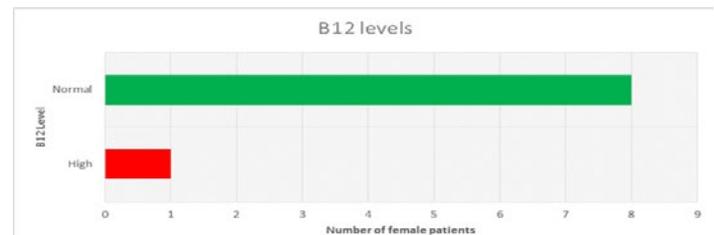
13 patients were investigated and 4 (30.7%) had abnormal TFT, 3 (23%) showed a raised TSH and 1 (7.7%) showed a low TSH (Free T4 high)



(Figure 3).

### Vitamin B12 levels

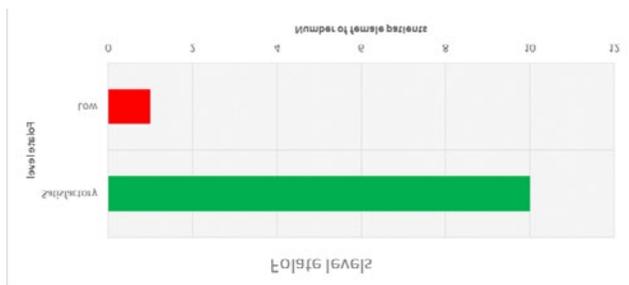
Out of the 9 female patients who were investigated for B12 levels, 1 was found to have high B12 level (11.1%).



(Figure 4)

### Folate Levels

Out of the 11 patients who were investigated for folate levels, 1 patient was found to have low folate level (9 %).



(Figure 5).

### Zinc Level

16 out of 17 patients were investigated for Zinc Levels. 7 out of the 16 (43.7%) patients were found to have low Zinc Levels.



(Figure 6)

### Hormone Levels

Out of the 17 female patients who presented with hair loss as a presenting complaint, 3 (17.6%) were found to have irregular periods on clinical history. These patients were investigated for SHBG (Sex Hormone Binding Globulin). 2 out of the 3 patients were noted to have low SHBG levels (66.6 %).

### Discussion

Currently, there is paucity in studies explaining the role of micronutrients such as Vitamin D, ferritin, B12, folate and zinc in the pathogenesis of Alopecia in young women. This cross-sectional study serves to highlight the importance of investigating the levels of micronutrients in female patients suffering from alopecia. This would potentially help to raise awareness among dermatologists to promote the culture of routinely investigating blood levels in female patients who present with alopecia.

This current study highlights that Vitamin D levels were found to be low in 93.54 % of the female patients who presented with alopecia, as illustrated by Figure 1. These findings are in line with a 2013 study conducted by Rasheed et al which investigated the role of Vitamin D in women with FPHL and chronic telogen effluvium [10]. This 2013 study reported low concentration of D2 vitamin in serum of women aged 18-45 with telogenic hair loss and FPHL compared to the control group [10]. A 2017 study in the Indian Dermatology Journal noted that levels of Vitamin D were reduced in patients with Alopecia Areata (AA) [11]. A significant negative correlation between the levels of serum Vitamin D and severity of Alopecia Areata was also reported in this study along with a recommendation

that vitamin D supplementation should be a part of treatment for AA [11]. This is consistent with the current findings in which female patients with alopecia were found to be Vitamin D deficient. Thus, it is highly important to investigate vitamin D levels when treating female patients who present with alopecia.

On the other hand, a 2012 Nigerian study on men suffering from androgenic alopecia noted no significant difference noted between Vitamin D level in patients and the control group [12]. Another cross sectional study of 296 men with male pattern alopecia carried out in New Zealand found no link between the severity of alopecia and serum levels of Vitamin D3 in the patients [13]. These two studies, which revolve around male population suffering from AGA explain the lack of link between the extent of androgenic alopecia in men and vitamin D levels. Thus, it could be concluded that Vitamin D deficiency is likely to be involved in FPHL or androgenic alopecia through androgen-independent mechanisms. This highlights the importance of testing vitamin D levels in women presenting with alopecia as FPHL is also seen in women without elevated androgen levels [5].

It is a common practice for dermatologists to assess serum iron status in women because of the assumption that iron deficiency (as measured by serum ferritin levels) causes alopecia despite minimal evidence to support this practice [14]. According to the current study we conducted, serum ferritin levels < 20 ng/ml is considered abnormal. However, serum ferritin levels from 20- 60 ng/ml may require treatment. It has been recommended by few authors that maintaining serum ferritin levels of more than 40 ng/mL or 70 ng/mL would help reverse severe hair loss due to TE (Telogen Effluvium) as ferritin levels less than 40 ng/ml as well as levels between 40 ng/ml and 70 ng/ml have been highly associated with telogen hair loss in previous studies [15,16].

