

ASSOCIATION OF GENERAL AND ABDOMINAL OBESITY WITH PLASMA VITAMIN D₃ LEVELS IN YOUNG ADULTS

Sandeep Soam Singh¹, Sonali Chaturvedi²

¹Assistant Professor, Department of Biochemistry, Muzaffarnagar Medical college, Begrajpur Industrial area, Ghosipura, Muzaffarnagar, U.P., Pin-251203.

²Senior Resident, Department of Biochemistry, Maulana Azad Medical College, New Delhi, Pin-110002.

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Address for Correspondence: Dr. Sandeep Singh Soam, Assistant Professor, Department of Biochemistry, Muzaffarnagar Medical College, Begrajpur Industrial area, Ghosipura, Muzaffarnagar, U.P., Pin-251203.

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Abstract

Aim: To assess whether serum Vitamin D levels are associated with general and abdominal obesity in young adults.

Materials & Methods: A total of 113 MBBS students of the same batch aged 17–21 years (59 boys and 54 girls) were included in this case-control study. Height and body weight were measured to calculate Body Mass Index (BMI) for General obesity and waist circumference was measured for central obesity. Plasma vitamin D levels were measured. Participants were grouped according to Asian criteria for BMI and abdominal circumference in normal and obese group.

Results: Mean age of students, who participated in study, was 18.2 ± 0.95 years. In the general obesity group the mean plasma Vitamin D level was 18.77 ± 13.31 ng/ml and in its normal reference group (with normal BMI) the mean plasma Vitamin D level was 19.02 ± 16.21 ng/ml. In the central obesity group the mean plasma Vitamin D level for males was 21.10 ± 13.30 ng/ml and in females 13.52 ± 10.5 ng/ml and in its normal reference group (with normal waist circumference) the mean plasma Vitamin D level in males was 20.16 ± 11.89 ng/ml and in females it was 12.66 ± 9.40 ng/ml.

Conclusion: Comparison between obese group and normal group revealed that general obesity and central obesity has no correlation with plasma Vitamin D levels. Plasma Vitamin D deficiency was prevalent even in apparently healthy young individuals and it is more common in females.

Key words: Plasma Vitamin D, Obese, Asian criteria of BMI, MBBS students

Introduction:

Obesity has been a global health problem since last two decades which impose a great burden on healthcare system [1]. Obesity is a very well known risk factor for many diseases like diabetes, coronary heart disease, systemic hypertension, arthritis and some cancers [1-3]. Distribution of fat in body is also very important to make obesity as risk factor for the above said diseases. Abdominal obesity imposes a greater risk for metabolic diseases and morbidity of people than general obesity [4, 5].

Several studies have shown the results that micronutrient deficiencies are associated with obesity [6-8]. Among various micronutrients, vitamin D has given maximum attention in recent years [9-11]. In one study the genes that are up-regulated by vitamin D, are involved in fatty acid oxidation and mitochondrial metabolism which are directly involved in energy expenditure [12]. Low serum Vitamin D levels are directly related to impaired glucose tolerance, impaired fasting glucose, β -cell dysfunction and insulin resistance [13, 14].

Many studies have been done in past for the correlation of obesity and serum vitamin D but many of them are from western world and findings of many of them are conflicting. Some studies find no association between serum vitamin D and obesity [15] while others have shown inverse relation between these [16, 17]. Furthermore, association can be more important in our study because of very young age groups and socioeconomically strong subjects. In current study, we try to assess that serum Vitamin D levels are associated with the general and abdominal obesity.

Materials and methods:

This was a prospective study conducted in the Department of Biochemistry, Subharti Medical College, Meerut, Uttar Pradesh. Consent was obtained from all subjects, after due information was provided, including possible risks. In the study all voluntary and apparently healthy MBBS students were included. Subjects with chronic diseases, which were suggested as per history and examination and who were taking vitamin D supplements, were excluded.

