The Prevalence of Vitamin D Deficiency among Overweight and Obese Individuals

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ABSTRACT: Objective: *Vitamin D deficiency and obesity are widely spread and were associated with chronic diseases. The goal of our study is to evaluate the prevalence of vitamin D deficiency in obese individuals and its association with the metabolic parameter. Method:A cross sectional study of individuals attending diet center located in Taif, Saudi Arabia, conducted between October 2015 and June 2016. We included those with BMI $\geq$25 and have vitamin D level. Vitamin D $\leq$ 20 ng/ml was considered to be deficient. Result:A total of 148 participants were enrolled with a mean age of 36 years, mainly female and married .The mean weight was 95.9 kg, mean BMI of 37.3 Kg/m^2, 94.6% were obese, and the mean vitamin D level was 15.7. Compared to those who are vitamin D sufficient ,those who are deficient were more likely to have class III obesity (p 0.891), exercise <150 min per week (p 0.453), have asthma (P 0.149), have higher mean total cholesterol level (p 0.310) and higher mean fasting blood glucose (p 0.632). Partial correlation adjusting for age, gender, exercise, diabetes, and hypertension showed non-significant negative correlation between vitamin D and BMI (r -.121, p0.202), vitamin D and cholesterol (r -.039, p 0.678) and vitamin D and blood glucose (r -.122, p 0.198).Conclusion: Non-significant negative correlation was found between BMI and vitamin D level, the average vitamin D level in overweight group was 21 ng/ml while the average in obese class 3 was 15 ng/ml.*

KEYWORDS: Vitamin D, obesity, diet, weight loss.

INTRODUCTION

Obesity is a medical condition means having excess body fat accumulated to the extent that it may have a negative effect on health [1]. There are various methods to classify obesity, with the body mass index (BMI) been the most widely used with BMI of 25.0-29.9 is overweight and BMI $\geq$ 30 is obesity [2]. Vitamin D is a fat-soluble vitamin. Naturally very few foods contain vitamin D, added to others, and available as a dietary supplement. It is also produced endogenously, in which dermal synthesis of vitamin D from cholesterol is obtained from sun exposure[4]. Vitamin D has a significant role in calcium homeostasis and metabolism, as it promotes calcium absorption in the gut and maintains adequate serum calcium and phosphate[4-6].

Endocrine society Guideline recommends vitamin D level screening for individuals at risk including those with obesity [9]. In a study conducted in Saudi Arabia for a sample with a mean age of37.4 years showed a prevalence of vitamin D deficiency of 50.2% in men and 49.8 in women [7]. And also a recent study to evaluate the association of vitamin D level with insulin resistance among obese Saudi females shows that vitamin D level was inversely associated with BMI, fat percent and insulin resistance index (HOMA-IR) [8].

Actually, vitamin D deficiency and obesity are widely spread and they are associated with cardiovascular (CV) disease, metabolic syndrome and type 2 diabetes mellitus (T2D)[3,10].The relation between 25-hydroxyvitamin D concentrations and bodyweight is well established, as a study revealed evidence that weight loss leads to increased vitamin D concentrations, which may in turn provide additional protection against chronic disease [11].There is a limited local data about the prevalence of vitamin D deficiency in overweight and obese individuals. The goal of our study is to evaluate the prevalence of vitamin D deficiency in obese individuals and its association with the uric acid, total cholesterol and glucose level.

METHOD

A cross sectional study that includes 148 obese individuals attending diet center located in Taif city Saudi Arabia, conducted between October 2015 and June 2016.we included those with BMI$\geq$25 and those with vitamin D level. We exclude those with BMI<25 and those without vitamin D level. Research proposal was received and approved by research committee at Taif University School of Medicine and permission was taken from the center.Researchers obtained personal data and medical history from each participant. The weight and height were measured and BMI were calculated. Laboratory investigation includes vitamin D, total cholesterol, uric acid and random blood glucose were done. BMI was categorized into three classes: overweight with BMI of 25-29.9, obesity class 1(BMI 30-34.9) obesity class 2 (BMI 35-39.9), and obesity class 3 (BMI $\geq$40).

We divided the groups based on the vitamin D level according to the Institute of Medicine recommendation. Those with vitamin D $\geq$ 20 were considered to be normal while those with vitamin D level < 20 were considered to be deficient.
Data were collected in an excel sheet and analyzed with SPSS version 20. The mean and the standard deviation (SD) were used to express scale data and frequency and percentage were presented category data. The Chi square to assess the relationship between the variables and t-test to compare the means were used in the analysis. We considered a p value of 0.05 or less to be significant.

RESULT

A total of 148 participants were enrolled in the study with a mean age of 36.0 years, mainly female, and married (Table 1). The mean weight was 95.9 kg, mean height of 159.9 cm, with a mean BMI of 37.3 Kg/m^2. Overall, 5.4% were overweight and 94.6% of the participants were obese. Half of the participants report a sedentary lifestyle with only 20.9% reported regular physical activity for $\geq$ 150 minutes per week. The commonest chronic disease among the participants was hypertension and diabetes. Regarding the laboratory data, the mean total cholesterol was 164.5 mg/dl, mean fasting blood glucose was 104.0 mg/dl, and the mean uric acid was 4.7 mg/dl.

