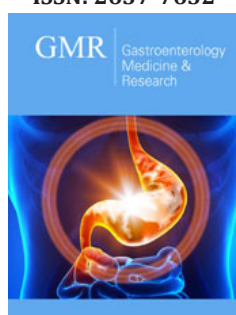# Does Vitamin D Deficiency Correlates with Metabolic Syndrome in Egyptian Population

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Abstract

Background: Metabolic syndrome (MS) has become a serious health problem worldwide and it is a major cause of morbidity and mortality especially from cardiovascular diseases. Different factors involved in pathogenesis like environmental, genetic, and sedentary life. Recent studies demonstrates that Vitamin D3 deficiency has a growing role in pathogenesis of MS. Many studies had addressed the relationship between serum Vitamin D3 and metabolic syndrome but to the best of our knowledge, few studies about this relationship in Egyptian population.

Aims: To assess the relationship between deficiency of Vitamin D3 with metabolic syndrome in Egyptian population.

Patients and methods: This is cross sectional study invite 200 participants from healthy clubs but only 180 accept to participate. According to the presence or absence of metabolic syndrome, our participant were divided into two groups. All participants were subjected to detailed medical history, clinical and anthropometric assessment, and laboratory analysis including serum Vitamin D3 level.

Result: The mean age of the studied patients was 40.91 ± 8.72, and majority were female (66.7%). Metabolic syndrome cases were significantly higher as regard the age, SBP, DBP, TG, FBS, WC and BMI but significantly lower regard HDL and Vitamin D3, and no significant association with sex. Vitamin D deficiency cases were significantly higher as regard Age, SBP, DBP, TG, FBS, WC and BMI but sig lower regard HDL. There was significant different between patients with and without Vitamin D3 deficiency as regard the presence of metabolic syndrome (P value=.00). There was moderate negative correlation between Vitamin D3 deficiency and age, SBP, DBP, FBS, WC and BMI with positive weak correlation with HDL level. Vitamin D3 deficiency < 20ng/ml and BMI >35 were significant predictors for metabolic syndrome with (P value 0.00, 0.04) respectively.

Conclusion: Vitamin D3 level inversely correlates with the presence of metabolic syndrome in Egyptian Population

Keywords: Metabolic syndrome; Vitamin D deficiency

Introduction

Metabolic syndrome (MS) has become a major health problem worldwide and it is a major cause of morbidity and mortality especially from cardiovascular diseases. Hypertension, dyslipidemia, hyperglycemia, insulin resistance, abdominal obesity is major component of MS [1]. Factors involved in pathogenesis of MS includes environmental, genetic, and sedentary life [2]. Vitamin D deficiency has a growing role in pathogenesis of MS [3]. A strong relationship of Vitamin D_3 deficiency and the degree of obesity especially central one may be related to insufficient sun exposure and outdoor activities [4]. Vitamin D_3 deficiency inversely affects the insulin secretion [5]. Many studies reported that the lower level of Vitamin D_3 induce the development of insulin resistance and thus Type 2 DM by decreasing insulin sensitivity [6]. Vitamin D_3 deficiency have been reported to upregulate the renin-angiotensin-aldosterone system (RAAS), resulting in systolic and diastolic hypertension [7]. Many studies addressed risk factors for MS, but there are few studies on the role of Vitamin D_3 deficiency on MS especially in Egyptian population.

Aim of study

Our study aimed assess the relationship between deficiency of Vitamin D with metabolic syndrome in Egyptian population.

Patients and Methods

Our cross sectional study invite 200 subjects from healthy clubs at Kafrelsheikh and Zagzig governorate, Egypt. However, 180 only were enrolled into the study as 20 patients did not attend their appointment for the laboratory tests. The criteria for inclusion in the study were any sex, or age, and participant were divided into two groups according to presence or absence of MS. The exclusion criteria were refusal to participate and Vitamin D supplementation. All participants were subjected to detailed medical history, clinical and anthropometric assessment, and laboratory analysis. MS was diagnosed if the patient had at least 3 out of 5 of its components, in accordance with the modified criteria proposed by the IDF in 2009. These includes waist circumference≥80cm, fasting glycemia≥100mg/dL, triglyceride level≥150mg/dL, HDL cholesterol level <50mg/dL, and elevated blood pressure (sBP≥130 and/or dBP≥85mmHg) or related therapies to any of above conditions [8]. A digital scale were used to assess anthropometric measurements. Waist circumference was measured midway between the upper margin of the iliac crest and the lower rib margin. We considered a waist circumference≤80 Body mass index (BMI) in the range of 18.5- 24.9kg/m^2 as normal, and between 25.0kg/m^2 and 29.9kg/m^2 denoted overweight, and I≥30kg/m^2 indicated obesity. Blood pressure was measured using a manual manometer in a semi sitting participant after adjusting the cuff according to arm circumference at the heart level. Fasting blood samples were withdrawn for biochemical assessment: serum cholesterol, high density lipoprotein (HDL), triglycerides (TG,), and Vitamin D$_3$. Vitamin D$_3$ was measured by competitive radioimmunoassay kits (Cobas®; Roche Vitamin D Total first generation assay (25OHD-I), Roche Diagnostics, Indianapolis, IN, USA).

