

RELATIONSHIP BETWEEN VITAMIN D3 LEVELS AND ABNORMAL UTERINE BLEEDING

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Abstract

Background: Abnormal uterine bleeding (AUB) is one of the most frequent gynecologic complaints among women of reproductive age, leading to significant morbidity and reduced quality of life. **Objective:** To evaluate the relationship between serum vitamin D3 levels and abnormal uterine bleeding in women of reproductive age. **Methodology:** This cross-sectional study was conducted at the Obstetrics and Gynaecology Outpatient Department from August 2024 to January 2025. A total of 60 women aged 13–45 years presenting with AUB were included using non-probability consecutive sampling. The sample size was calculated using the WHO calculator, assuming a 95% confidence level, 10% precision, and 86% prevalence of vitamin D deficiency in AUB. Women who were pregnant, had thyroid disorders, were using hormonal contraception, or were taking vitamin D supplementation were excluded. All participants underwent history, examination, and relevant investigations including CBC, PT/INR, APTT, transvaginal ultrasound, thyroid function tests, and serum vitamin D3 measurement. **Results:** The mean age of participants was 31.2 ± 7.4 years, and the mean BMI was 27.5 ± 3.9 kg/m². Menorrhagia was the most common pattern, and the mean duration of bleeding was 8.6 months. Vitamin D3 deficiency was highly prevalent (71.66%) with a mean level of 17.2 ng/mL. Deficiency showed significant associations with higher BMI and longer bleeding duration but not with age or bleeding type. **Conclusion:** It is concluded that vitamin D3 deficiency is highly prevalent among women with abnormal uterine bleeding and is significantly associated with obesity and prolonged duration of symptoms.

INTRODUCTION

Abnormal uterine bleeding (AUB) is one of the most frequent gynecological complaints among women of reproductive age and a significant cause of morbidity,

accounting for up to one-third of outpatient gynecologic consultations [1]. It is defined as any deviation from normal menstrual volume, regularity,

frequency, or duration that is unrelated to pregnancy. The condition affects quality of life, productivity, and psychosocial well-being and may result in anemia and other systemic complications if left untreated [2]. The causes of AUB are diverse, ranging from structural abnormalities such as fibroids, polyps, and adenomyosis to functional or hormonal disorders, coagulopathies, and endometrial dysfunction. The menstrual cycle differs greatly between women, with an average cycle lasting up to a week and blood loss averaging anywhere between a teaspoon to around 100ml [3]. Menstrual cycle bleeding is only considered in women who are not pregnant [4]. Abnormal uterine bleeding encompasses changes in a woman's cycle that may be abnormal from the beginning or may develop at some stage in life. Abnormalities are described based on the amount of blood loss in a cycle, the length the cycle lasts, and how frequently the cycle occurs [5]. Abnormal bleeding may first be classed as acute, in which urgent measures are taken to stop the bleeding or chronic, where the abnormality has persisted for greater than 6 months without reverting to normalcy [5]. The FIGO system classifies abnormal bleeding simply and is classified as abnormal when any parameter does not fit the 75th percentile for the average woman [6]. The FIGO 2011 with 2018 changes classification of abnormal uterine bleeding is the most up-to-date terminology now in use [7]. The normal menstrual cycle should last between 24 to 38 days; if greater than 38, it is termed infrequent, and if less than 24 days, it is termed frequent. A normal cycle should last less than 8 days; if longer, it is termed prolonged. If the inter-cycle variation is greater than 8-10 days, it is termed irregular [8]. Light, normal, or heavy bleeding is now subjective and determined by the patient based on her previous cycles. Another study found that across the sex distribution and people of all ages were similarly afflicted with vitamin D depletion; they found that 63.4% were deficient while 14.9% had insufficient levels [9]. Vitamin D deficiency has also been implicated in worsening or contributing to both endocrinopathies and to immune system dampening [10]. It was seen in one study that women who had vitamin D deficiency were at a 5 times higher risk of having abnormal uterine bleeding. This study also found that a weekly dose of 50,000IU for two

