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The Relationship of Serum Vitamin 25(OH)D_3-Levels with Women Obesity

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ABSTRACT

Objectives: *This paper aims to evaluate the relationship between vitamin D3 levels and obesity in adult women compared to normal weight women.* ***Method:*** *Ninety-six (96) women them age around (20-50) years were collected and classified into three groups based on BMI categories. ELISA kit was used to measure vitamin D3 levels in serum of blood.* ***Results:*** *The results showed significantly lower vitamin D3 levels (15.28±1.13) in obese and overweight women (22.46 ±1.31) compared to normal weight group (34.40 ±2.43) at p≤ 0.05, and a negative significant correlation between vitamin25(OH) D3 levels and BMI in obese women.* ***Novelty:*** *This finding suggested that vitamin D3 deficiency in obese women may be due to its storage in adipose tissue which reduces its levels in the bloodstream. In addition to other different mechanism. More studies are required for detect the complex interchange between vitamin D3 and obesity to know more about the biological mechanism of action.*

INTRODUCTION

One of the most prevalent and widespread health problems is overweight and obesity in the world and represent a growing public health challenge, particularly among women [1], [2]. Scientific evidence suggests that obesity in women is not limited to weight, but is associated with many complex physiological and hormonal changes that directly affect reproductive health and metabolism [3], [4]. Among the most prominent of these changes is the disruption of hormonal balance, particularly with regard to the hormones oestrogen, progesterone and insulin, which may contribute to the exacerbation of obesity or difficulty in losing weight [5], [6].

In addition, several studies have identified a robust link between the presence of obesity and the occurrence of vitamin D_3 decreases, an essential nutrient that plays an important role in regulating many vital functions, including supporting the immune system, maintaining bone health and participating in hormonal balance [7]. Vitamin D is a steroid vitamin often known as the sunshine vitamin, which is one of the most important nutrients and primary hormones for women health [8]. The skin exposure to ultraviolet light enhance the synthesized of the vitamin as the dehydrocholesterol in the skin absorbs UV light at wavelengths of 290-300 nanometers to formation vitamin D3 [9]. The suitable amount and wavelength of sunlight is important for vitamin D_3 production [10]. There may be issues with absorption and the use of antibiotics and chronic and metabolic diseases that cause decreases vitamin D_3levels within the body [11].

Vitamin 25(OH)D_3 deficiency is a problem that particularly affects women, people with overweight and obesity, dark skin subjects and whom in places with thick layer of ozone are more likely to develop a deficiency of this vitamin [12].

Vitamin D is crucial for cell differentiation and proliferation, and essential for functions of immune system, as well as has been identified as a crucial factor in the prevention and treatment of some types of cancers, rheumatoid arthritis, plaque sclerosis, high blood pressure, obesity, psoriasis, osteoporosis and mental diseases [13], [14].

Vitamin D deficiency is believed to contribute to the development of hormonal disorders, and excess adipose tissue may interfere with its absorption or metabolism in the body [15].

This research purposes are investigating an association between female obesity and vitamin D_3 deficiency, focusing on the potential biological mechanisms and health implications of this complex interaction. It also seeks to highlight the importance of early detection and integrated therapeutic intervention to minimize the negative effects of these overlapping health phenomena.

RESEARCH METHOD

Subjects and Methods

Ninety-six (96) women their age between 20 and 50 years has been obtained from private laboratories located in the city of Al- Hilla, which is situated within the province of Babylon for this study, during the period from September 2024 to March 2025.

In this study, women were separated into three groups, group I (30 women apparently heathy with normal weight as a control group), group II (35 women who have overweight), and group III (31 women with obesity). An entire history was collected, involving name, age, past medical and drug history, and chronic disease.

The body. Mass.index.(BMI) was calculated by dividing the women's weight in (kg) by their height in (m^2). According to world health organization (WHO) classification system, BMI is divided into three categories as a "normal weight "is defined as a BMI of 18.5to24.9kg/$m^{2)}$, "overweight" is defined as a BMI of25 to 29.9kg/m^2, "obese" is defined as a BMI of 30 or higher kg/m^2) [16]. Blood samples were collected for measurement of vitamin D3. Five milliliters of blood were obtained via venipuncture after an overnights fast between 8:30 a.m. and 11:30 a.m. Serum levels of Vitamin D_3 were measured using commercially available enzyme-linked-immunosorbent-assay (ELISA)kit "Pars-Biochem-Nanjing-Jiangsu-China" in strict accordance with the "manufacturer's instructions".