A total of 113 participants were included out of which 59(52.2%) were males and 54(47.8%) were females. The mean age of all the participants was 18.20 ± 0.95 years. All the participants were subjected to complete general and physical examination. Height in meters, weight in kilograms and abdominal circumference in centimeters was measured. BMI was calculated by weight in kilogram divided by height in meter squared for individual subject $[\text{Weight (in Kg.)} / \text{Height (in meter)}^2]$.

Study subjects were grouped into obese and normal categories according to Asian criteria for BMI (for general obesity) and waist circumference (for central obesity) as follows:

Cut-off of BMI (Kg/ meter²) for Asian Indians[18]:

Underweight --- < 18 , Normal --- $18 - 22.99$, Overweight --- $23 - 24.99$, Obese --- ≥ 25

Those participants, who were in underweight and overweight categories, were excluded to adhere the aim of study as comparison of normal and obese participants only.

Waist Circumference cut-off for Asian Indian [19] :

For Female

Normal ----- ≤ 80 cm, Obese ----- > 80 cm.

For Male

Normal ----- ≤ 90 cm, Obese ----- > 90 cm.

Participants in normal BMI group and normal waist circumference group were considered as reference group.

Biochemical analysis

Venous blood samples were collected after about 12 hours of fasting, in EDTA vials[20] from both the study groups. Care was taken to prevent hemolysis of the sample. Haemolysed samples were discarded. The plasma was separated from each blood sample and stored in Deep freezer at -80°C separately.

Samples were processed for plasma 25(OH) vitamin D assessment by Robonik ELISA Reader and Washer with Sandwich ELISA kit method from Euroimmun Medizinische Labordiagnostika AG. According to the manufacturer the limit for detection of 25(OH) vitamin D by the kit method was 1.6 ng/ml.

Reference interval for Vitamin D [21] :-

Deficiency - < 20 ng/ml, Insufficiency - $20 - 30$ ng/ml, Normal - $30 - 70$ ng/ml, Elevation - $70 - 150$ ng/ml, Intoxication - > 150 ng/ml.

Prior to the study due approval was obtained from the Institutional Ethical committee.

Statistical analysis

Data was analyzed by using Microsoft Excel 2007, R2.8.0 Statistical Package for the Social Sciences (SPSS) for windows version 20.0(SPSS Inc; Chicago, IL,USA). Comparison between the mean data of obese group and normal group was done by unpaired student t-test and correlation was done Pearson correlation analysis. The data was presented as means $\pm$ SD with p-value of <0.05 being indicative of statistical significance.

Results and Discussion

The following observations were made from this study:

Mean age of students, who participated in study, was 18.2 ± 0.95 years.

In the general obesity group 27 (45.8%) were males and 15 (27.8%) were females while in normal group (according to asian criteria of BMI) 15 (25.4%) were males and 42 (37.2%) were females (Table1).

In the central obesity group 20 (33.9%) were males and 28 (51.9%) were females while in normal group (according to asian criteria of waist circumference) 39

(66.1%) were males and 26 (48.1%) were females (Table 2).

According to Vitamin D grading, 35(59.3%) males were deficient, 10(16.9%) males were in insufficient and 14(23.7%) males were in normal category. According to same Vitamin D grading, 44(81.5%) females were in deficient, 05(9.3%) females were in insufficient and 01(0.9%) females were in normal category (Table 3).

In the general obesity group the mean plasma Vitamin D level was 18.77 ± 13.31 ng/ml and in its normal reference group (with normal BMI) the mean plasma Vitamin D level was 19.02 ± 16.21 ng/ml. On applying unpaired student t-test we did not found any significant difference in levels of plasma vitamin D between these groups (Table 4).

In the central obesity group the mean plasma Vitamin D level for males was 21.10 ± 13.30 ng/ml and in females 13.52 ± 10.5 ng/ml and in its normal reference group (with normal waist circumference) the mean plasma Vitamin D level in males was 20.16 ± 11.89 ng/ml and in females it was 12.66 ± 9.40 ng/ml. On applying unpaired student t-test we did not found any significant difference in levels of plasma vitamin D between these groups in both males and females separately (Table 5).