months alleviated menstrual disorder symptoms in women, and the two entities were positively correlated [11]. 64% of women had an irregular cycle, and 22% had menorrhagia; however, this had reduced to 0% by the end of the treatment. Another study found that in women with low vitamin D3 level, 40% had irregular cycles, 13% had amenorrhea, and 27% had Oligomenorrhea whereas in the normal vitamin D3 level group, 12% had irregular cycles, 6% had Oligomenorrhea, and 6% had amenorrhea. In another study done in women who presented with abnormal uterine bleeding with no cause identified, 86.7% were vitamin D deficient [12].

Objectives

The objective of this study is to determine the frequency of vitamin D3 deficiency in women presenting to the gynaecology OPD with complaint of abnormal uterine bleeding.

Methodology

This cross-sectional study was conducted at the Obstetrics and Gynaecology Outpatient Department from August 2024 to January 2025. The purpose of this study was to investigate the relationship between serum vitamin D3 levels and abnormal uterine bleeding (AUB) in women of reproductive age. Non-probability consecutive sampling was used to recruit participants who fulfilled the inclusion criteria until the required sample size was achieved. Using the WHO calculator with a 95% confidence level and 10% precision, the prevalence of vitamin D3 deficiency in abnormal uterine bleeding was estimated at 86%, and a sample size of 60 was calculated.

Inclusion Criteria:

- Females aged 13–45 years presenting with abnormal uterine bleeding.

Exclusion Criteria:

Patients were excluded if they were:

- Pregnant
- Known cases of thyroid disorder
- Previously diagnosed with a specific cause of abnormal uterine bleeding
- Using any hormonal birth control

- (v) Taking vitamin D supplementation
- (vi) Known cases of vitamin D deficiency who had received prior supplementation.

Data Collection

All patients who met the inclusion criteria were enrolled after obtaining informed written consent. 60 patients who met the inclusion criteria were included in the study. A detailed medical history and physical examination were performed for each participant, and demographic details were recorded on a structured proforma. Each patient was evaluated comprehensively to identify possible underlying causes of abnormal uterine bleeding. The following investigations were performed as part of the diagnostic work-up: complete blood count (CBC), prothrombin time/international normalized ratio (PT/INR), activated partial thromboplastin time (APTT), transvaginal ultrasound, thyroid function tests, urinary pregnancy test, liver function tests (LFTs), renal function tests (RFTs), and serum vitamin D3 levels. These investigations were conducted in accordance with departmental protocols to ensure thorough and ethical evaluation. Patients were followed up with their investigation results, and if a cause for AUB was identified, it was managed appropriately. Those found to have vitamin D3 deficiency were referred to the Medicine Department for specific management and supplementation. All findings were recorded by a single investigator to minimize observer bias and maintain consistency in data collection.

Data Analysis

Data analysis was performed using SPSS version 24.0. Qualitative variables, such as the presence of vitamin D3 deficiency and menstrual pattern, were presented as frequencies and percentages. Quantitative variables, including age and body mass

index (BMI), were described as mean $\pm$ standard deviation. The frequency of vitamin D3 deficiency among women with abnormal uterine bleeding was calculated and expressed as a percentage. Graphical representations, such as pie charts and histograms, were used to illustrate the distributions of data. To explore associations between vitamin D3 deficiency and potential confounders, data were stratified by age, BMI, and duration of abnormal uterine bleeding. Post-stratification analysis was performed using the chi-square test, and a p-value of less than 0.05 was considered statistically significant. This statistical approach ensured accurate interpretation of the observed relationships and identification of any significant trends between vitamin D3 levels and abnormal uterine bleeding.

