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Original Article

Association of Vitamin D Deficiency and Type-2 Diabetes Mellitus in Adults

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ABSTRACT

Objective: To find the relationship of vitamin D deficiency with type-2 diabetes mellitus in adults.
Study Design: Comparative cross-sectional study.
Place and Duration of Study: Combined Military Hospital, Peshawar Pakistan, from Oct 2020 to Mar 2021.
Methodology: Patients with type-2 Diabetes and non-diabetics were selected outdoors and indoors using consecutive sampling techniques. Vitamin D serum levels were measured in all participants. Vitamin D serum level <10ng/ml was considered deficient in Vitamin D. Demographic data, duration of type-2 diabetes mellitus, diet, and co-morbidities, were recorded. Participants were separated into groups such as Group-1, which includes diabetic patients, and Group-2, which contains control (normal/non-diabetic) patients.
Results: In the current study, 100 participants were examined. In Diabetes-Group, Vitamin D deficiency was documented in 15(30%) patients, while in the Control (normal/no-diabetics) Group, no patients were found to have Vitamin D deficiency (p<0.001). No significant association of Vitamin D Deficiency was recorded with age (p=0103) and gender of participants in both groups (p=0.719).
Conclusion: In adults, type-2 diabetes mellitus is associated with Vitamin D deficiency, and diabetic patients may need to be screened for Vitamin D deficiency.

Keywords: Type-2 diabetes mellitus, Vitamin D Deficiency, Adult, Middle Aged.

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INTRODUCTION

Type-2 diabetes mellitus (DM) is a multifactorial and irretrievable enduring disease. In Pakistan, type-2 DM is considered a leading health problem with an 11.7% ratio, as per a study by Meo *et al*.[1] They found it to be more common among males and residents of urban areas. Vitamin D deficiency is considered to have a link with the development of diabetes mellitus.[2] In two Studies carried out in Quetta among homemakers, 58.9% were found Vitamin D deficient.[3] Vitamin D emerges as a potential improvable risk factor to combat the increasing burden of type-2 DM and find an innovative approach for preventing the development of type-2 DM.[4] In Pakistan, various studies have been conducted to find the relationship between Vitamin D and type-2 DM. Most of them have shown a positive relationship between the two.[5,6] Similar trends have been documented internationally as well.[7,8] Vitamin D has a significant function in immune modulation and in tumour suppression. Vitamin D is also important for health and the development of bones. Moreover, the serum level of Vitamin D is related to the development of osteoporosis, and a serum Vitamin D level of 12ng/dl increases the risk of infection and mortality.[9,10]

Considering the magnitude of the problem and the fact that recent data from this part of the country is not available in the form of published literature, we carried out the current study to find the relationship between Vitamin D and type-2 DM in our patients. The results would help us in identifying patients requiring vitamin D replacement.

METHODOLOGY

The comparative cross sectional study was conducted at the Department of Medicine, Combined Military Hospital, Peshawar Pakistan, from October 2020 to March 2021 after approval was obtained from the Ethical Review Committee of Combined Military Hospital Peshawar (Reference number 18). Free statistics calculator version 4.0 was used to calculate the sample size, an anticipated incidence of Vitamin D

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deficiency of 69% in Group-1 (diabetic) and 23% in the Control (non-diabetic) Group.[11]

Inclusion Criteria: Participants aged 20-60 years, having an adequate dietary intake (diet comprising at least major macronutrients, i.e. carbohydrates, proteins and fats) and proper sun exposure (at least 30 min of daily midday sunlight) were included in both Diabetes and Non-Diabetes Groups using a consecutive sampling technique.

Exclusion Criteria: Participants having type-1 diabetes mellitus, diet deficient in vitamin D, using supplemental Vitamin D, Gastrointestinal diseases (Irritable bowel syndrome, Crohn's and celiac disease untreated, pancreatic enzyme insufficiency, primary biliary disease, alcoholic liver disease), chronic kidney disease, rheumatological disorders including rheumatoid arthritis and osteoarthritis, bone diseases (Osteomalacia, Osteoporosis), skin diseases (Psoriasis, Atopic dermatitis) were not included.

Informed consent was taken from all participants. 3ml of venous blood was withdrawn, and serum Vitamin D level was measured using the kit method (Roche Diagnostics). Vitamin D serum level <10ng/ml was considered deficient in Vitamin D .[12]

Statistical Package for Social Sciences (SPSS) version 24.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test and Independent sample t-test were applied to explore the inferential statistics. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

There were 100 participants in the current study, including 50 patients with diabetes and 50 control (non-diabetics). The mean age was 43.60±10.58 years in the Diabetes Group and 39.26±11.26 years in the Control Group. Mean Vitamin D levels were 19.03±12.96 and 27.52±15.04 in Diabetes and Non-Diabetes Groups respectively (*p*=0.003) . No significant (*p*=0.719) relation was found in the patient having deficiency of Vitamin D with their gender. The frequency of the Vitamin D deficiency in both groups is described in the Figure.

