Association Between Vitamin D and Serum Ferritin with Obesity in Iraqi Population: Case Control Study

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Abstract
Background: Obesity has become pandemic due to obesogenic environment (cheap calorie dense food, new technologies and changes in communities that reduce physical activity) and excessive emphasis on low fat intake resulting in excessive intake of sugar and simple carbohydrates. In addition to that many reports found that obesity is associated with vitamin D deficiency and both are areas of concern in public health. Serum ferritin as acute phase reactant also may be associated with obesity as there is subclinical inflammation in obese subjects. The study aimed to find the association between vitamin D and serum ferritin with obesity. Method: 105 obese and 83 non obese had been included in this case control study and the level of vitamin D and serum ferritin measured in both groups. Results: the results show no significant difference between the obese and non-obese groups regarding vitamin D (p=0.987) and serum ferritin level(p=0.826). conclusion: serum ferritin level and vitamin D not associated with obesity in Iraqi population.
Keywords: obesity, vitamin D, ferritin.

1. Introduction

Obesity is a condition of increase accumulation of fat that accompanies numerous health problems. Obesity defined by world health organization as body mass index ≥30kg/m2 while overweight between 25-29.9kg/m2 1 Globally there is increase in prevalence of overweight and obesity.2 the prevalence among men 10.8% and women 14.9% worldwide.3
High percentage of obesity and overweight have been reported in many local studies in Iraq, a community based survey in Erbil city, Iraq (N=1480 adults in 2017), the prevalence of obesity was 40.9%4 while in southern Iraq, Basrah the overweight/obesity was 55.1%5. In a study in Baghdad, Iraq for non-pregnant women (N = 200, ≥18 years) attending outpatient clinics there were 39% overweight and 37% had obesity 6, and among female relatives of primary care attendees (N = 440) in Baghdad, the prevalence of obesity was 35.2%7. The prevalence of overweight/obesity in a national STEPwise approach to surveillance (STEPS) survey in 2005–2006 in Iraq (25–65 years) was 66.9% 8.
The prevalence of overweight/obesity in the Eastern Mediterranean region among adults ranges from 25% to 81.9%9. In Iran, 2016, the prevalence of overweight/obesity (BMI ≥25 kg/m2) was 59.3% 10. In 2017, in Jordan, overweight or obesity (BMI ≥25 kg/m2) was 74.5% among women and 77.2% among men (age ≥18 years) 11, and in Morocco, overweight was 35.5% and obesity 20.6% (age ≥18 years) 12.
In the Eastern Mediterranean region, the attributed risk factors for obesity may include sedentary lifestyle and dietary changes9. Also the overweight and obesity may rise in middle age 13,14 and elderly 4,5,6,7, among women 4,5,14,15, those with higher socioeconomic status13,14,16, illiterate women5, and those with urban residence 14,15,16,17. Some studies have shown that tobacco use is inversely associated with overweight/obesity 15,18,19, while poor dietary behavior, such as intake of foods high in fat and sugars or insufficient fruit and vegetables and physical inactivity are positively associated with overweight/obesity 18,19,20,21,22. Other studies have shown an association between overweight/obesity and non communicable diseases such as hypertension and diabetes 23,24. In a systematic review, depression increased the odds for developing obesity 25.
Obesity act as predisposing factor for subclinical inflammation. Many studies have concluded that overweight and obese people are in a state of an ongoing subclinical inflammation that can secondarily lead to more catastrophic events like iron deficiency, malignancy, and so forth 26,27,28.
Ferritin is used as a marker of iron deficiency in various healthcare facilities across the globe 29. Being an acute phase reactant, serum ferritin level is prone to be higher in overweight and obese people, because of a state of subclinical, but generalized inflammation in them 30,31,32. Due to this fact, using serum ferritin as a marker iron deficiency anemia in overweight or obese people is controversial 31,32.
This is so because there is a relative scarcity of more specific test for the diagnosis of iron deficiency anemia like transferrin saturation or total iron binding capacity and so forth. Therefore, the use and

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interpretation of serum ferritin assay alone become challenging.33

Vitamin D is essential for the maintenance of bone tissue, as well as for homeostasis of the minerals calcium and phosphorus. Its receptors have been found all over the human body indicating multiple functions. Since body vitamin D is mainly result of endogenous synthesis it is nowadays often considered as a hormone more than vitamin in the narrow sense. The active form of vitamin D, 1,25-dihydroxyvitamin D (1,25(OH)2D), not only stimulates calcium absorption, osteoclastic bone resorption, and osteoblast function and decreases PTH (parathyroid hormone) secretion but also has extraskeletal functions such as decreasing collagen type 1 production, enhancing muscular function, and stimulating cell differentiation, insulin secretion, and the immune system 34.

