

Vitamin D Insufficiency In Type 2 Diabetics: A Hospital-Based Evaluation Of Incidence And Severity

Dr Surumi Azees
Dr Balachandra A Shetty
Dr Aswathi Kamal
Dr Anju Anto

Abstract

Objective: The objective of the study was to determine the frequency and intensity of vitamin D insufficiency in individuals with type 2 diabetes mellitus (DM).

Methods: This retrospective investigation was carried out in the Department of Medicine over a one-year period. After receiving the consent of the patients and approval from the Ethical committee, a total of 200 participants were recruited for the study. Out of them, 100 healthy individuals were included as the case group (Group-A) and 100 patients with type-2 diabetes mellitus were enrolled as the control group (Group-B).

Results: A total of 120 individuals (60% males and 40% females) were included in the study. Our study revealed that 38% of the participants fell within the age range of 40-50, while 32% were between 50-60 years old. Additionally, 16% were below the age of 40, and 14% were above the age of 60. Out of the total sample, 35 individuals (35%) had been diagnosed with diabetes for a duration of 1-5 years, 45 individuals (45%) for 6-10 years, and 20 individuals (20%) for more than 10 years. Out of the total sample, 6 individuals (6%) were diagnosed with ischemic heart disease, whereas 18 individuals (18%) had hypertension as a result of vitamin D insufficiency. Diabetes patients with well-managed HbA1C levels had 10 instances of adequate, inadequate, and insufficient levels of Vitamin D, while uncontrolled diabetes patients had 8 instances, 34 instances, and 18 instances respectively.

Conclusion: Diabetic patients have a higher prevalence of vitamin D insufficiency compared to the general healthy population. The majority of afflicted patients were male, and the deficit was most commonly identified in the uncontrolled group.

Keywords: Prevalence, Severity, Vitamin D deficiency, Diabetes Mellitus

Date of Submission: 16-10-2024
26-10-2024

Date of Acceptance:

I. Introduction

The global pandemic of Diabetes Mellitus (DM) is a significant contemporary health issue due to the substantial burden of vascular problems linked to the disorder. By the year 2025, it is projected that over 380 million people globally would be impacted by diabetes. The occurrence and frequency of Type-2 Diabetes Mellitus (T2DM) is experiencing a significant and rapid rise. In 2010, the global number of diabetes patients exceeded 285 million, and it is projected to reach around 438 million by 2030.¹ Asian Indians have a heightened susceptibility to developing insulin resistance, the metabolic syndrome, type 2 diabetes mellitus (T2DM), and coronary heart disease.² Diabetes mellitus (DM) is a collection of disorders characterized by high blood sugar levels and linked to disruptions in the processing of carbohydrates, fats, and proteins due to deficiencies in insulin production, insulin function, or both.³ Vitamin D deficiency is a growing concern worldwide, with an estimated one billion individuals experiencing either a shortage or inadequacy of this vitamin.⁴ Possible factors contributing to this phenomenon include insufficient sunlight exposure in metropolitan environments, inadequate consumption of fortified meals, and obesity.^{5,6}

Vitamin D is a hormone with several effects that is known to have an impact on the immune system, as well as calcium and bone metabolism.^{7,8} Receptors for the activated form of it have been discovered on pancreatic β cells and immune cells.^{9,10} There is evidence that shows a connection between vitamin D deficiency and bacterial and viral illnesses.^{11,12} Each year, foot infection is responsible for 20% of hospitalizations among diabetic people.¹³ Immunological deficiencies, together with neuropathy and vascular abnormalities, play a

significant role in the development of diabetic foot and subsequent infections.¹⁴ Various studies have demonstrated that a lack of vitamin D results in malfunctioning immune cells, damage to β cells, and reduced insulin production.^{15,16} Several studies have indicated a link between Vitamin D insufficiency and several metabolic disorders, such as hypertension, diabetes, dyslipidemia, and obesity.¹⁷ Research has demonstrated that vitamin D has a role in the development of diabetes, and individuals with diabetes are most likely to have a shortage in vitamin D. Therefore, the objective of this study was to determine the prevalence and severity of vitamin D deficiency in individuals with type 2 diabetes mellitus (DM).

II. Materials And Methods

This retrospective investigation was carried out in the Department of Medicine over a one-year period. After receiving the consent of the patients and approval from the Ethical committee, a total of 200 participants were recruited for the study. Out of them, 100 individuals without any health issues were included as case group (Group-A), while the remaining 100 participants were type-2 diabetes mellitus patients and served as the control group (Group-B).

Controls consist of healthy individuals who have been matched for age and sex. This study excluded individuals under the age of 18, individuals with chronic kidney disease, individuals who had taken calcium or vitamin D supplements in the past 3 months, and individuals with any known chronic illness. The patients who met the criteria indicated above were chosen after obtaining informed consent. All patients in this study underwent a comprehensive history and clinical assessment.

