(e) ISSN Online: 2321-9599

(p) ISSN Print: 2348-6805

ORIGINAL ARTICLE

PREVALENCE OF VITAMIN D LEVELS IN PATIENTS OF DIABETES MALLITUS IN RURAL AND URBAN POPULATION OF MALWA REGION OF PUNJAB

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ABSTRACT:

Aim and Objectives – To evaluate the levels of vitamin D having type 2 diabetes mellitus in urban and rural population. **Materials and Method** - A total number of two hundred subjects visiting the out-patient or admitted as in-patients were enrolled in the study, and were grouped into cases diagnosed with Type 2 Diabetes as per ADA guidelines and healthy volunteers. The subjects in each group were further classified into rural and urban population as defined by the census of India (2011). Informed consent was taken from the subjects before participating in the study. All cases were interviewed regarding personal details and detailed history regarding the disease was taken. Investigation ofVitamin D levels [25(OH)D] was done for each subject. **Results**- In the present study, the mean vitamin D levels among cases of rural and urban population was found to be 21.88±8.45ng/ml and 16.2±5.58 ng/ml respectively. The difference was found to be statistically significant (p value:<0.001).**Conclusion**-The present study concluded that the prevalence of Vitamin D insufficiency or deficiency is significantly higher among subjects of Type 2 DM than in healthy controls. The study also reports that among subjects of Type 2 DM, urban population has higher prevalence of Vitamin D insufficiency or deficiency than rural population.

Keywords- Vitamin D, Type 2 Diabetes mellitus, metabolic disorder, insulin.

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This article may be cited as: Gupta A, Soin D, Garg R, Goyal G. Prevalence of vitamin d levels in patients of diabetes mallitus in rural and urban population of Malwa region of Punjab. J Adv Med Dent Scie Res 2017;5(2):111-115.

Access this article online	
Quick Response Code	Website: www.jamdsr.com
	DOI: 10.21276/jamdsr.2017.5.2.26

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders characterized by hyperglycemia resulting from defects in insulin secretion, insulin resistance or both. The chronic hyperglycemia of diabetes is associated with long term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.[1] The prevalence of diabetes is rapidly rising at an alarming rate.[2] Over the past 30 years, the status of diabetes has changed from being considered as a mild disorder of the elderly to one of the major causes of morbidity and mortality affecting the youth and middle aged people.[3 Type 2 DM has become an observably global public health problem. Type 2 DM is increasing at an alarming rate in both developed and developing countries.[3] At present, seven out of top ten countries with the largest number of patients diagnosed with diabetes are low- or middle-income countries, including India, China, Russia, Brazil, Pakistan, Indonesia, and Bangladesh[3], among which the prevalence rates are 12.1% and 9.7% in India and China, respectively.[4] Vitamin D is essential for bone health and low vitamin D is associated with many diseases, such as autoimmune diseases, many forms of cancers, diabetes mellitus, cardiovascular disease and infectious diseases.[5] Vitamin D deficiency has been a neglected disorder. It has been estimated that approximately one billion people have vitamin D deficiency worldwide.[6]Majority of the population of India lives in areas receiving ample sunlight throughout the year and hence there was a disbelief that Vitamin D deficiency is uncommon in India.[7] However from the data available in the published literature, a large proportion of population in India is found to be deficient in Vitamin D levels.[8] Recently, vitamin D has sparked widespread interest in the pathogenesis and prevention of diabetes. Glycaemic control tends to worsen in winter months and is believed to be

because of concomitant fall in vitamin D levels .[9]There is no exact estimation of prevalence of vitamin D deficiency in patients with T2DM around the world. However, studies in different populations have indicated a relatively severe lack of vitamin D in T2DM patients when compared to the levels in healthy people.