Numerous studies have analyzed calcifediol concentrations that may be decreased in obesity. One "superfluous" body mass index unit is known to induce a 1.15% reduction in the 25(OH)D concentration.35In particular, an analysis conducted in 58 obese adolescents demonstrated that a 1% increase in fat weight was associated with a 1.15 ± 0.55 nmol/L reduction in serum calcifediol.36

There is no consensus as to why calcifediol levels are decreased in obese individuals. The first (and most popular) point of view is that adipose tissue absorbs the fat-soluble vitamin D.37 Some available data reveal that serum 25(OH)D concentrations show a strong inverse correlation with fat volume and a weaker inverse correlation with body mass index 35.

Another hypothesis explains the low 25(OH)D concentrations by the fact that obese people lead a sedentary lifestyle and are less active physically, which entails a decrease in exposure to sunlight and in endogenous synthesis of vitamin D37.

In this study we aimed to find the association between the level of serum ferritin and vitamin D3 with obesity in Iraqi population.

2. Subjects and methods

This case control study was conducted in Al-Najaf teaching hospital , Najaf, Iraq during the period from June through November, 2021 . The study was approved by the institutional ethical review board of Arab board. Informed written consent was obtained from all study participants.

Total 257 healthy individuals between the ages of 18-60 years irrespective of gender were interviewed in detail regarding their medical, surgical and personal history to validate/confirm their suitability for inclusion in this study. Sixty-nine individuals were excluded on the basis of conditions which influence the result of study like pregnancy, alcoholism, hemoglobinopathies, diabetes mellitus, bleeding disorders, any acute illness during last one month, hypertension, thyroid disease. Finally, 188 subjects were included in the present study. The subjects were divided into two groups depending on body mass index(BMI), obese(BMI≥30) and non obese (BMI<30).

The weight and height of all the subjects were measured in kilograms and meters respectively, using a weight scale with a built-in Stadiometer. Subjects were asked to stand in an erect posture wearing light clothing. Body mass index was calculated using the following formula: (weight in kg / height in m2).23

Serum ferritin and vitamin D had been measured for all participants by using MINI VIDAS which is a compact automated immunoassay system based on the Enzyme Linked Flourescent Assay principle.

3. Results

A total of 188 subjects had been included in this study. There were 105 obese (BMI≥30) and 83 were non obese (BMI<30). The sociodemographic characteristics

Table (1) Sociodemographic characteristics of participants

		BMI (Kg/m2)		Total	P value
		≥30 (n=105)	<30 (n=83)		
Age/years	mean±SD	33.25±10.29	27.42±8.52		<0.001
Gender	Male	14	9	23	0.605
		60.9%	39.1%	100%	
	Female	91	74	165	
		55.2%	44.8%	100%	
Residence	Rural	21	22	43	0.292
		48.8%	51.2%	100%	
	Urban	84	61	145	
		57.9%	42.1%	100%	
Marrital_status	Married	84	42	126	<0.001
		66.7%	33.3%	100%	
	Single	21	41	62	
		33.9%	66.1%	100%	

Table 1 shows significant difference between obese groups and non-obese regarding age also obesity significantly associated with marital status were those who are married had higher percentage of obesity.

Table (2) Association between serum ferritin and obesity						
		BMI (Kg/m²)		Total	OR(95%CI)	P value
		>=30	<30			
S.ferritin ng/ml	Low	86	69	155	**0.918 (0.43-1.96)**	**0.826**
		55.5%	44.5%	100.0%		
	Normal	19	14	33		
		57.6%	42.4%	100.0%		

There is no significant association between serum ferritin and obesity as shown in table 2.

