

# Type II Diabetes and Vitamin D Levels Interdependence Among Working Old Adults

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## ABSTRACT

**Objective:** Due to the increase in the development of chronic Type II Diabetes among old working adults due to the role and levels of Vitamin D. The research was conducted for the exploration of the same research topic. This research aims to investigate the association between type II diabetes and vitamin D levels in the old working adults (above the age of 45 years).

**Materials and Methods:** This cross-sectional research was conducted in the premises of Lahore which included a total of 1821 working employees of various institutes, firms and companies. The study included males (83%) and females (17%). The mean age of the research participants was 52±5.5 years. A self-report was used for the assessment of the sociodemographic data of the individuals included in the research. Fasting Plasma Glucose (FPG) and Glycosylated Hemoglobin (HbA1c) were assessed by blood samples for the determination of diabetes and vitamin D level status. We included four categories of vitamin D including <10, 10-19.9, 20-29.9 and ≥30 with measuring unit as ng/ml. Respective Bivariate associations between the composite indicator and vitamin D categories for diabetes mellitus were either self-reported or FPG ≥ 126 mg/dl / HbA1c ≥ 6.5%. Further associations were also made through multivariate models in order to investigate potential controlling cofounders.

**Results:** Increasing FPG has a direct association with severe vitamin D level deficiency (<10 ng/ml) for the FPG values of β, 95% Confidence Interval and P-Value respectively 3.13; 0.78, 5.47 and ≤0.01 and HbA1c values for β, 95% Confidence Interval and P-Value respectively 0.15; 0.08, 0.23 and ≤0.001) which were adjusted in the linear regression models. Multivariate models show that after controlling potential models diabetes mellitus was also associated with deficiency of vitamin D levels with values of OR, 95% Confidence Interval and P-Value respectively 2.55; 1.16, 5.62 and ≤0.05).

Practical implication: Vit-D can be used as an essential dose for older DM patients.

**Conclusion:** The outcomes of the research reflect that there is an association between deficiency of vitamin D and diabetes mellitus among older working adults working in different corporate and commercial sectors. The identification of risk is unique with respect to the location and working environment of the individuals who were screened for diabetes mellitus.

**Keywords:** Cardiovascular disease, 25-hydroxyvitamin D, diabetes mellitus (DM), older adults.

## INTRODUCTION

The estimated prevalence of 25-hydroxyvitamin D (Vitamin D) is 30% to 87%<sup>1</sup>. Vitamin D deficiency (<20 ng/ml) has been recognized as the cause of rickets among children and osteomalacia among adults back in the 19<sup>th</sup> century<sup>2</sup>. Under 10 ng/ml is categorized as severe deficiency<sup>3</sup>. In the last four decades, observational studies have also correlated the deficiency of vitamin D with the onset of diabetes mellitus and chronic cardiovascular diseases<sup>4</sup>. For the prevention of chronic diseases efforts have been made to develop national and international guidelines to maintain vitamin D levels and good calcium homeostasis<sup>5</sup>. The worldwide prevalence of type II diabetes especially among industrial countries is at an increase which is expected to cross 4.4% by 2030<sup>7</sup>. The increase is also trending among working adults as a result of their social and economic effects globally. Most of the countries have taken diabetes prevention as a priority. Studies put the association of Vitamin D levels with the onset of Type II diabetes in question. Few of the studies report the association between ill and elderly instead of healthy working adults. The shift has been observed from the ill-aged population to the older working age groups<sup>8</sup>. A public approach is required in the workplace setting for improved participation. Due to the increase in the development of chronic type II diabetes among old working adults due to the role of Vitamin D levels the research was conducted for the exploration of the same.

This research aims to investigate the association between type II diabetes and vitamin D levels in the old working adults (above the age of 45 years).