The correlation coefficient(r) between plasma Vitamin D and BMI (Asian Criteria) was 0.047 and the p-value was 0.620 showing that there is no correlation between these two parameters. The

correlation coefficient(r) between plasma Vitamin D and waist circumference was 0.041 and the p-value was 0.665 also showing that there is no correlation between these two parameters (Table 6; Graph 1 and Graph 2).

In this study we did not found any significant relation between the plasma vitamin D, general obesity and abdominal obesity. Similarly Khan A H et al [15] found no correlation between serum vitamin D levels and obesity. Another study by Parikh et al [22] showed that obese individuals had lower levels of plasma Vitamin D but it was statistically insignificant. Few studies have shown plasma vitamin D levels are inversely correlated with obesity. Zhang et al. reported a significant inverse association between serum 25(OH)D levels and obesity, particularly abdominal obesity [16]. In another cross-sectional study, an inverse relationship was reported between serum 25(OH)D levels and risk of metabolic obesity among male subjects [10]. Another study, done by Afzal et al. showed that the low plasma 25(OH)D concentrations might be a modest mediator between obesity and increased risk of diabetes [17].

This study had few limitations such as it was based on a single measurement of plasma vitamin D. Bigger sample size may be more predictive than the current study. Despite various adjustments, we were not able to control other confounding factors such as skin color, routine dietary sources intake and sun exposure. Finally we did not include the Serum Parathormone (PTH) measurement in this study.

Table: 1 GENDER DISTRIBUTION OF PARTICIPANTS ACCORDING TO BMI (ASIAN CRITERIA)			
GENDER			Total
MALE	BMI GROUP (Asian criteria)	UNDERWEIGHT	01 (1.7%)
		NORMAL	15 (25.4%)
		OVERWEIGHT	16 (27.1%)
		OBESE	27 (45.8%)
	Total		59 (100.0%)
FEMALE	BMI GROUP (Asian criteria)	UNDERWEIGHT	3 (5.6%)
		NORMAL	27 (50.0%)
		OVERWEIGHT	9 (16.7%)
		OBESE	15 (27.8%)
	Total		54 (100.0%)
Total	BMI GROUP (Asian criteria)	UNDERWEIGHT	4 (3.5%)
		NORMAL	42 (37.2%)
		OVERWEIGHT	25 (22.1%)
		OBESE	42 (37.2%)
	Total		113 (100.0%)

Table: 2 GENDER DISTRIBUTION IN STUDY GROUP ACCORDING TO ABDOMINAL-CIRCUMFERENCE			
GENDER			Total
MALE	ABDO. CIRCUM. GROUP	NORMAL	39 (66.1%)
		OBESE	20 (33.9%)
	Total		59 (100.0%)
FEMALE	ABDO. CIRCUM. GROUP	NORMAL	26 (48.1%)
		OBESE	28 (51.9%)
	Total		54 (100.0%)
Total	ABDO. CIRCUM. GROUP	NORMAL	65 (57.5%)
		OBESE	48 (42.5%)
	Total		113 (100.0%)

Table:3 Gender Distribution in Study Group according to Vitamin D Grade			
GENDER			Total
MALE	VITAMIN D GRADE	DEFICIENCY	35 (59.3%)
		INSUFFICIENCY	10 (16.9%)
		NORMAL	14 (23.7%)
	Total		59 (100.0%)
FEMALE	VITAMIN D GRADE	DEFICIENCY	44 (81.5%)
		INSUFFICIENCY	5 (9.3%)
		NORMAL	4 (7.4%)
		ELEVATED	1 (1.9%)
	Total		54 (100.0%)
Total	VITAMIN D GRADE	DEFICIENCY	79 (69.9%)
		INSUFFICIENCY	15 (13.3%)
		NORMAL	18 (15.9%)
		ELEVATED	1 (0.9%)
	Total		113 (100.0%)

Table 4: Participants grouped According to BMI (Asian criteria) [For General Obesity]		
Plasma Vitamin D (Mean±SD) (ng/ml)	Normal	Obese
	19.02±16.21	18.77±13.31 ^{NS}

^{NS}Statistically not significant (p > 0.05)