Table (3) Association between vitamin D3 and obesity						
		BMI (Kg/m²)		Total	OR(95%CI)	P value
		>=30	<30			
Vitamin D IU	<30	91	72	163	0.993 (0.425-2.31)	0.987
		55.8%	44.2%	100.0%		
	30-100	14	11	25		
		56.0%	44.0%	100.0%		

As shown in table 3, there is no significant association between obesity and vitamin D3.

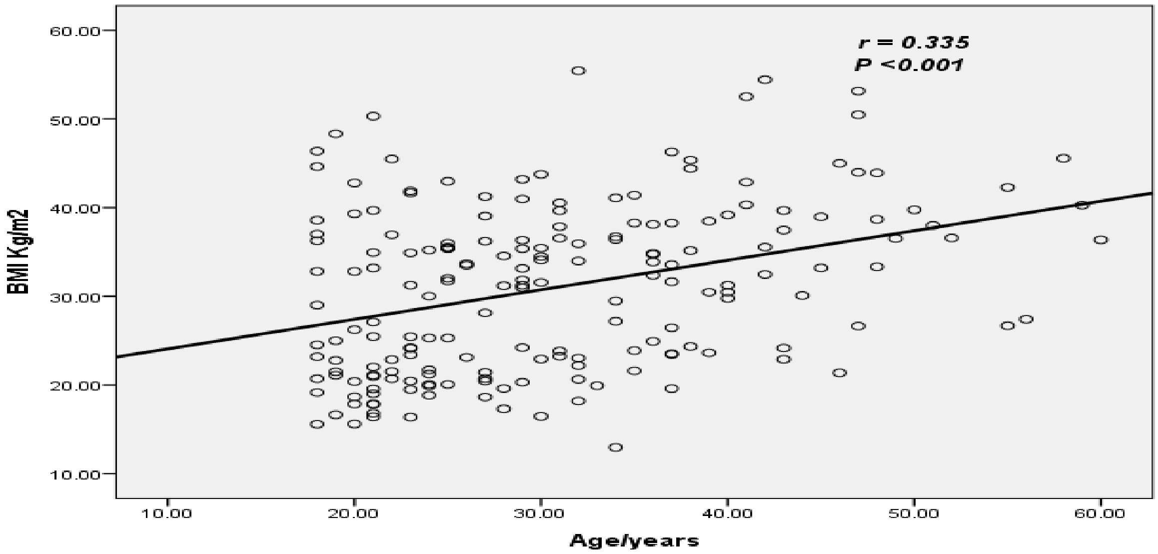

Figure (1) correlation between body mass index and age

There is significant weak correlation between age and body mass index as shown in figure 1.