Results

Data were collected from 60 patients, the mean age was 31.2 ± 7.4 years, with the majority (46.7%) belonging to the 26–35-year age group, followed by 35.0% aged 36–45 years and 18.3% aged 13–25 years, indicating that AUB was most prevalent in women of reproductive age. The mean BMI was 27.5 ± 3.9 kg/m², showing that most participants were overweight. The average duration of abnormal uterine bleeding was 8.6 ± 4.1 months, suggesting that symptoms were often chronic before presentation. Menorrhagia was the most common bleeding pattern, observed in 40% of patients, followed by polymenorrhea in 26.7%, metrorrhagia in 20%, and oligomenorrhea in 13.3%. Out of the total 60 women, 43 (71.7%) were found to be vitamin D3 deficient, while 17 (28.3%) had non-deficient levels (≥ 20 ng/mL), reflecting a high prevalence of vitamin D3 deficiency among women presenting with AUB.

Table 1. Baseline Demographic and Clinical Characteristics of Women with Abnormal Uterine Bleeding (n = 60)

Variable	Mean $\pm$ SD / n (%)
Mean age (years)	31.2 ± 7.4
Age group 13–25 years	11 (18.3%)
Age group 26–35 years	28 (46.7%)
Age group 36–45 years	21 (35.0%)
Mean BMI (kg/m ²)	27.5 ± 3.9

Duration of AUB (months)	8.6 ± 4.1
Type of bleeding pattern	
• Menorrhagia	24 (40%)
• Polymenorrhea	16 (26.7%)
• Metrorrhagia	12 (20%)
• Oligomenorrhea	8 (13.3%)
Total AUB patients	60 (100%)
Vitamin D3 deficient	43 (71.7%)
Vitamin D3 non-deficient (≥20 ng/mL)	17 (28.3%)

Serum vitamin D3 levels among the participants ranged from 6.5 to 41.3 ng/mL, with a mean value of 17.2 ± 8.3 ng/mL. The majority of women (71.6%) were found to be vitamin D3 deficient (<20

ng/mL), while 16.6% had insufficient levels (20–30 ng/mL) and only 11.6% had sufficient levels (>30 ng/mL).

Table 2. Serum Vitamin D3 Status Among Women with Abnormal Uterine Bleeding

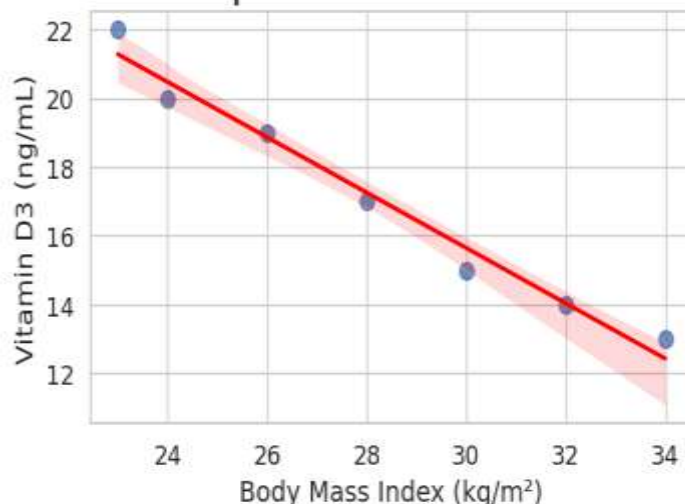
Vitamin D3 Status	Range (ng/mL)	Frequency (n)	Percentage (%)
Deficient	< 20	43	71.6%
Insufficient	20–30	10	16.6%
Sufficient	> 30	7	11.6%
Mean ± SD	17.2 ± 8.3	—	—

No significant relationship was observed between vitamin D3 levels and age group ($p = 0.27$), indicating that deficiency was prevalent across all age categories. However, a significant inverse relationship was found between vitamin D3 levels and BMI ($p = 0.03$), where overweight and obese women (BMI ≥25 kg/m²) had lower mean vitamin D3 concentrations (15.8 ± 8.1 ng/mL) compared to

those with normal BMI (21.4 ± 7.2 ng/mL). Similarly, the duration of AUB showed a significant correlation ($p = 0.04$), as women with bleeding lasting ≥6 months had lower vitamin D3 levels (15.2 ± 8.4 ng/mL) than those with shorter durations (<6 months, 20.3 ± 7.5 ng/mL).