## MATERIALS AND METHODS

This cross-sectional research was conducted on the premises of Lahore which included a total of 1821 working employees of

various institutes, firms and companies after taking their informed consent. The study included males (83%) and females (17%). The mean age of the research participants was 52 ± 5.5 years. A self-report was used for the assessment of the sociodemographic data of the individuals included in the research. Fasting Plasma Glucose (FPG) and Glycosylated Hemoglobin (HbA1c) were assessed by blood samples for the determination of diabetes and vitamin D level status. We included four categories of vitamin D including <10, 10-19.9, 20-29.9 and ≥30 with measuring unit as ng/ml. Respective Bivariate associations between the composite indicator and vitamin D categories for diabetes mellitus were either self-reported or FPG ≥ 126 mg/dl / HbA1c ≥ 6.5%. Further associations were also made through multivariate models in order to investigate potential controlling cofounders. A well-framed questionnaire was used to collect the data of the participants from 8 am to 4 pm. The online questionnaire included information related to arterial hypertension, chronic diseases, gender, age, cardiovascular diseases, diabetes mellitus, medical history, etc. The data of some patients was collected manually as well because of non-using of internet. The relation of the work-induced stress has also been established with diabetes mellitus and it was also measured in the research [9]. Study outcomes were tabulated for FPG and HbA1c deficiency among participants along with Age, Upper Management, Gender, Exercise, Alcohol, Intake, Meat Intake specially Fish Intake, Current Smoker, Recruitment Period, Urine Albumin, Systolic BP, Diastolic BP, Hypertension, Waist Circumference, C-Reactive Protein and Serum Creatinine.

## RESULTS

Increasing FPG has a direct association with severe vitamin D level deficiency (<10 ng/ml) for the FPG values of β, 95% Confidence Interval and P-Value respectively 3.13; 0.78, 5.47 and ≤0.01 and HbA1c values for β, 95% Confidence Interval and P-Value respectively 0.15; 0.08, 0.23 and ≤0.001) which were

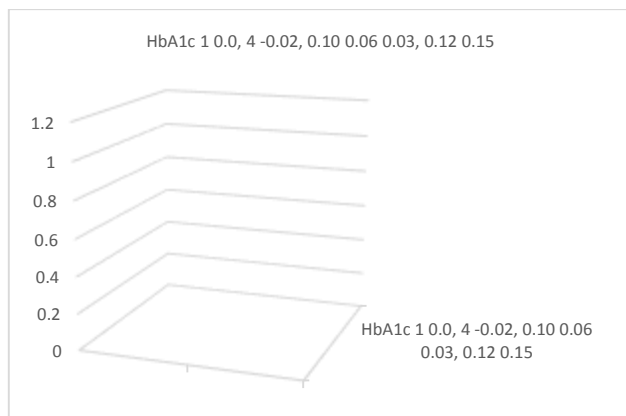
adjusted in the linear regression models. Multivariate models show that after controlling potential models diabetes mellitus was also associated with deficiency of vitamin D levels with values of OR, 95% Confidence Interval and P-Value respectively 2.55; 1.16, 5.62 and  $\leq 0.05$ ). Of the total 2056 employees, a total of 1821 presented their full data. There was no significant difference among excluded subjects from the study. In the self-reporting diagnosis, a total of 111 (6%) participants fulfilled the DM criteria with an overall mean level of Vitamin D of  $22.1 \pm 10.8$  ng/ml. 13% of the participants presented severe vitamin d deficiency. Females were more likely to have vitamin D deficiency and increased waist circumference having HbA1c and FPG trend P-Value  $\leq 0.01$ . The highest vitamin D category were active smokers, who consumed alcohol and they were also physically active. Both the groups did not differ for diastolic and systolic BP measurements. Decreasing levels of vitamin D showed an increased prevalence of diabetes mellitus (3% to 7%). Participants having diabetes also showed reduced vitamin D levels having respective values of  $22.0 \pm 10.8$  ng/ml and  $20.3 \pm 10.0$  ng/ml having P-value  $\leq 0.05$ .

Table 1: Self-Reported Characteristics based on the results of questionnaire

Self-Reported Characteristics	Diabetes Mellitus
Age	0.126
Upper Management	-0.01
Gender	-0.004
Exercise	0.069
Alcohol Intake	0.024
Fish Intake	0.01
Current Smoker	0.042
Recruitment Period	0.038
Urine Albumin	0.107

Table 2: Comparison between FPG and HbA1c (N=1821)