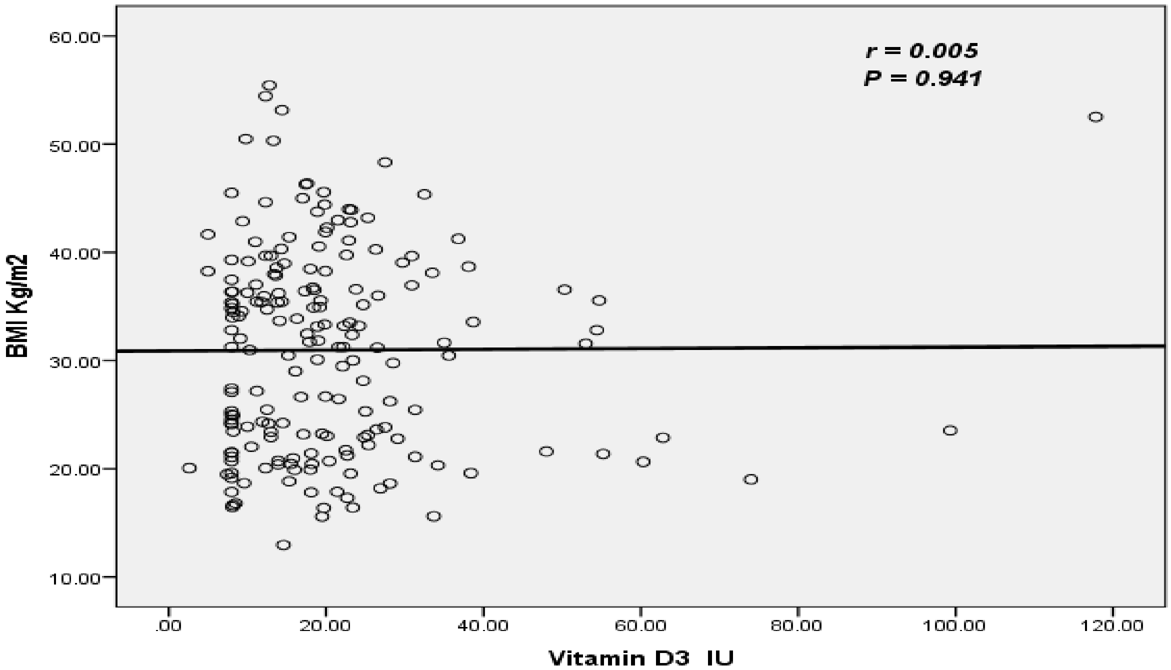

Figure (2) Correlation between body mass index and vitamin D3

Figure 2 shows in significant correlation between body mass index and vitamin D3

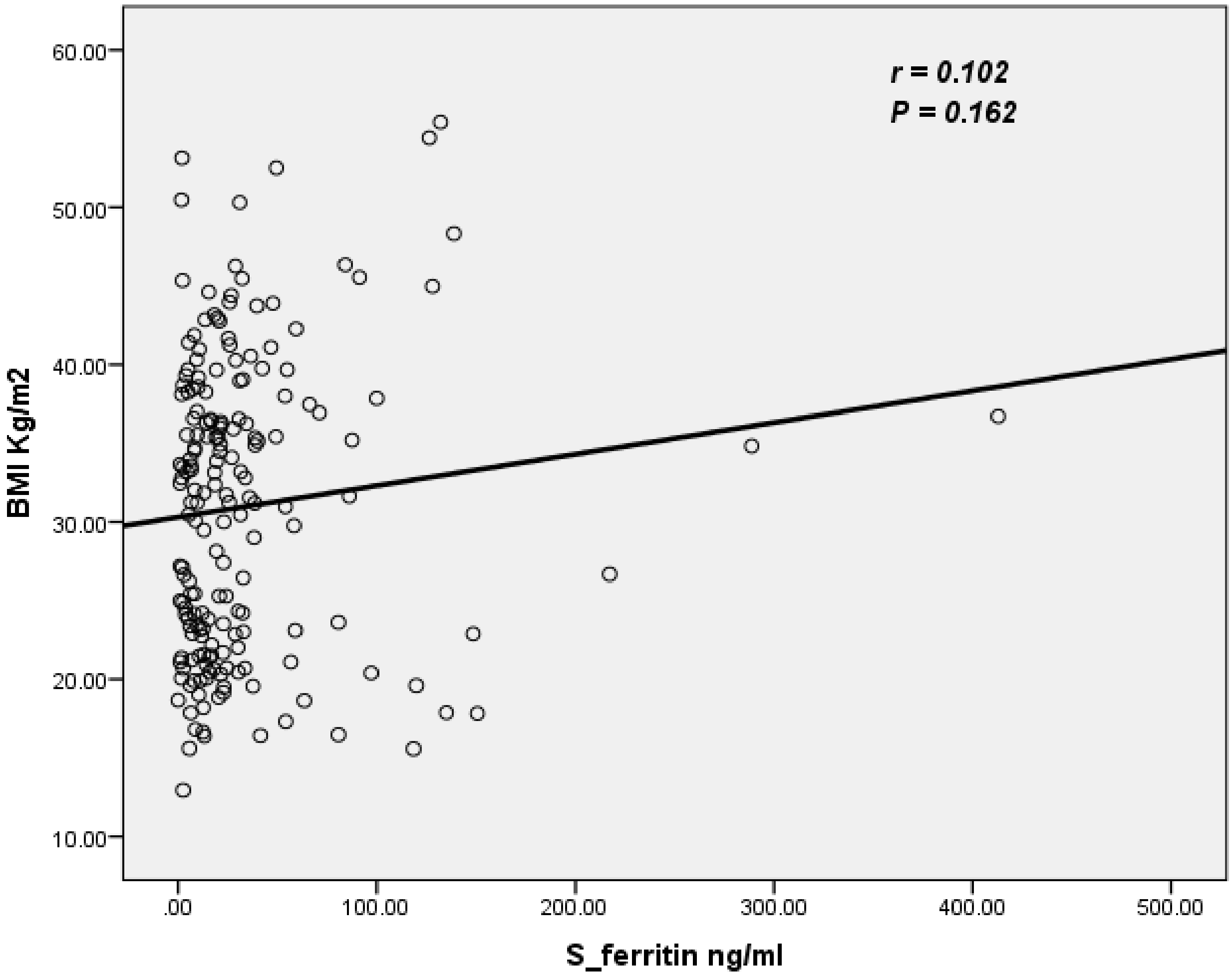