Laboratory procedures that are performed on a regular basis Standard procedures were used to conduct investigations such as CBC, FBS, RBS, PP2BS, HbA1C, blood urea, serum creatinine, lipid profile, urine albumin, and Vitamin D3 levels in the central laboratory. The serum vitamin D level was categorized as follows: sufficient if it ranged from 30 to 100ng/ml, insufficient if it ranged from 20 to 29ng/ml, and deficient if it was less than 20ng/ml. The results were analyzed using appropriate statistical procedures. Data were analyzed by using SPSS-20.

III. Results

Table 1: Demographic data

Gender	Cases	Controls	Total
Male	30	50	80 (40%)
Female	70	50	120 (60%)
Age groups in years			
<40	20	12	32 (16%)
40-50	36	40	76 (38%)
50-60	30	34	64 (32%)
>60	14	14	28 (14%)

There were about 120 (60%) males and 80 (40%) females were enrolled in study. We found highest 76 (38%) in the range of 40-50 years then 64 (32%) people in 50-60, 32 (16%) in <40 and 28 (14%) in >60 respectively.

Table 2: Vitamin D level in diabetes patients in relation with the parameters

Parameters	n	%	
Duration of diabetes	1-5 years	35	35
	6-10 years	45	45
	>10 years	20	20
Hypertension	Yes	18	18
	No	82	82
Ischemic heart	Yes	6	6
	No	94	94

35 (35%) patients having diabetes duration of 1-5 years, 45 (45%) had 6-10 years and 20 (20%) had more than 10 years of duration. 18 (18%) had hypertension and 6 (6%) had ischemic heart disease which had relation with the deficiency of vitamin D level.

Table 3: The prevalence & severity of vitamin D level with the category of diabetes control

Vitamin D level	Diabetes control	
	Controlled Diabetic (n=40)	Uncontrolled Diabetic (n=60)
	n	n
Sufficient	10	8
Insufficient	24	34
Deficient	6	18

In patients with controlled diabetes as per HbA1C criteria, the prevalence of sufficient, insufficient and deficient Vitamin D was 10 cases, 24 cases and 6 cases respectively, where in patients with uncontrolled diabetes it was 8 cases, 34 cases and 18 cases respectively.

IV. Discussion

Vitamin D insufficiency is a significant global health issue. According to a study conducted by Pfoftrnhauer KM et al., the global prevalence of Vitamin D insufficiency is approximately 15%.¹⁸ Given the demonstrated impact of vitamin D on the pathophysiology of diabetes and the high incidence of vitamin D insufficiency, we have undertaken this study to examine the reciprocal effects of these two prevalent diseases. Studies conducted in diverse geographical regions and cultural contexts have revealed a wide variety of prevalence rates for vitamin D deficiency in individuals with diabetes, ranging from 67% to 98.8%.¹⁹ India has been officially designated as the "Capital of Diabetes." Diabetes mellitus is recognized as a significant and growing pandemic in India, with the current number of diabetes patients reaching 41 million. This number is projected to increase to 70 million by the year 2025. Given the demonstrated impact of vitamin D on the pathophysiology of diabetes and the high incidence of vitamin D insufficiency, we have undertaken this study to examine the reciprocal effects of these two prevalent diseases.

A total of 200 participants were involved in the study, with about 120 (60%) being males and 80 (40%) being girls. In the given data, the biggest number of individuals, 76 (38%), was discovered in the age range of 40-50 years. This was followed by 64 (32%) individuals in the 50-60 age range, 32 (16%) individuals below the age of 40, and 28 (14%) individuals above the age of 60. The study conducted by Patel D et al.²⁰ discovered a nearly same correlation between age and gender. Out of the total number of patients, 35% had diabetes for 1-5 years, 45% had diabetes for 6-10 years, and 20% had diabetes for more than 10 years. Out of the total sample, 18 individuals (18%) were diagnosed with hypertension, while 6 individuals (6%) had ischemic heart disease, both of which were found to be associated with a shortage in vitamin D levels. The prevalence of adequate, inadequate, and deficient Vitamin D levels in patients with well-managed diabetes, as determined by HbA1C criteria, was 10 cases, 24 cases, and 6 instances respectively. In contrast, patients with poorly managed diabetes had 8 cases, 34 cases, and 18 cases of adequate, inadequate, and deficient Vitamin D levels respectively. According to Subramanian A.²¹, the percentage of individuals with Vitamin D deficiency and insufficiency was higher among nondiabetic patients compared to those with type 2 diabetes mellitus (44.4% vs 28.6% and 14.4% vs 11.9%, respectively). A study conducted by Shalini P et al.²² shown that the prevalence of Vitamin D deficiency is higher (80.4%) in hypertension patients compared to healthy individuals (67.7%).

V. Conclusion

Diabetic patients have a higher prevalence of vitamin D insufficiency compared to the general healthy population. The majority of afflicted patients were male, and the deficit was most commonly identified in the uncontrolled group. It is necessary to examine all individuals diagnosed with type 2 diabetes mellitus for their vitamin D levels. If they are discovered to have insufficient or deficient levels of vitamin D, they should be prescribed vitamin D supplements. Additionally, it is imperative to maintain rigorous management of diabetic condition in order to avert vitamin D insufficiency.