MATERIAL AND METHODS-

The present study was an observational randomised comparative study conducted in the department of Medicine, with collaboration of department of Biochemistry at Guru Gobind Singh Medical College and Hospital, Faridkot. A total number of two hundred subjects visiting the out-patient or admitted as in-patients were enrolled in the study, and were grouped into cases diagnosed with Type 2 Diabetes as per ADA guidelines and healthy volunteers. The subjects in each group were further classified into rural and urban population as defined by the census of India (2011). Informed consent was taken from the subjects before participating in the study. All cases were interviewed regarding personal details and detailed history regarding the disease was taken. Investigation of Vitamin D levels [25(OH)D] was done for each subject. The sample size was 200 subjects were enrolled and randomly divided into four groups: Group 1: Fifty subjects diagnosed with type 2 diabetes mellitus of rural population, Group 2: Fifty subjects diagnosed with type 2 diabetes mellitus of urban population ,Group 3: Fifty non-diabetic subjects from rural population, Group 4: Fifty non-diabetic subjects from urban population. Inclusion criteria were Age >18 years , Patients diagnosed with type 2 Diabetes Mellitus according to ADA 2014 guidelines while exclusion criteria were the Subjects receiving Vitamin D supplementation in last six months of study, Patients of Type 1 Diabetes mellitus, Patients who are in End Stage Renal Disease, Metabolic bone disease or disease of parathyroid glands. The data collected from the subjects was entered, compiled and analysed using appropriate statistical methods in SPSS 20.

RESULTS-

Investigations includes Vitamin D levels [25(OH)D] was done for each subject after taking written informed consent. The data collected was analyzed and the following results and observations were obtained. In the present study, total number of subjects studied was two hundred. Out of these, hundred cases diagnosed with Type 2 DM according to ADA guidelines and hundred healthy age and sex matched controls were taken. Cases and controls were further classified into rural and urban population defined as per censes of India (2011). Out of hundred cases, fifty belong to rural population and another fifty, belong to urban population. The controls were also enrolled as fifty belonging to rural population and rest fifty, to urban population. In the study, out of two hundred subjects, one hundred six were males and ninety four were females. Out of these, fifty four males were in case group and fifty two males were in control group. Similarly out of total ninety four females, forty six were in case group and forty eight were in control group. Hence sex distribution among both groups was nearly similar.

In the present study, among cases belonging to rural population, there were twenty eight males and twenty two females and among cases belonging to urban population, there were twenty six males and twenty four females. Similarly, among controls belonging to rural population, there were twenty six males and twenty four females and among controls, belonging to urban population, there were twenty seven males and twenty three females. The sex distribution in the study groups according to their region of locality was nearly similar. In the present study, out of hundred cases diagnosed with Type 2 DM, 61(61%) patients had deficient levels of vitamin D(<20ng/ml) while 33(33%) patients had insufficient levels(20-30ng/ml) and only 6(6%) patients had sufficient levels of vitamin D(>30ng/ml). In the control group, 59(59%) were found to have sufficient levels of vitamin D (>30ng/ml), with 27(27%) found to have insufficient levels (20-30ng/ml) and 14(14%) show deficiency of vitamin D levels (<20ng/ml). Hence vitamin D insufficiency or deficiency among cases was statistically significant (p<0.001), when compared to healthy controls. In the present study, Vitamin D insufficiency or deficiency was found in 40(80%) cases belonging to rural population and 49(98%) to urban population. Hence, vitamin D insufficiency or deficiency among cases of urban and rural population was found to be highly statistically significant (p value:<0.001)In the present, the mean vitamin D level among cases was found to be 18.95 ±7.26 ng/ml, whereas among controls, the mean vitamin D level was found to be 36.48± 11.45 ng/ml that was statistically significant (p value: <0.001)In the present study, the mean vitamin D levels among cases of rural and urban population was found to be 21.88±8.45ng/ml and 16.2±5.58 ng/ml respectively. The difference was found to be statistically significant (p value:<0.001).

TABLE 1: Classification of study groups

Group	Total Number of subjects	Locality of the group	Number of Subjects on the basis of their locality
Cases	100	Urban	50
		Rural	50
Controls	100	Urban	50
		Rural	50

TABLE 2: Showing the sex wise distribution of study groups

Group	Males (%)	Females (%)
Cases(N=100)	54(54%)	46(46%)
Controls(N=100)	52(52%)	48(48%)
Total(N=200)	106	94

TABLE 3: Showing the sex wise distribution of study groups according to their locality

Group		**Males (%)**	**Females (%)**
Cases	Rural(N=50)	28(56%)	22(44%)
(N=100)	Urban(N=50	26(52%)	24(48%)
Controls	Rural(N=50)	26(52%)	24(48%)
(N=100)	Urban(N=50	27(54%)	23(46%)

TABLE 4: Showing the mean age of study groups:

Group	**Mean Age(Years)**	**Standard Deviation**
Cases(N=100)	56.78	10.33
Controls(N=100)	57.02	9.48