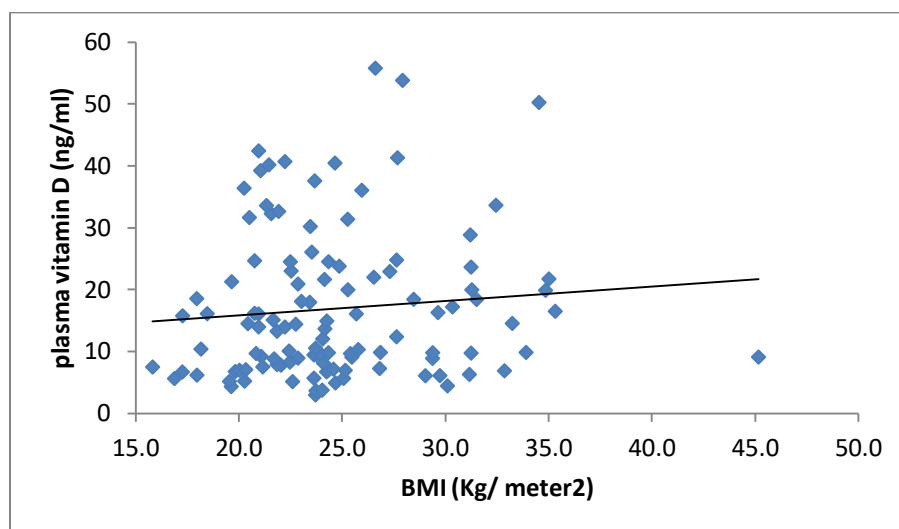
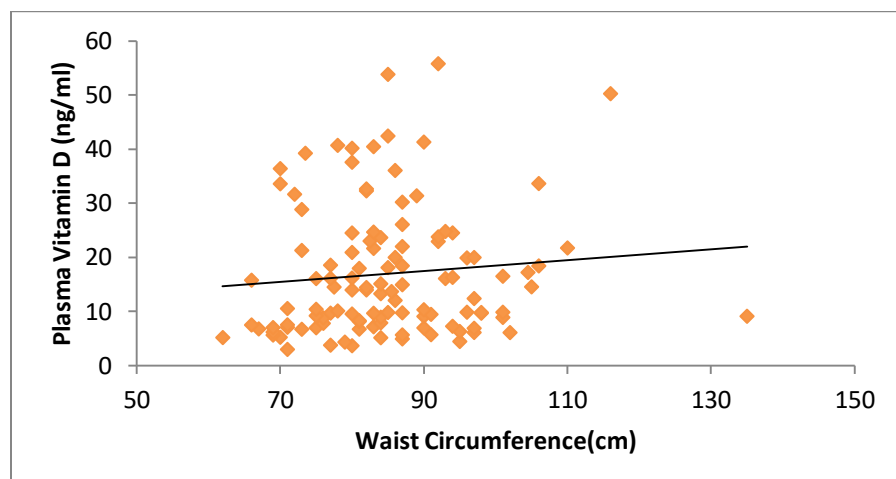
**Table 5: Participants grouped According to Waist Circumference
[For Central Obesity]**

Plasma Vitamin D (Mean±SD) (ng/ml)	Male		Female	
	Normal	Obese	Normal	Obese
	20.16±11.89	21.10±13.30 ^{NS}	12.66±9.40	13.52±10.5 ^{NS}

^{NS}Statistically not significant (p > 0.05)

Table: 6 Correlation of Plasma Vitamin D with BMI and Waist circumference

Plasma VitaminD (ng/ml)	BMI (Asian Criteria)		Waist circumference	
	r- value	p- value	r- value	p- value
	0.047	0.620	0.041	0.665

**Graph 1: showing correlation between BMI and Plasma vitamin D levels in studied subjects****Graph 2: showing correlation between Waist circumference and Plasma vitamin D levels in studied subjects**

Conclusion

In conclusion plasma vitamin D[25(OH)D] concentrations were not associated with General obesity and Central obesity. Plasma Vitamin D deficiency was prevalent in apparently healthy young individuals and was more common in female participants.

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