Statistical Analysis

The analyses were conducted utilizing IBMSPSS statistics, version 23 (IBM-Armonke- New York-U.S.A). A one-way analyses of variance (A.N.O.V.A) was employed to compare the levels of vitamin D_3 and the BMI of the subjects under consideration. Post.Hoc.test with least significant difference (LSD) correction were used for multiple comparisons with a significance level set at a ($p. \leq 0.05$) significant level. To ascertain the existence of a relationship between vitamin D_3 levels and BMI, a correlative analysis and Pearson's correlation coefficient were employed. The numeral dataset were expressed as the (mean M± standard error SE).

RESULTS AND DISCUSSION

Results

Serum data of vitamin D_3 levels were showed a significant decrease in the overweight and obese women groups (22.46 ±1.31), (15.28±1.13) respectively as comparison to that in the control group (34.40 ±2.43) at ($p \leq 0.05$), see Figure 1.

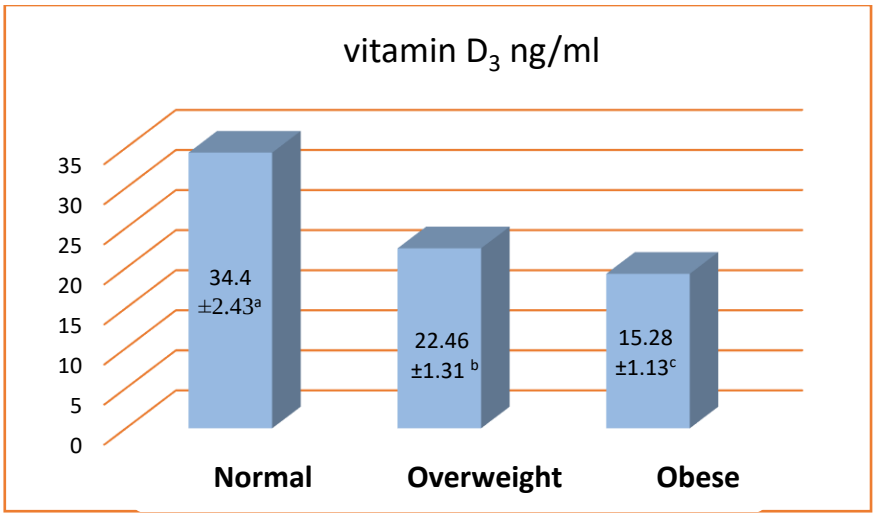

Figure 1. Association between (mean± SE) serum vitamin D_3 ng/ml levels and BMI categories.

Different small litters denoted significant difference between groups.

Moreover, the study groups classified into three categories according to age classification, (20-29) year which included (N= 50 women), (30-39) year (N= 30 women), and (≥ 40) year (N= 16 women). The levels of serum vitamin D_3 showed no significant differences with age in study groups as showed in Figure 2.

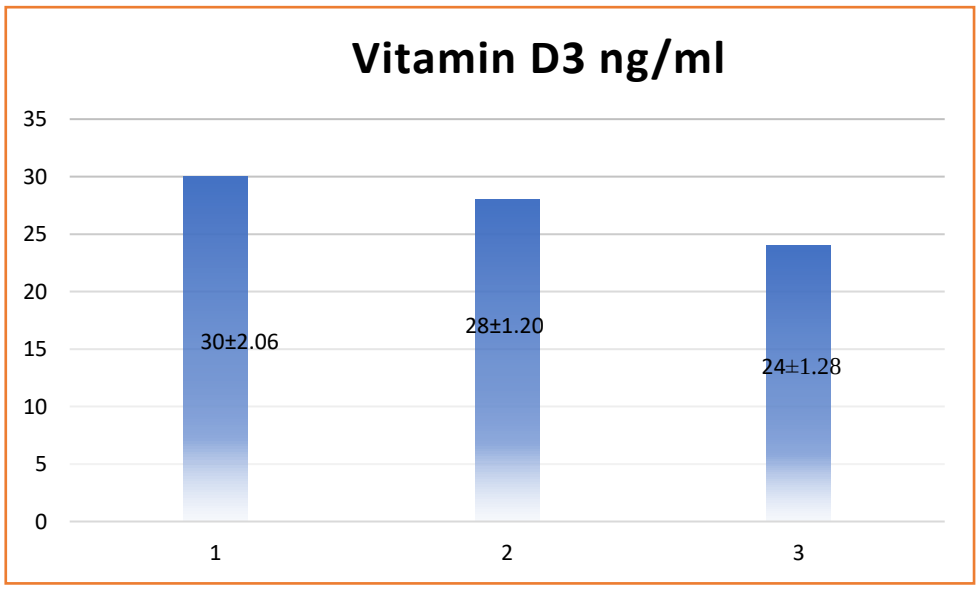

Figure 2. Association between (mean± SE) serum vitamin D_3 ng/ml levels and Age categories. 1. (20-29) year, 2. (30-39) year, and 3. (≥ 40) year.