TABLE 5: Showing the prevalence of vitamin d in the study groups

Groups	**Sufficient (>30ng/Ml)**	**Insufficient (20-30ng/Ml)**	**Deficient (<20ng/Ml)**
Cases (N=100)	6(6%)	33(33%)	61(61%)
Controls (N=100)	59(59%)	27(27%)	14(14%)

TABLE 6: Showing the prevalence of vitamin d in study groups according to their locality

Groups		**Sufficient (>30ng/ml)**	**Insufficient (20-30ng/ml)**	**Deficient (<20ng/ml)**
Cases	Rural(N=50)	10(20%)	18(36%)	22(44%)
(N=100)	Urban(N=50)	1(2%)	10(20%)	39(78%)
Controls	Rural(N=50)	37(74%)	8(16%)	5(10%)
(N=100)	Urban(N=50)	22(44%)	19(38%)	9(18%)

TABLE 7: Showing the vitamin d levels in the study groups

Groups	**Mean Vitamin D[25(OH)D] levels (ng/ml)**	**Standard deviation**
Cases(N=100)	18.95	7.26
Controls(N=100)	36.48	11.45

TABLE 8: Showing the levels of vitamin d in the study groups according to their locality

Groups		**Mean Vitamin D[25(OH)D] levels (ng/ml)**	**Standard deviation**
Cases (N=100)	Rural (N=50)	21.8800	8.44836
	Urban (N=50)	16.1010	5.58269
Controls (N=100)	Rural (N=50)	38.4969	11.33231
	Urban (N=50)	28.2765	7.70114

DISCUSSION-

Diabetes is a metabolic disease due to progressive destruction of beta cells in the pancreas. The pancreas is responsible for the production of insulin. Autoimmune and environmental factors have been proved to be associated with its development. The prevalence of Diabetes is on a rise, specifically Type 2 diabetes, due to the obesity epidemic, the ageing of populations, and a sedentary

