



RESEARCH ARTICLE

CORRELATION OF VITAMIN D LEVEL WITH BODY MASS INDEX AND WAIST CIRCUMFERENCE IN DIABETIC POPULATION

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ABSTRACT

Objective: The objective of the study to investigate the correlation of vitamin D level with body mass index and waist circumference in diabetic population.

Patients and Methods: An observational cross-sectional study on 100 subjects (male=55 and female=45), age range 30-60 year, was performed. Subjects underwent physical examination and biochemical testing. Subjects included were newly diagnosed or previously diagnosed case of diabetes mellitus. Analysis was performed using SPSS Statistical package for windows (SPSS VERSION 20).

Results: Only 6% of the subjects had optimal level of vitamin D level and 67% of subjects were deficient. There were highly significant inverse association of waist circumference and body mass index (BMI) with vitamin D level (p-value 0.001). There were also inverse association of fasting blood glucose and HbA1C with vitamin D level (p-value 0.014 and <0.001 respectively) in diabetic population.

Conclusion: Our results suggest correlation of vitamin D level with body mass index and waist circumference in diabetic population.

INTRODUCTION

Health concerns associated with low serum vitamin D are on the rise. Vitamin D is required not only for bone health (6) but also plays a role in a range of ailments such as autoimmune disease (Hypponen *et al.*, 2001), cardiovascular disease (CVD) (Maki, 2009), type 2 diabetes mellitus (T2DM)(7), hypertension (Judd *et al.*, 2008), depression (Ganji *et al.*, 2010) and certain types of cancer (Spina *et al.*, 2006). Type 2 diabetes mellitus (T2DM) is a major metabolic disorder that has become increasingly prevalent (Shils *et al.*, 2006). The number of people suffering from diabetes is expected to become more than double by 2030 from 171 million to an astonishing 366 million people worldwide, with 90% of them suffering from T2DM (Wild, 2000). The pathogenesis of T2DM remains unknown since there are many malfunctioning mechanisms that occur simultaneously and can lead to the development of the disease. Besides the genetic factors that predispose people to developing T2DM, there are also many environmental factors contributing significantly to its development. These factors include physical inactivity, poor nutrition (habits), and obesity (Zhao *et al.*, 2013).

1. Nevertheless, growing evidence indicates that vitamin D deficiency (as measured by serum 25-hydroxy vitamin-D3 concentration) may also result in the pathogenesis of T2DM (Bellan *et al.*, 2014). This study focuses on correlation of vitamin D level with body mass index and waist circumference in diabetic population. The body mass index (BMI) or Quetelet index is a value derived from the mass (weight) and height of an individual. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of kg/m², resulting from mass in kilograms and height in meters. Higher body mass index (BMI) is associated with morbidity and mortality especially that related to diabetes mellitus and cardiovascular diseases (World Health Organization, 1995). In 1997, a WHO expert committee classified a BMI of 25.0 – 29.9 kg/m² as overweight, 30 – 34.9 kg/m² as obesity and ≥ 35 kg/m² as morbid obesity (World Health Organization, 2000). Ethnic specific BMI cut off values, especially for Asian populations, have been proposed to address the higher prevalence of diabetes and cardiovascular diseases and the differing associations of BMI with body fat in different populations (World Health Organization, 2000). Guidelines for obesity and overweight based on body mass indices (BMI) for Asian Indians were revised based on consensus developed through discussions by a Prevention and Management of Obesity and Metabolic Syndrome group

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(Misra, 2009). The revised guidelines categorize overweight as a BMI of 23.0 – 24.0 (Raatikainen, 2006) and obesity as a BMI ≥ 25 using values lower than the ethnic specific BMI previously advocated for Asian Indians (Misra, 2013). Waist circumference also measures central obesity. Waist circumference is measured at a level midway between the lowest rib and the iliac crest at the end of a normal expiration to the nearest of 0.1 cm. According to International Diabetes Federation, criteria for central obesity in Asian is waist circumference ≥ 90 cm and ≥ 80 cm for male and female respectively (<https://www.idf.org/component/attachments/attachments.html?id=705&task>.)

Aim of the study

The aim of this study was to investigate the correlation of vitamin D level with body mass index and waist circumference in diabetic population.

MATERIALS AND METHODS

Type And Place Of Study: The present study is a cross-sectional, observational study in 100 subjects of age group 30-60 year (mostly in between 51-60 year) attending endocrinology, general medicine OPD, or admitted to medical wards in Jawahar Lal Nehru Medical College, AMU; Aligarh. **Inclusion Criteria:** subjects included were in age group between 30 to 60 year and who were newly diagnosed or previously diagnosed diabetes mellitus patients. **Exclusion Criteria:** Those who did not fulfill the inclusion criteria. **Anthropometric Measurement and Laboratory Analysis:** Study included physical and biochemical data. Physical data included –weight, height, body mass index, and waist circumference. Biochemical data included – fasting blood glucose, HbA1C, and 25-hydroxy vitamin D (25-OH D) level. Vitamin D status was classified as- sufficient ≥ 75 nmol/l, insufficient $< 75 \geq 50$ nmol/l, deficient ≤ 50 nmol/l.

Statistical Analysis

Statistical Analysis was performed using SPSS Statistical package for windows (SPSS VERSION 20). All p-values were two-tailed and p values < 0.05 were considered statistically significant.

RESULTS

Total 100 subjects were included in the study, out of which 55 were males and 45 were females. Mean age of the total study population were 53.83 year with age range of 30 to 60 year. In this study mean weight (in kg), height (in cm), BMI (kg/m²) and waist circumference (in cm) of the subjects were 78.6, 163.4, 29.4 and 103.1 respectively.