Ethics and consent

The study was approved by the Faculty's ethics committee and permission was obtained from all departmental heads who ensured confidentiality was maintained and ethical principles were followed. Prior to participation in the study, the background and reasons for conducting the study were explained and prospective patients were not obliged to participate. Written informed consent was obtained from all participants

Statistical analysis

Statistical analysis was performed by using statistical package for social sciences (SPSS) version 22.0. Descriptive statistics was presented as proportion, Mean ± standard deviation (SD) and median with interquartile range. Comparative analysis was done by χ^2 test. A P-value less 0.05 was considered significant.

Results

We initially invited 200 subjects, however, 180 only were enrolled into the study as 20 patients did not attend their appointment for the laboratory tests. The mean age of the studied patients was 40.91±8.72, and majority were female (66.7%). Metabolic syndrome was present in 60 participants (33.3%) while Vitamin D$_3$ deficiency was present in 80 participants (44.4%) (Table 1). Table 2 show that metabolic syndrome cases were significantly higher as regard the age, SBP, DBP, TG, FBS, WC and BMI but significantly lower regard HDL and Vitamin D$_3$, and no significant association with sex. Table 3 show there was significant different between patients with and without Vitamin D$_3$ deficiency as regard the presence of metabolic syndrome P value=.00 with 95% confidence interval at 56(18.4-169.6). Significant association and significant risk between VD deficiency and MS. Table 4 show that Vitamin D$_3$ deficiency cases were significantly higher as regard Age, SBP, DBP, TG, FBS, WC and BMI but significantly lower regard HDL and no significant association with sex. Table 5 show a spearman correlation analysis was run to determine the relationship between Vitamin D$_3$ deficiency and variable risk factors'. There was moderate negative correlation between Vitamin D deficiency and age, SBP, DBP, FBS, WC and BMI. (r=. -0.495), (r=-0.610), (r=-0.661), (r=-0.622), (r=-0.692), (r=-0.632), (r=-0.617), (r=-0.617) respectively and positive weak correlation with HDL level (r=.339). Table 6 show multivariate logistic regression for independent predictors of metabolic syndrome demonstrate that Vitamin D$_3$ deficiency <20ng/ml and BMI >35 were significant predictors with (P value 0.00, 0.04) respectively, while we found Age >42 were insignificant one (p value=.22) for metabolic syndrome.

Table 1: Age and sex distribution among studied group.

		Age
Mean±SD		40.91±8.72
Median (Range)		42.0(18-52)
		N (%)
Sex	Male	60(33.3)
	Female	120(66.7)
Metabolic syndrome	Positive	60(33.3)
	Negative	120(66.7)
Vitamin D$_3$	Normal	100(55.6)
	Deficient	80(44.4)
	Total	180(100.0)

Table 2: Comparison between metabolic and non-metabolic syndrome.

			No	Metabolic	P
Age			38.3±8.95	46.13±5.28	0.00**
SBP			117.33±8.95	136.66±5.42	0.00**
DBP			77.66±5.90	87.66±2.51	0.00**
TG			122.86±22.43	181.66±14.69	0.00**
FBS			96.86±9.43	116.33±6.5	0.00**
HDL			55.3±7.51	47.86±6.19	0.00**
WC (cm)			86.73±7.07	98.93±6.15	0.00**
Vitamin D_3			27.43±8.34	17.6±6.85	0.00**
BMI			29.5±4.11	36.66±2.13	0.00**
Sex	Male	N (%)	37(30.8%)	23(38.3%)	0.31
	Female	N (%)	83(69.2%)	37(61.7%)	

SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, TG: Triglyceride, FBS: Fasting Blood Sugar, HDL: High Density Lipoprotein, WC: Waist Circumference, BMI: Body Mass Index.

Table 3: Association and risk assessment between metabolic syndrome and Vitamin D deficiency.