lifestyle. Vitamin D is a steroid hormone and has two forms: vitamin D3 (colecalciferol), which is produced in 80%-90% of the cases by skin absorption of the UVB, and vitamin D2 (ergocalciferol), produced by plants and fish. Known actions of vitamin D are in bone metabolism, in the kidneys and the parathyroid glands. In recent years a theoretical possibility of anti-inflammatory and immunomodulatory effects was raised in the medical literature. A large bulk of literature reports the high prevalence of vitamin D deficiency in patients of Type 2 DM across the globe. Urban subjects had significantly higher prevalence of insufficient or deficient vitamin D levels compared to their rural counterparts, attributable to a greater exposure to sunlight in the rural as compared to urban areas. The present study assessed the prevalence of Vitamin D [25(OH)D] levels in patients of type 2 diabetes mellitus in rural and urban population. Vitamin D Xpress ELISA Kit was used for the quantitative measurement of vitamin D3 in serum. Vitamin D [25(OH)D] deficiency was defined as a Vitamin D [25(OH)D] level below 20 ng/ mL, insufficiency as a level between 21 – 29 ng/mL, and sufficiency as a level of 30 – 100 ng/ml. In the present study, out of hundred cases diagnosed with Type 2 DM, 61(61%) patients had deficient levels of vitamin D [25(OH)D] (<20ng/ml) while 33(33%) patients had insufficient levels(20-30ng/ml) and only 6(6%) patients had sufficient levels of vitamin D [25(OH)D] (>30ng/ml). In the control group, 59(59%) were found to have sufficient levels of vitamin D [25(OH)D] (>30ng/ml), with 27(27%) found to have insufficient levels (20-30ng/ml) and 14(14%) show deficientlevels of vitamin D [25(OH)D] (<20ng/ml). Hence vitamin D [25(OH)D] insufficiency or deficiency among cases was statistically significant(p value:<0.001), when compared to healthy controls. The study also reports that mean vitamin D[25(OH)D] level was significantly lower (18.95±7.26 ng/ml) among cases of Type 2 DM than healthy controls (36.48 ± 11.45ng/ml) and the difference was found to be statistically significant (p value:<0.001).Similar reports were found by Cigolini M et al [10] in 2006 who conducted the study on prevalence of vitamin D deficiency in Type 2 DM patients. The study reports higher prevalence of vitamin D insufficiency or deficiency in diabetic patients than in control subjects (60.8 vs. 42.8%,P value<0.001). The mean vitamin D concentration was 24.1 ±9.1 ng/ml (median 22.3, range 4.9 –91.0) among control subjects and 19.7±10 ng/ml (17,3– 76) among diabetic patients. Henceforth, Vitamin D levels were significantly lower in patients with Type 2 DM when compared with control Group (P value:<0.001). In the year 2012, Yu JR et al[11] in their study had reported that 98% of subjects with Type 2 DM had vitamin D insufficiency or deficiency. The study showed that mean ± SD concentration of Vitamin D in Type 2DM patients was 12.90 ± 0.4 ng/ml while that in controls was15.40 ± 0.5 ng/ml, which was statistically significant (p value:<0.001).A similar study conducted by Shanthi B et al[12] in 2012 on fifty patients with Type 2 DM reported the mean serum vitamin D3 levels of 18.49 ±3.497ng/ml. The study concludes that patients with Type 2 DM had low levels of vitamin D.The study conducted by AI- Zaharani M et al [13] in 2013 on 248 patients with Type 2 DM found that 148 (59.8%) patients were deficient in serum vitamin D3, 96(38.6%) patients had insufficient serum vitamin D3 levels while only 4(1.6%) patients had sufficient serum vitamin D3 level. A similar study done by Zhuang X et al in 2013[14] on 487 patients of Type 2 DM also reported that Vitamin D deficiency was highly prevalent, accounting for 88.3%of the study sample. In the present study, among cases belonging to rural population, Vitamin D [25(OH)D] insufficiency was found in 18(36%), deficiency in 22(44%) and only 10(20%) cases had sufficient vitamin D [25(OH)D] levels, whereas among those belonging to the urban population, 39(78%) had deficient vitamin D [25(OH)D] levels, 8(16%) had insufficiency and 1(2%) had sufficient vitamin D levels. Hence, cases of urban population have higher prevalence of vitamin D [25(OH)D] insufficiency or deficiency, as compared to those of rural. The mean vitamin D [25(OH)D] levels among cases of rural and urban population was found to be 21.88±8.45 ng/ml and 16.21±5.58 ng/ml respectively, that was statistically significant(P value<0.001).The study conducted by Mohan G et al[15] in 2106 also reports higher mean serum vitamin D3 levels (29.29 ± 18.62 ng/ml) in patients with rural background compared with urban population(21.64 ± 9.48 ng/ml). The correlation was statistically significant (P value:<0.041). Similar findings were cited by Bachhel R et al[16] in 2016, ninety-six (94.12%) urban subjects displayed insufficient levels as compared to 81.25% rural subjects. It could perhaps be attributed to a greater exposure to sunlight in the rural as compared to urban areas. The present study also reports a significantly higher prevalence of insufficient or deficient vitamin D [25(OH) D] levels in urban subjects of Type 2 DM compared to their rural counterparts. A similar trend has been shown in various other studies, covering different populations around the world. This finding can perhaps be attributed to a greater exposure to sunlight in the rural areas when compared to the urban areas. Also, there is a greater tendency among urbanites to use protective sunscreens which could prevent vitamin D synthesis by UV light.

CONCLUSION-

The present study was observational randomized comparative study conducted in the Medicine department of Guru Gobind Singh Medical College and Hospital, Faridkot to assess the prevalence of Vitamin D level and corrected calcium in patients of type 2 diabetes mellitus of rural and urban population. The prevalence of vitamin D [25(OH)D] insufficiency or deficiency was found to be 94% in cases (with Type 2 DM) and 41% in healthy controls (without Type 2 DM).The difference was found to be statistically significant (p value: <0.001)..Among cases

of Type 2 DM, higher prevalence of vitamin D [25(OH)D] deficiency or insufficiency was found in T2DM subjects of urban population than the rural population. The difference was found to be statistically significant (p value: <0.001).The mean Vitamin D [25(OH)D] level was lower among T2DM subjects than healthy controls, the difference was found to be statistically significant(p value: <0.001).Among cases of Type 2 DM, the difference in mean vitamin D [25(OH)D] levels among urban and rural population was statistically significant, with urban population showing lower levels of mean vitamin D than rural population (p value: <0.001).The present study concluded that the prevalence of Vitamin D insufficiency or deficiency is significantly higher among subjects of Type 2 DM than in healthy controls. The study also reports that among subjects of Type 2 DM, urban population has higher prevalence of Vitamin D insufficiency or deficiency than rural population. Hence, the study emphasizes a need for public awareness regarding dietary rectifications and lifestyle changes that incorporate ways to have a greater exposure to sunlight. It will help in normalizing vitamin D levels and can prevent the subsequent occurrence of Type 2 DM

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Source of support: Nil **Conflict of interest:** None declared