Figure 1. International Diabetes Federation Criteria for Central Obesity

Country/Ethnic Group	Waist Circumference
Europids	Male ≥ 94 cm
	Female ≥ 80 cm
South Asians, Chinese, Japanese	Male ≥ 90 cm
	Female ≥ 80 cm
Ethnic South And Central America	Use South Asian Recommendations Until More Specific Data Are Available
	Use European Data Until More Specific Data Are Available
Sub-Saharan Africans, Eastern Mediterranean And Middle East (Arab) Populations	Use European Data Until More Specific Data Are Available
	Use European Data Until More Specific Data Are Available

Figure 2. Vitamin D Status Of Study Population

VITAMIN D STATUS	LEVEL OF 25 OH VITAMIN D
SUFFICIENT	≥ 75 nmol/l
INSUFFICIENT	$< 75 \geq 50$ nmol/l
DEFICIENT	≤ 50 nmol/l

Figure 3. Baseline characteristic of study population

Baseline characteristics	Total(n=100)
Age(year)	53.8(30-60)
Male	55
Female	45
Weight(kg)	78.6(54-98)
Height(cm)	163.4(148-178)
Waist circumference(cm)	103.1(82-121)
Body mass index(kg/m ²)	29.4(36.2-22.5)
Overweight	5
Obese	92
25 OH vit D3(nmol/l)	44.8(26.3-77.9)
Vitamin D deficient	67
Vitamin D in insufficient	27
Fasting blood sugar	144.3(110-206)
HBA1C	8.09(5.9-12.2)

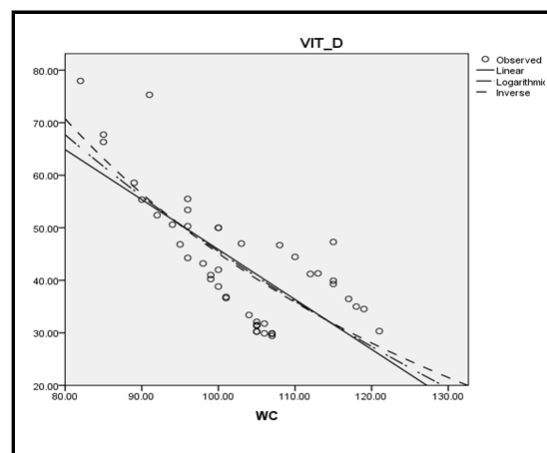


Figure 4. Showing Association Between Vitamin D Level And Waist Circumference

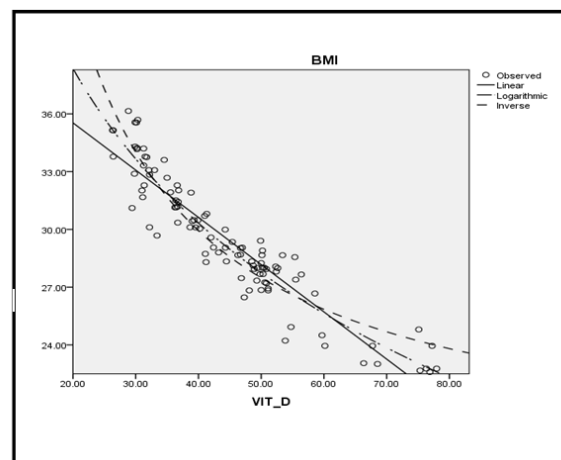


Figure 5. Showing Association Between Vitamin D Level And Body Mass Index

In the study, 92 percent were obese and 5 percent were overweight as per criteria for obesity according to BMI in asians. Mean vitamin D level of study population were 44.8 nmol/l. Vitamin D insufficiency and deficiency were present in

27 and 67 percent of study population respectively and rest were vitamin D sufficient. We could not find any statistical significant association between age and vitamin D level ($p=0.354$) in study subjects. Mean waist circumference (in cm) of male 105.87 ± 1.29 and of female 102.51 ± 9.44 . There is highly significant association between waist circumference with vitamin D level (p -value <0.001) in both male and female. Increased waist circumference was associated with low level of vitamin D. Deficient group has comparatively higher waist circumference than insufficient and sufficient group. Higher level of BMI was significantly associated with low level of vitamin D level (p -value <0.001). Mean fasting blood glucose and mean HbA1C of study subjects was 144.3mg/dl and 8.09% respectively. There were inverse association of fasting blood glucose and HbA1C with vitamin D level (p -value 0.014 and <0.001 respectively).

DISCUSSION

In our cross sectional study conducted in 100 patients of diabetes mellitus, we concluded that 67% subjects were Vitamin D deficient. In the study population mean $25(\text{OH})\text{D}$ level was 44.8 nmol/l . In our study we could not find any association between age distribution of study population and vitamin D level of the study population ($p=0.354$). There was highly significant inverse association between waist circumference and BMI with vitamin D level in both male and female i.e; subjects with low level of vitamin D level had high waist circumference and BMI. HUNT study, Szmitko et al. (2006) and Ford et al. (2004) also show that the increased waist circumference is associated with low vitamin D level.

Conclusion

Our result suggest that vitamin D level is significantly associated with body mass index (BMI) and waist circumference in study population. High BMI and waist circumference was associated with low level of vitamin D level. The principal limitation of our study was its cross-sectional design, and thus the causative nature of the association cannot be established. In addition, this study was based on a single measurement of vitamin D. Abbreviations: CVD-cardiovascular disease, IDF-international diabetes federation, BMI-body mass index, HbA1C-glycated hemoglobin, T2DM-type 2 diabetes mellitus, OPD-out patient department, AMU-Aligarh Muslim University, FBS-fasting blood sugar, 25 OH D - 25 hydroxy vitamin D, WC-waist circumference.

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