Compared to those who are vitamin D sufficient, those who are vitamin D deficient weren't statically significant difference in the mean age (p 0.848), the mean weight (p 0.645), the mean height (p 0.092), or the mean BMI (p 0.539) (Table 3). Those who are vitamins D sufficient were more likely to have class II obesity while those who are vitamin D deficient were more likely to have class III obesity (P 0.891). Those who are vitamin D sufficient were more likely to exercise $\geq$ 150 min per week while those who are vitamin D deficient were more likely to exercise <150 min per week (p 0.453).

Those who are vitamin D sufficient were more likely to have diabetes (p 0.331) while those who are vitamin D deficient were more likely to have asthma (p 0.149). There was no statically significant difference in the percentage of the other chronic diseases between groups. Also, those who are vitamin D deficient were more likely to have higher mean total cholesterol level (p 0.310) and higher mean fasting blood glucose (p 0.632) compared to those who are vitamin D sufficient Partial correlation adjusting for age, gender, exercise, diabetes, and hypertension showed non-significant negative correlation between; vitamin D and BMI (r -.121, p0.202), vitamin D and cholesterol (r -.039, p 0.678), and vitamin D and blood glucose (r -.122, p 0.198).

DISCUSSION

There is evidence that vitamin D status have negative relationship with obesity [12]. Previous study showed that the mean level of 25-OH-D in the deficient participants was 60% below that of participants with normal values, 10.2 ± 0.55 compared to 22.3 ± 1.2 ng\ml in the sufficient group respectively. [13] In our study the mean level of 25-OH-D in the vitamin D deficient and vitamin D sufficient was 11.3 ± 3.5 vs 27.8 ± 8.0 ng/ml respectively. Recent study reported 25-OH-D level in overweight, obese class I, class II, class III was 30.4, 24.2, 26.4, and 25.6ng\ml, respectively [14]. Our study showed that obese participant were more likely to have lower vitamin D level, as overweight 25-OH-D level was 21 ng/ml, obese class I was 17 ng/ml, obese class II was 15 ng/ml, obese class III was 15 ng/ml.

In our study, those who are vitamin D sufficient were more likely to exercise $\geq$ 150 min compared to those who are vitamin D deficient. This is concurring to a previous study finding which indicate that exercise is associated with an increase in the vitamin D level. [15]Previous studies showed there is higher risk of being vitamin D deficient in individual with history of diabetes and hypertension [16,17]. Our finding showed that those who are diabetics or hypertensive were more likely to be vitamin d sufficient, and this may be due to the small sample size and the sample was mainly obese individuals.

CONCLUSION

Non-significant negative correlation was found between BMI and vitamin D level, the average vitamin D level in overweight group is 21 ng/ml while the average in obese class 3 is 15 ng/ml.

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Baseline characteristics (N= 148)	
Mean age (years)	36.0$\pm$11.4
Male (%)	17.7
Single (%)	31.5
Mean weight (Kg)	95.9$\pm$19.9
Mean height (m)	159.9$\pm$8.9
Mean BMI (Kg/m^2)	37.3$\pm$6.2
Vitamin D deficient (%)	73
BMI destitutions	
Overweight (%)	5.4
Obesity class I (%)	34.5
Obesity class II (%)	33.1
Obesity class III (%)	27
Lifestyle habits	
Sedentary lifestyle (%)	52.7
Exercise <150 min (%)	26.4
Exercise $\geq$ 150 min (%)	20.9
Smoking (%)	0.0
Chronic disease	
Diabetes (%)	8.8
Hypertension (%)	11.5
Asthma (%)	2
Hyperlipidemia (%)	3.4
History of cardiac disease (%)	0.7
Laboratory data	
Total cholesterol (mg/dl)	164.5$\pm$31.4
Vitamin D 25-OH (ng/ml)	15.7$\pm$9.0
Uric acid (mg/dl)	4.7$\pm$1.2
Blood glucose (mg/dl)	104.0$\pm$36.7

Table 1: Baseline characteristics of the whole cohort.