No		Metabolic Syndrome		P Value	OR (CI 95.0%)
		Metabolic			
Vitamin D_3 Deficiency	No	96(80.0%)	4 (6.7%)		
	N (%)				
	Yes	24(20.0%)	56(93.3%)	0.00**	
	N (%)				56 (18.4-169.6)
Total		120(100%)	60(100%)		

	No Vitamin D_3 Deficiency	Vitamin D Deficiency	t/ X^2	P
Age	36.88±8.91	45.95±5.18	8.074	0.00**
SBP	116.6±9.28	132.75±8.78	11.872	0.00**
DBP	76.8±6.01	86.25±3.51	12.459	0.00**
TG	119.44±21.47	171.25±24.12	15.222	0.00**
FBS	94.84±8.65	114.0±7.56	15.6	0.00**
HDL	55.72±8.18	49.2±5.81	6.014	0.00**
WC	85.68±7.32	97.2±6.09	11.281	0.00**
BMI	28.72±3.92	35.85±2.64	13.911	0.00**
Sex	Male	N	38	22		
		%	38.00%	27.50%		
	Female	N	62	58	2.21	0.13
		%	62.00%	72.50%		
Total		N	100	80		
	%	100.00%	100.00%		

Table 4: Relation with Vitamin D3 deficiency.

				No Vitamin D$_3$ Deficiency	Vitamin D Deficiency	t/ X^2	P
Age				36.88±8.91	45.95±5.18	8.074	0.00**
SBP				116.6±9.28	132.75±8.78	11.872	0.00**
DBP				76.8±6.01	86.25±3.51	12.459	0.00**
TG				119.44±21.47	171.25±24.12	15.222	0.00**
FBS				94.84±8.65	114.0±7.56	15.6	0.00**
HDL				55.72±8.18	49.2±5.81	6.014	0.00**
WC				85.68±7.32	97.2±6.09	11.281	0.00**
BMI				28.72±3.92	35.85±2.64	13.911	0.00**
Sex	Male	N		38	22		
		%		38.00%	27.50%		
	Female	N		62	58	2.21	0.13
		%		62.00%	72.50%		
Total		N		100	80		
	%			100.00%	100.00%		

Table 5: Correlations between Vitamin D and other parameters.

		Vitamin D
Age	r	-0.495**
	P	0.000
SBP	r	-0.610**
	P	0.000
DBP	r	-0.661**
	P	0.000
TG	r	-0.622**
	P	0.000
FBS	r	-0.692**
	P	0.000
HDL	r	0.339**
	P	0.000
WC	r	-0.632**
	P	0.000
BMI	r	-0.617**
	P	0.000

Table 6: Multivariate logistic regression for independent predictors of MS.

		Wald	P	OR Lower	95% C.I Upper	
	Age >42 years	1.488	0.222	1.057	0.967	1.156
	VD3 <20 (ng/ml)	3.92	0.042*	1.952	1.101	3.006
	BMI >35	30.204	0.00**	1.699	1.406	2.053

Discussion

MS is a group of abnormal metabolic disorders characterized by hypertension, insulin resistance, hyperglycemia, dyslipidemia, and central obesity. It is a major cause of morbidity and mortality [9]. In our study we divide participant into two groups according to the presence or absence of MS based on above mentioned criteria. Our study demonstrate that MS group have older age, higher systolic and diastolic blood pressure, TG level, waist circumference and BMI and lower level of Vitamin D and HDL and this are consistent with other studies [10-13] that concluded that MS is more prevalent in obese and elderly people. Our study demonstrated that was significant different between patients with and without Vitamin D_3 deficiency as regard the presence of metabolic syndrome and this concordant with many studies [14,15] that concluded that Vitamin D_3 deficiency has a growing role in the pathogenesis of MS. Our study showed that Vitamin D_3 deficiency cases were significantly higher as regard Age, SBP, DBP, TG, FBS, WC and BMI. This in agreement with a study of Wieder-Huszla and his colleagues that concludes that Vitamin D_3 deficiency was an independent factor for MS in the elderly [16]. Another study by Lee and his colleagues that found that lower Vitamin D level was associated with higher blood pressure and CVS risk [8]. Spearman correlation in our study revealed There was moderate negative correlation between Vitamin D3 deficiency and age, SBP, DBP, FBS, WC and BMI and positive weak correlation with HDL level. This was in agreement with many studies [14-16]. Interestingly, our study demonstrated that Vitamin D_3 deficiency <20ng/ml and BMI >35 were significant predictors for metabolic syndrome. This in agreement with a study of Wang and his colleagues that concluded that low Vitamin D_3 concentration is an independent risk factor for M.S [17,18].

Conclusion: Vitamin D_3 level inversely correlates with the presence of metabolic syndrome in Egyptian Population.

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