To explore the correlation between serum vitamin D_3 and BMI in this study as exhibited in Table 1, the Pearson's correlation coefficient was employed to analyze the data, revealing a negative and statically significant relationship between vitamin D_3 levels and BMI in obese women (r=- 0.61, p= 0.05). Further, results for 25-hydroxyvitamin D_3 showed a positive non-significant correlation with BMI in normal weight and a negative non-significant in overweight groups.

Table 1. Relationship between vitamin D_3 levels in serum and BMI in Study Groups.

Parameter / BMI	Vitamin D_3	
	r	**p**
Normal weight	0.25	0.17
Overweight	- 0.28	0.09
Obese	- 0.61	0.05*

Significant at P≤ 0.05.

Discussion

Vitamin D_3, also referred to as colecalciferol,is a "soluble vitamin in fats" that plays a pivotal role in maintaing bone health by regulating body phosphate and calcium elements levels, also it is known for its involvement in, muscle strength, immune function and cell growth [17]. In obese individuals, fat mass increases, which leads to vitamin retention in fat cells and decreases its bioavailability in circulatory system [18]. In this study, the data exhibited a significant lower in vitamin levels in overweight and obese women this agreement with study indicated that in obese individuals, the increased amount of fat may sequester vitamin D causing decrease bioavailability of vitamin D even if adequate levels are consumed through diet or supplements [19]. On the other hand, a recent study suggests that leptin hormone, secreted by adipose tissue cells, may inhibit the expression of vitamin D receptors in some cells, reducing its effectiveness even if the vitamin level is within the normal range [20]. As well, leptin reduces vitamin D receptor expression in immune cells and the liver [21]. Another study also suggested that leptin affects the activity of enzymes responsible of conversion the vitamin to its active form in the kidneys and in liver, such as the CYP27B1 enzyme, thus reducing the effectiveness of the vitamin [22]. Moreover, leptin resistance in obese individuals stimulates inflammation, and chronic inflammation alters vitamin metabolism and inhibits its immune effect [23].

A study of obese men and women revealed that weight reduction resulting from a low- calorie diet was associated with elevated levels for 25hydroxyvitamin D_3 of the serum. This increase of 25hydroxyvitamin D_3levels was observed in both sexes, though it was more pronounced in women, with a direct correlation between increased 25hydroxyvitamin D_3 levels with greater weight loss in women [24], [25].

Moreover, as women's weight increases, the prevalence of hormonal disorders increases concomitantly. Polycystic.ovary.syndrome (POCS) has recognized as one of a generality prevalent hormonal defects in obese women. Siahaan *et al*, observed a substantial positive impact of vitamin supplements on improving the hormonal status of obese women [26].

A recent study have shown that vitamin D_3 has a so important role in improving the cells sensitivity to insulin, as it enhances insulin secretion and reduces chronic inflammation that increases insulin resistance, as adipose tissue level rise, the body's production of inflammatory cytokines such as interleukins"IL-6", TNF-alpha , concomitantly increases that impair insulin signaling [27]. So, another study indicated an inverse association between vitamin D_3 levels and insulin resistance in obese women with diabetes or PCOS [28].

So, another study indicated a converse relation of both insulin resistance and levels of 25-hydroxyvitamin D_3, suggesting that a deficiency of vitamin D_3 might contribute to the development of insulin resistance [29].

Lei, *et al*, explained that the administration of vitamin D_3 supplementation to obese adolescent girls resulted in enhanced insulin sensitivy [30].

In addition, contributing factors to vitamin D_3 deficiency include sedentary lifestyle, decrease physical activity, exposure to sun-light deficiency, and diet deficient in vitamin D (26).

CONCLUSION

Fundamental Finding : The study demonstrates a significant negative relationship between serum vitamin D3 levels and overweight or obesity among women, with obese individuals showing notably lower vitamin D levels compared to those of normal weight. **Implication :** These results suggest that obesity may contribute to decreased vitamin D levels, highlighting the need to include vitamin D assessment in the management plans for obese women. **Limitation :** However, the study does not explore the underlying biological mechanisms, which limits the depth of causal understanding. **Future Research :** Future investigations are recommended to uncover the biological pathways involved in this association and to examine whether improving vitamin D status could help prevent obesity-related complications.

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