Characteristics	Vitamin D Sufficient	Vitamin D deficient	P value
Number of participants (%)	27	73	n/a
Mean age (years)	36.3$\pm$11.0	35.9$\pm$11.6	0.848
Male (%)	18	17.6	0.960
Single (%)	33	30.8	0.774
Mean weight (Kg)	97.1$\pm$20.2	95.4$\pm$19.9	0.645
Mean height (m)	161.9$\pm$9.3	159.1$\pm$8.7	0.092
Mean BMI (Kg/m^2)	36.8$\pm$5.8	37.5$\pm$6.4	0.539
BMI destitutions at baseline			
Overweight (%)	5	5.5	
Obesity class I (%)	35	34.3	0.891
Obesity class II (%)	37.5	31.5	
Obesity class III (%)	22.5	28.7	
Lifestyle habits			
Sedentary lifestyle (%)	55	51.9	
Exercise <150 min (%)	20	28.7	0.453
Exercise $\geq$ 150 min (%)	25	19.4	
Chronic disease			
Diabetes (%)	12.5	7.4	0.331
Hypertension (%)	12.5	11.1	0.814
Asthma (%)	0	2.8	0.149
Hyperlipidemia (%)	2.5	3.7	0.719
History of cardiac disease (%)	0.0	0.9	0.541
Baseline laboratory data			
Total cholesterol (mg/dl)	160.7$\pm$23.3	166.0$\pm$34.1	0.310
Vitamin D 25-OH (ng/ml)	27.8$\pm$8.0	11.3$\pm$3.5	<0.001
Uric acid (mg/dl)	4.7$\pm$1.0	4.7$\pm$1.3	0.907
Blood glucose (mg/dl)	101.6$\pm$36.3	105.0$\pm$37.0	0.632

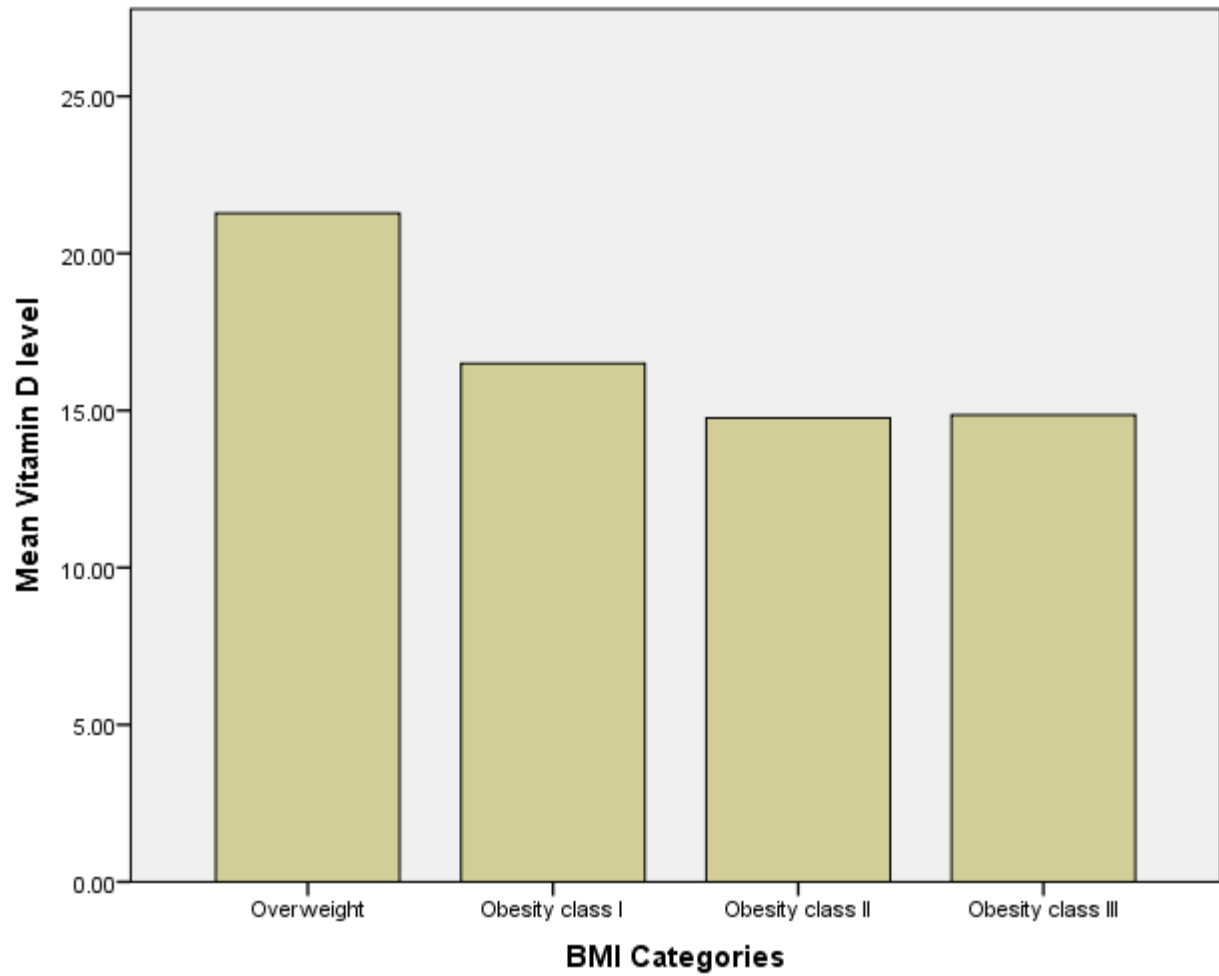**Table 2: Baseline characteristics according to the vitamin D level.**

Figure 1: The mean vitamin D level in relation to BMI (p 0.147).