References

- [1] International Diabetes Federation. Diabetes Facts [Www.Idf.Org](http://www.idf.org).
- [2] Misra A, Khurana L. Obesity And The Metabolic Syndrome In Developing Countries. *The Journal Of Clinical Endocrinology & Metabolism*. 2008 Nov 1;93(11_Supplement_1):S9- 30.
- [3] Longo DL, Fauci As, Kasper DL, Hauser SI, Jameson JI Loscalzo J. *Harrisons's Principles Of Internal Medicine*. 19th Ed. Mcgraw-Hill Education; 2017:2399.
- [4] Holick Mf. Vitamin D Deficiency. *N. Eng. J. Med.* 357(3), 266–281 (2007).
- [5] Calvo Ms, Whiting Sj, Barton Cn. Vitamin D Intake: A Global Perspective Of Current Status. *J. Nutr.* 135(2), 310–316 (2005).
- [6] Wortsman J, Matsuoka Ly, Chen Tc, Lu Z, Holick Mf. Decreased Bioavailability Of Vitamin D In Obesity. *Am. J. Clin. Nutr.* 72(3), 690–693 (2000).
- [7] Baeke F, Van Etten E, Overbergh L, Mathieu C. Vitamin D3 And The Immune System: Maintaining The Balance In Health And Disease. *Nutrition Research Reviews*. 2007 Jun;20(1):106-18.
- [8] Cantorna Mt, Zhu Y, Froicu M, Wittke A. Vitamin D Status, 1, 25-Dihydroxyvitamin D3, And The Immune System. *The American Journal Of Clinical Nutrition*. 2004 Dec 1;80(6):1717s-20s.
- [9] Chiu Kc, Chu A, Go VI, Saad Mf. Hypovitaminosis D Is Associated With Insulin Resistance And B Cell Dysfunction. *The American Journal Of Clinical Nutrition*. 2004 May 1;79(5):820-5.
- [10] Veldman Cm, Cantorna Mt, Deluca Hf. Expression Of 1, 25-Dihydroxyvitamin D3 Receptor In The Immune System. *Archives Of Biochemistry And Biophysics*. 2000 Feb 15;374(2):334-8.
- [11] Kawaura A, Takeda E, Tanida N, Nakagawa K, Yamamoto H, Sawada K, Okano T. Inhibitory Effect Of Long Term 1 α -Hydroxyvitamin D3 Administration On Helicobacter Pylori Infection. *Journal Of Clinical Biochemistry And Nutrition*. 2006;38(2):103-6.
- [12] Sabetta Jr, Depetrillo P, Cipriani Rj, Smardin J, Burns La, Landry Ml. Serum 25- Hydroxyvitamin D And The Incidence Of

- Acute Viral Respiratory Tract Infections In Healthy Adults. Plos One. 2010 Jun 14;5(6):E11088.
- [13] Lavin Me & O'neal Lw (1988) The Diabetic Foot, Pp. 203–205. St Louis: Cw Mosby Co.
- [14] Geerlings Se, Hoepelman Ai. Immune Dysfunction In Patients With Diabetes Mellitus (Dm). Fems Immunology & Medical Microbiology. 1999 Dec 1;26(3-4):259-65.
- [15] Hayes Ce, Nashold Fe, Spach Km, Pedersen Lb. The Immunological Functions Of The Vitamin D Endocrine System. Cellular And Molecular Biology-Paris- Wegmann-. 2003 Mar 1;49(2):277-300.
- [16] Mattila C, Knekt P, Männistö S, Rissanen H, Laaksonen Ma, Montonen J, Reunanen A. Serum 25-Hydroxyvitamin D Concentration And Subsequent Risk Of Type 2 Diabetes. Diabetes Care. 2007 Oct 1;30(10):2569-70.
- [17] Mitri J, Muraru Md, Pittas Ag. Vitamin D And Type 2 Diabetes: A Systematic Review. Euro J Clin Nutri. 2011;65(9):1005.
- [18] Pfothhauer Km, Shubrook Jh. Vitamin D Deficiency, Its Role In Health And Disease, And Current Supplementation Recommendations. Journal Of Osteopathic Medicine. 2017 May 1;117(5):301-5.
- [19] Alhumaidi M, Adnan Ag, Dewish M. Vitamin D Deficiency In Patients With Type-2 Diabetes Mellitus In Southern Region Of Saudi Arabia. Maedica. 2013;8(3):231.
- [20] Patel D, Pandya H. Prevalence And Severity Of Vitamin D Deficiency In Type 2 Diabetic Patients. International Journal Of Advances In Medicine. 2020;7(8):1251.
- [21] Subramanian A, Nigam P, Misra A, Pandey Rm, Mathur M, Gupta R, Madhusudan S. Severe Vitamin D Deficiency In Patients With Type 2 Diabetes In North India. Diabetes Manage. (2011) 1(5), 477–483
- [22] Shalini S, Dorstyn L, Dawar S, Kumar S. Old, New And Emerging Functions Of Caspases. Cell Death & Differentiation. 2015 Apr;22(4):526-39.