Vitamin D deficiency was found more in DM-Group 15(30%) than in the Control Group. The *p*-value was highly statistically significant (<0.001) with an odds ratio of 0.700 and 95% CI of 0.584-0.839. Table shows the association of type-2 diabetes mellitus with Vitamin D deficiency.

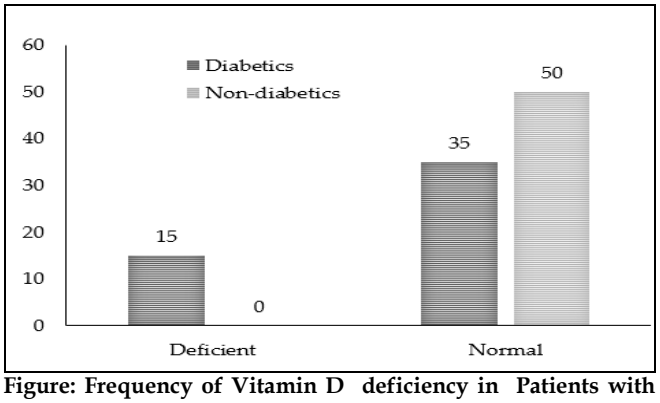

Figure: Frequency of Vitamin D deficiency in Patients with Diabetes and Control Group

Table: Association of Age, Gender and Vitamin D Deficiency Among Study Groups (n=100)

Parameters	Diabetes Mellitus-Group	Control-Group	*p*-value
Age			
(Mean± SD)	43.60± 10.58	39.26± 11.26	0.103
Gender n(%)			
Male Female	25(50) 25(50)	25(50) 25(50)	0.719
Vitamin D Levels			
Mean± SD	19.03±12.96	27.52±15.04	0.003
Vitamin D			
(<10ng/ml)	15(30)	0(0)	<0.001

DISCUSSION

Type-2 DM is considered a leading health problem in Pakistan. Type-2 DM is a complex disease and is connected with the metabolism of energy. Glycemic control is important in diabetic patients, as there is an increased prevalence of anxiety and depression in patients with poor glycemic control, as evidenced by previous studies.[13] Compilations of micro-vascular like nephropathy, neuropathy, retino-pathy and macro-vascular complications like cerebro-vascular disease, coronary heart disease, cardiomyo-pathy, arrhythmias, peripheral artery diseases may also occur due to the poor control of glycemic.[14] Although type-2 DM pharmacotherapy is well studied and is successfully effective, it is still a serious problem because it is related to numerous other reasons like high cost, poor long-term adherence and potential side effects.[15] So, there is also a high ratio of type-2 DM and vitamin D deficiency.[16] The primary objective of the current study was to find the relationship between Vitamin D and type-2 DM. The results show a

significant alternate relation between Vitamin D and type-2 DM, which shows similarities with the previous study. Wennberg *et al*. found that Vitamin D supplementation could reduce insulin resistance in type-2 DM patients.[17] The same finding that Vitamin D supplementation is beneficial for type-2 DM patients was found in another study.[18] Study done in Pakistan in 2017 recorded the increased ratio of Vitamin D deficiency in type-2 DM patients.[14] Another study detailed study of Vitamin D3 in type-2 DM patients and reached the analysis that Vitamin D3 (4000 IU/d) may not affect the HbA1c in type-2 DM patients.[19] In our results, we also found a negative relationship between Vitamin D and type-2 DM. In another study, a negative relationship was found between Vitamin D and type-2 DM, which shows that in type-2 DM patients, the range of Vitamin D reduces.[20]

Moreover, our current study found a non-significant relation between type-2 DM and Vitamin D, male and female, and patients with different age groups. Our study also contrasts with another study, which shows more relation between Vitamin D and type-2 DM in females than males.[21]

LIMITATION OF STUDY

Our current study has some limitations because it was cross sectional study, so it was difficult to indicate the cause-and-effect relationship. In the current research, we did not segregate the included patients based on co-morbidities. These diseases may act as confounding variables in accurately determining Vitamin D deficiency in patients.

CONCLUSION

Patients with type-2 diabetes were found to have reduced Vitamin D levels. Therefore, these patients need to be screened for Vitamin D deficiency.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AG & MA: Conception, study design, drafting the manuscript, approval of the final version to be published.

ARA & SQ: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

AHK & AS: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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