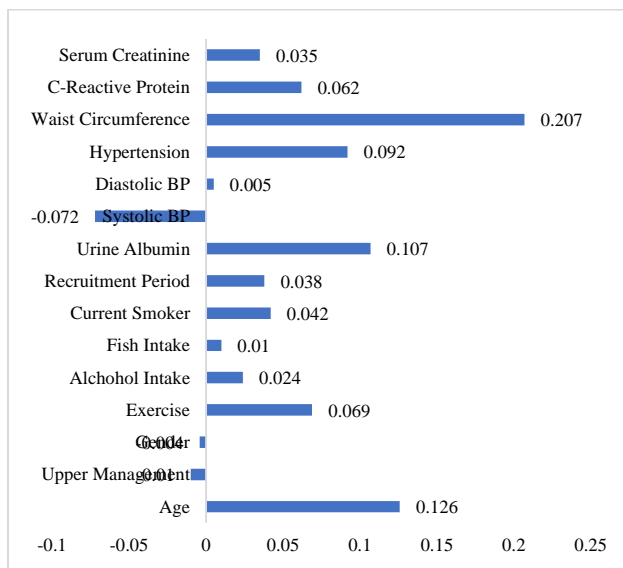
N=1821	Sufficiency ( $\geq 30$ ng/ml)	Insufficiency (20-29.9 ng/ml)		Moderate Deficiency (10-19.9 ng/ml)		Severe Deficiency (<10 ng/ml)	
	Ref Cat	$\beta$	95% CI	$\beta$	95% CI	$\beta$	95% CI
FPG	1	1.0, 8	-0.76, 2.92	1.85	0.02, 3.67	3.13	0.78, 5.47
HbA1c	1	0.0, 4	-0.02, 0.10	0.06	0.03, 0.12	0.15	0.08, 0.23



**DISCUSSION**

The objective of the research was to assess the association between vitamin D deficiency and type II diabetes among working adults including self-reported characteristics and dependent variables. Dependent variables were taken as the prevalence either threshold values or self-reported diagnosis among the participants having sufficient, deficient and severely deficient levels of vitamin D in comparison to the participants having normal levels. Association were strong when adjusted for various potential cofounders. The outcomes of this research about the deficiency of vitamin D levels were slightly lower than the German study which was conducted on 18 years to 79 years population (13% versus 16% prevalence)<sup>10</sup>. The association of vitamin D deficiency was mostly found in overweight females and associated characteristics

Systolic BP	-0.072
Diastolic BP	0.005
Hypertension	0.092
Waist Circumference	0.207
C-Reactive Protein	0.062
Serum Creatinine	0.035



included alcohol intake, smoking and physical exertion. Studies have also explored the association of lifestyle factors with the onset of DM and deficiency of vitamin D levels. Obese people can take less benefit from vitamin D levels as it is a lipophilic phenomenon stored in the fat cells. Studies conducted in the Arabian countries also associate vitamin D levels deficiency with females as they mostly keep their body covered which is not in general among the European females<sup>11</sup>. The female population in this research was 17% with a mean age of 51.8 years where the association can be made with the postmenopausal effects<sup>12</sup>. The association of vitamin in D deficiency with alcohol intake and smoking was inverse. Our outcomes about the alcohol intake and smoking are contrary to available literature<sup>13</sup>. The 6% prevalence of DM in this research is comparable with other studies<sup>14</sup>. Several pieces of evidence support the vitamin D influence on the impaired  $\beta$ -cell function, systematic inflammation and insulin resistance<sup>15</sup>. Vitamin D potentially modulates the response of insulin which enhances the glucose level<sup>16</sup>. There was a higher number of undiagnosed DM cases; whereas, 33% of the diabetic cases were healthy. It proves that the workplace is an appropriate screening setting. Our outcomes also correspond to the outcomes of studies conducted on German and Korean elderly patients where vitamin D was found associated with the better glycemic levels<sup>17-18</sup>. No casual conclusion can be drawn due to the cross-sectional design of the research and the outcomes are also limited to the population of this research that including the elderly working class. No anti-diabetic drugs were assessed during the research along with the type I diabetic status of the participants.

**CONCLUSION**

The outcomes of the research reflect that there is an association between deficiency of vitamin D and diabetes mellitus among older

working adults working in different corporate and commercial sectors. The identification of risk is unique with respect to the location and working environment of the individuals who were screened for diabetes mellitus. Screening for the deficiency of vitamin D levels is recommended for the people at risk of Type II diabetes.

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