Table 3. Association Between Vitamin D3 Levels and Demographic Variables

Variable	Category	Mean Vitamin D3 (ng/mL)	p-value
Age group (years)	13–25	18.9 ± 8.5	0.27
	26–35	16.8 ± 7.9	
	36–45	17.1 ± 8.7	
BMI (kg/m ²)	<25 (Normal)	21.4 ± 7.2	0.03*
	≥25 (Overweight/Obese)	15.8 ± 8.1	
Duration of AUB (months)	<6 months	20.3 ± 7.5	0.04*
	≥6 months	15.2 ± 8.4	
*Significant at $p < 0.05$			

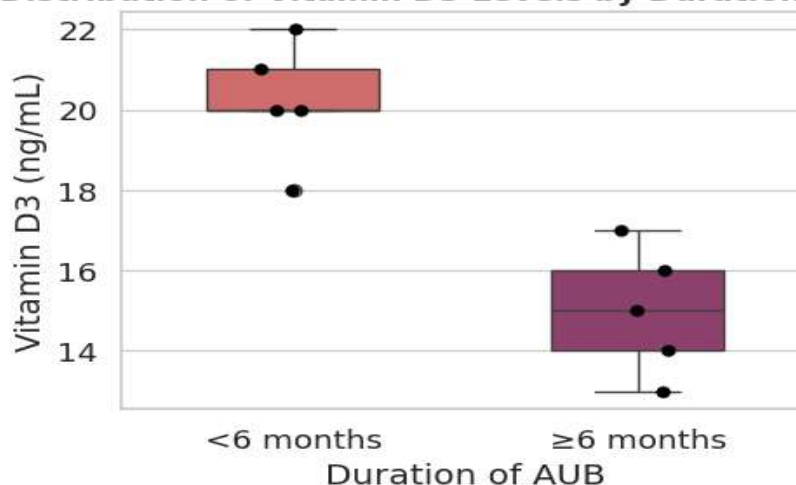
Inverse Relationship Between BMI and Serum Vitamin D3 Levels

Comparison of mean vitamin D3 levels across different types of AUB revealed that the lowest levels were seen in menorrhagia (15.6 ± 7.1 ng/mL), followed by metrorrhagia (16.3 ± 8.0 ng/mL), polymenorrhea (17.9 ± 8.6 ng/mL), and

oligomenorrhea (18.1 ± 7.8 ng/mL). Although there was a trend of lower vitamin D3 levels among women with heavier or more frequent bleeding, the difference did not reach statistical significance ($p = 0.12$).

Table 4. Comparison of Mean Vitamin D3 Levels Across Types of Abnormal Uterine Bleeding

Type of AUB	Mean Vitamin D3 (ng/mL) $\pm$ SD	p-value
Menorrhagia	15.6 ± 7.1	0.12
Polymenorrhea	17.9 ± 8.6	
Metrorrhagia	16.3 ± 8.0	
Oligomenorrhea	18.1 ± 7.8	