Results from the current study suggest that 62% of the female patients suffering from alopecia were found to have abnormal ferritin results of < 20 ng/ml. If we add those who may need treatment who have ferritin levels between 20 - 60 ng/ml then the percentage of patients needing supplementation rises to 75%. These findings are in agreement with a 2003 study conducted by Kantor et al which demonstrated that alopecia areata and AGA and under the age of 40 showed lower serum ferritin concentration than controls without hair loss. However, the mean ferritin levels in patients with TE were not significantly lower than the control group [16]. On the other hand, a 2017 study conducted in Egypt noted that low iron levels is likely to contribute to TE among premenopausal women and recommends checking haemoglobin levels in acute TE and monitoring serum ferritin levels in chronic TE [17]. The low ferritin levels noted in female patients with alopecia could possibly be due to the fact that iron is a co-factor for ribonucleotide reductase, a rate limiting enzyme involved in DNA synthesis. Depletion of iron levels in the body could prevent proper functioning of ribonucleotide reductase, which in turn results in inhibition of proliferation, causing hair loss [18]. Thus, ferritin levels should be part of the screening test in these patients. In contrast to these results, Olsen et al reported that despite iron deficiency being a common issue amongst females, the incidence of iron deficiency was not higher in patients with hair loss (FPHL or TE) [19].

Two out of the eight water-soluble vitamin substances of the Vitamin B Complex (Vitamin B12 and folate) were investigated in this current

study. B12 levels were noted to be of very little significance in the disease process of alopecia as suggested by Figure 4 in which only one patient was found to have a high B12 level compared to the other subjects. It was also noted that only one out of the 11 patients who were investigated for folate levels was noted to have a low level (9 %), as illustrated by Figure 5. In line with these results, a reduction in vitamin B12 levels in females with AGA treated with ethinyl estradiol and cyproterone acetate were reported by Ramsay et al in a 1990 study [20]. It was noted that the B12 deficiency in these patients caused vitamin B12-related anxiety, causing some patient to stop treatment. The B12 levels were corrected with a daily 200 µg vitamin B12 supplement. However, the reduction in vitamin B12 levels in itself was not found to have any impact on hair shedding.

Data from this current study showed that zinc levels are possibly linked to alopecia as 43.7 % of the female patients investigated were found to have low Zinc Levels. These findings are supported by a study of 312 patients with Alopecia Areata (AA), Male pattern hair loss (MPHL), FPHL (Female pattern hair loss), or TE (Telogen Effluvium) showed that all groups had statistically lower zinc concentrations compared to the 30 healthy controls in the study [21]. In patients with AA and low serum zinc levels, supplementation has been shown to have therapeutic effects. This highlights the need to check Zinc levels as part of the routine blood tests for female patients who present with alopecia.

Hormones like androgens, growth hormone, estradiol, thyroxine, prolactin, and melatonin all may have stimulatory or inhibitory on hair growth. Furthermore, it is long believed that thyroid dysfunction including hypothyroidism, hyperthyroidism and parathyroid disorders all can cause hair loss [22]. In our study 30.7% (Figure 3) of patients showed abnormal thyroid function test this raised the importance of checking TFT early in the investigations.

Furthermore, this study also investigated the link between irregular periods and alopecia. It was noted that 66.6% of the patients with irregular periods who complained of alopecia presented with low SHBG (Sex Hormone Binding Globulin). When SHBG levels are low, testosterone can function abnormally high despite of the normal level. In a 1982 study by Miller et al noted that there was a significant reduction in SHBG (Sex Hormone Binding Globulin) levels in a group of eight women aged 21-41 years who complained of diffuse hair loss, compared to a control group of women of similar age range who did not present with alopecia [23]. However, testosterone levels were noted to be normal in that study group. In line with these results, a 1986 study by De Villez et al noted that female patients with a marked increase in the  $3\alpha$ ,  $17\beta$ -androstenediol glucuronide/sex hormone binding globulin ratio and low serum SHBG (Sex hormone binding globulin) were noted to have female pattern alopecia [24]. This highlights the importance of testing for levels of sex hormones to rule out the possible causes of hair loss in female patients such as polycystic ovarian syndrome, etc [25].

Although the sample size of this study is relatively small, however, it only concentrates on a specific age group of women and excludes different types of hair loss like alopecia areata and scarring alopecia and this gives it reliability. It will be our task to investigate and study the hair loss in women of other age groups.

## Conclusion

Conclusively, results from this current study shed a greater light on the importance of investigating the levels of micronutrients, haemoglobin, vitamins, minerals and hormones in young female patients who present with alopecia. This will raise awareness and help dermatologists get a better understanding of the need to check these levels of micronutrients. It should also be a routine practice amongst primary care practitioners to check these levels before referring patients to secondary care for dermatologist review. This would not only reduce the burden of dermatological services in secondary care but also expediate the process of treating these female patients.

This study is an initial step in identifying the causes in the pathogenesis and treatment of alopecia. Research focused on female population of different age groups affected by alopecia is currently ongoing. This research focus on the young age group of 20-30 years old presenting with Hair loss. An age where the hair should be at its peak. Early investigation for hair loss at this age group can identify the underlying contributing factor where the treatment can be well defined and straight forward. Future research should focus on studying the therapeutic effects of vitamins in alopecia, especially FPHL to raise awareness of the role of routine blood tests to investigate the levels of micronutrients in this group of female patients.

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