Figure (3) Correlation between body mass index and serum ferritin

There is no significant correlation between serum ferritin and body mass index as shown in figure 3.

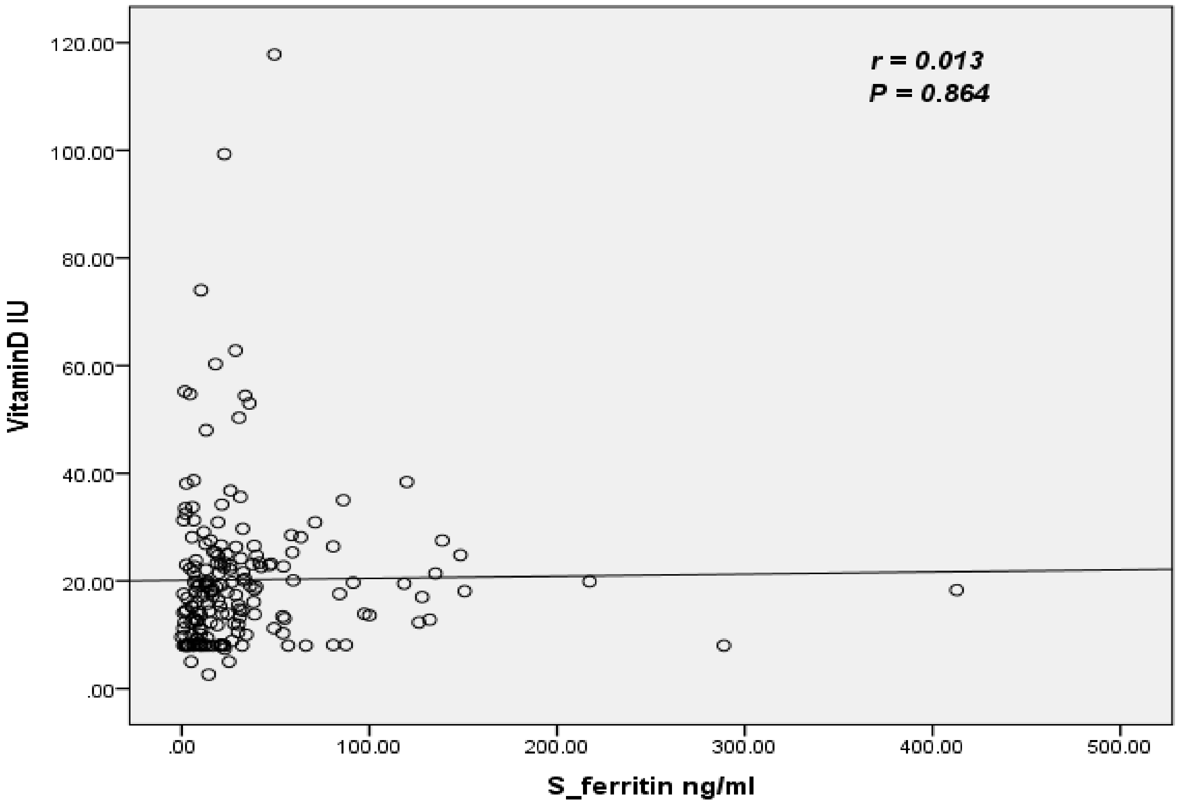

Figure (4) correlation between vitamin D and serum ferritin.