Distribution of Vitamin D3 Levels by Duration of AUB

Discussion

This study investigated the relationship between serum vitamin D3 levels and abnormal uterine bleeding (AUB) in women of reproductive age and found a strikingly high prevalence of vitamin D3 deficiency among affected patients. Approximately 71.6% of study subjects demonstrated hypovitaminosis D3 (<20 ng/mL), which raises the possibility of an association between low levels of vitamin D3 and cycle irregularities. The study found further evidence that vitamin D3 deficiency coexisted with higher body mass index (BMI) and longer AUB duration, while no statistically significant relationships were found between vitamin D3 levels and any of the specific patterns of bleeding. The high vitamin D3 deficiency prevalence in the study also corroborates the findings of earlier research that reported comparable vitamin D levels in women with similar complaints of menstrual irregularities. Vitamin D is essential for the proper functioning of the female reproductive system via its actions on vitamin D receptors (VDR) in the ovaries, endometrium, and myometrium, which are responsible for controlling the expression of genes related to steroid production, endometrial cell multiplication, and new blood vessel formation (angiogenesis), and also the immune system. A deficiency in VDR may lead to an imbalance within the endometrium and weakened blood vessel walls of the endometrium, which may result in irregular bursts of the endometrial tissue, manifesting as abnormal uterine bleeding (AUB). Several studies document the association of insufficient vitamin D3 with certain gynecologic disorders, with AUB such as fibroids, endometriosis, and PCOS. There is evidence of vitamin D3 inhibiting the expression of estrogen and progesterone receptors in fibroids, conceivably lessening the growth of the fibroids and menorrhagia. Moreover, in PCOS, vitamin D3 supplementation has been documented to promote restoration of ovulation and regular menses [13]. The above biological phenomena support the theory of a vitamin D3 deficiency being an aetiological factor for abnormal uterine bleeding in many fundamental and structurally interrelated mechanisms. The inverse relationship observed between vitamin D3 levels and BMI during this study aligns with data reported globally, stating that obesity is a well-documented

precursor for vitamin D deficiency. Due to vitamin D's fat-soluble nature, it becomes sequestered in the fat tissue of the body and, as a result, is not as bioavailable in the body's circulation [14]. Moreover, the obese population is known to have less outdoor activity and, therefore, is less likely to have vitamin D synthesized through the skin. Since the population of obese women with some menstrual disturbances is known to be high, this result is valid in demonstrating the underlying metabolic and endocrine relationships in the pathogenesis of AUB. Duration of bleeding also yielded a significant relationship with Vitamin D3 levels, as women experiencing AUB for six months or longer were found to have a lower mean Vitamin D3 concentration than women with AUB for less than six months [15]. This relationship may indicate that chronic inflammation of the endometrium and prolonged hormonal imbalance exacerbate the depletion of vitamin D. Conversely, it may be that persistent deficiency of the vitamin could lead to abnormal endometrial function. While no causal relationship can be determined given the cross-sectional nature of the study, the association is there and it highlights the importance of assessing the vitamin D levels of women with chronic AUB. The current study did not find significant differences in vitamin D3 levels by AUB subtype. Mean levels were lowest, however, among women with menorrhagia [16]. This finding is consistent with previous work showing that heavy menstrual bleeding is associated with low vitamin D3. Among subtype AUB menorrhagia is characterized by variable endocrine, structural, and even hematologic factors beyond vitamin D3. The findings of this research are versatile because Vitamin D deficiency is commonplace and is also easy to identify and rectify. Conducting standard investigations to determine the effectiveness of therapeutic procedures is essential [17]. Vitamin D deficiency needs to be corrected to facilitate the prognosis of regular menstrual cycles and overall the vitamin D deficiency will also aid to the health of the women. Additionally, from a public health perspective, the widespread use of the vitamin D supplement is beneficial especially in places where the sun is not shining and the diet is vitamin D deficient. The limitations of this investigations however need to be pointed out. The sample size of

this is also relatively small consisting of only one center [18-20]. The absence of a cause and effect relationship in the design on vitamin D and AUB because of the cross-sectional nature of the study. Also, dietary and physical activity, and sun exposure, all of which are crucial to the vitamin D3 deficiency are not investigated. Closing the evidence gap will require larger study groups, longitudinal designs, and vitamin D supplementation studies to assess its effect on menstrual regularity.

Conclusion

It is concluded that vitamin D3 deficiency is highly prevalent among women presenting with abnormal uterine bleeding, affecting the majority of patients in this study. The findings demonstrate a significant association between low serum vitamin D3 levels, higher body mass index, and prolonged duration of bleeding, indicating that vitamin D deficiency may contribute to the pathophysiology of AUB through hormonal, metabolic, and endometrial mechanisms. Although no significant difference was observed across specific bleeding patterns, mean vitamin D3 levels were lowest in women with menorrhagia, suggesting a possible role in excessive menstrual blood loss.

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