There is no significant correlation between vitamin D and serum ferritin level.

Table (4) Association between gender and serum ferritin

		S.ferritin ng/ml		Total	P value
		Low	Normal		
Gender	Male	12	11	23	<0.001
		52.2%	47.8%	100.0%	
	Female	143	22	165	
		86.7%	13.3%	100.0%	

There is significant association between gender and serum ferritin where the percentage of low serum ferritin higher in female.

Table (5) Association between gender and vitamin D

		Vitamin D IU		Total	P value
		<30	30-100		
Gender	Male	20	3	23	0.969
		87.0%	13.0%	100.0%	
	Female	143	22	165	
		86.7%	13.3%	100.0%	

Table 5 shows no significant association between gender and vitamin D3

4. Discussion

Worldwide obesity has nearly tripled since 1975. In 2016, more than 1.9 billion adults, 18 years and older, were overweight. Of these over 650 million were obese. Thirty nine percent of adults aged 18 years and over were overweight in 2016, and 13% were obese. Most of the world's population live in countries where overweight and obesity kills more people than underweight.39

In this study there is significant increase in body mass index with increasing age and this result found in a study done by Karissa L.40and this result may be attributed to decrease in basal metabolic rate with aging and decrease in physical activity.

Globally, a higher proportion of women are obese than men Low et al.41, yet most obesity treatment and service options are not gender-informed Kanter and Caballero42

These findings were unlike the result in this study in which there is no significant association between males and females which may be due to small sample size of the male.

The study examined the relationship of plasma ferritin level with obesity. The result shows no significant association between obesity and serum ferritin.

Several studies, with contradictory findings, have detected an association between ferritin and obesity with few reports concluding that high ferritin levels were associated with increased obesity43,44,45. However, others reported either similar46,47 or even lower48 ferritin concentration in obese versus normal weight adults.

There is also an inverse association between 25D concentration and body mass index (BMI)49-52. The mechanisms involved in lower 25D concentrations in obese individuals are not fully described, but it is possible that sequestration of vitamin D metabolites in fat compartments decreases their bioavailability49. Several clinical and epidemiological studies reported that obese subjects have lower serum concentrations of 25D with a negative correlation of vitamin D concentrations with body mass index and waist circumference53,54. Additionally, fat mass is inversely associated with 25D levels55-60. Another explanation is that obese people have vitamin D deficiency because of less sun exposure due to a sedentary lifestyle59. A study involving 243 adults reported a decrease of 0.74 nmol/l of serum 25D per 1 kg/m2 increase in BMI60. In this study there is no significant association between vitamin D level and obesity, and this may be due to lower sun exposure in most of Iraqi population whether obese or normal body weight which is due to the traditions and religious reasons of wearing clothes all over the body except the hands and face.

Research on the association between vitamin D and ferritin is rare. In addition, the association between vitamin D and ferritin is still being debated because the findings vary across studies. One study reported that vitamin D is positively associated with ferritin 61 in this study Serum ferritin concentrations were higher in men than in women which is the same result of. Han LL etal 62 Serum ferritin is often reported as having lower reference intervals in females compared to males 63. However, harmonization studies reporting such differences suggest the possibility of subclinical diseases influencing the reference intervals64. Serum ferritin reference intervals from various studies are persistently lower for females. This notion was the focus of a review by Rushton and Barth 63, who suggested that the difference between genders for the serum ferritin reference intervals is due to the high incidence of subclinical iron deficiency among the general adult female population. The extent of any subclinical disease in a population is generally unknown and its impact therefore difficult to estimate. Iron deficiency is a global health concern and is highly prevalent among the general female population 65 and difficult to identify 66.

Study findings revealed a lower 25OHD concentrations in females compared to males which is attributed to indoor working of women with less sun exposure in addition to more clothes covering the body than men due to religious reasons and this finding similar to the finding of Muscogiuri G etal.67

5. Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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