VITAMIN D DEFICIENCY AND ASSOCIATED FACTORS IN TYPE 2 DIABETES MELLITUS PATIENTS IN A TERTIARY CARE HOSPITAL IN DELHI: A CROSS-SECTIONAL STUDY

Community Medicine

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ABSTRACT

Aim: To find out prevalence of Vitamin D deficiency and associated factors in T2DM patients.
Methodology: Cross-sectional observational analysis conducted in 300 T2DM patients. Data collection tools included semi-structured questionnaire and fasting blood samples from subjects. SPSS version 25 was used for data analysis.
Results: Prevalence of Vitamin D deficiency in T2DM was 84.6%. Statistically significant association between serum cholesterol and lipid profile with Vitamin D deficiency was found. Female gender and inadequate sunlight exposure were independent predictors of Vitamin D deficiency.
Conclusion: High prevalence of Vitamin D deficiency was observed in T2DM patients. T2DM patients should be encouraged to get more sunlight exposure and health professionals should be more vigilant for Vitamin D deficiency detection among female diabetics.

KEYWORDS

Type 2 diabetes; Vitamin D; Vitamin D deficiency

CONTEXT:

World Health Organization estimated 366 million people to be affected with diabetes worldwide and number will increase to 552million by 2030.[1] 31.7million diabetics in India (in year 2000) are predicted to increase to 79.4million in 2030.[2] Specific Vitamin D receptors are present on pancreatic cells.[3] 1-hydroxylase enzyme in pancreatic cells catalyzes conversion of 25(OH)D to 1,25-dihydroxyvitamin D in presence of Vitamin D.[4] Present study was formulated to study prevalence of vitamin D deficiency and associated factors in T2DM patients.

MATERIAL AND METHODS:

Observational cross-sectional study was conducted among T2DM patients attending tertiary care hospital of Delhi, from April 2017 to May 2018.

Sample size was calculated based on Kumar RA et al. study which showed 83% prevalence of Vitamin D deficiency (<30ng/ml).[5] Taking 95% level of significance and 10% allowable error, sample size was calculated to be 140. Considering clustering effect of patients attending diabetic clinic, design effect of 2 was factored to get 280 patients. Considering non-participation rate of 5%, 294 subjects (rounded to 300) were selected.

Inclusion criteria: T2DM patients with HbA1c >7% attending diabetic clinic in tertiary care hospital.

Exclusion criteria: Patients suffering from type-1 diabetes, gestational diabetes, severe incapacitating illness (stroke, terminal stage of cancer, documented mental disorder).

Pre-tested semi-structured interview schedule was used for data collection. Body Mass Index (BMI) criteria modified for Asians was used. Vitamin D deficiency was defined as Serum 25-hydoxyvitamin D level<20 ng/ml, insufficiency as <30 ng/ml and sufficiency as ≥30 ng/ml.

Ethical clearance was taken from Institutional Ethical Committee. Confidentiality of data was maintained. Written informed consent was taken from study participants. SPSS version 25 was used for statistical analysis. Odds Ratio was used for quantitative data analysis. 'p'

value<0.05 was considered statistically significant. **Results:** A total of 300 patients were included in study, of which 144(48.0%) were males and 156(52.0%) were females. Mean (±SD) of age of subjects was 50.7±11.5years. Prevalence of Vitamin D deficiency was 69.0%, Vitamin D insufficiency was 15.7% and Vitamin D sufficiency was 15.3%. Overall, prevalence of Vitamin D deficiency (including insufficiency) was 84.6% (95%CI: 80.1%-88.3%).

Table-1: Distribution of characteristics among subjects (n=300)

Characteristics	Vitamin D Deficiency	
	Present (254) No. (%)	Absent (46) No. (%)
Age groups (Years)		
18-30	13 (72.2)	5 (27.8)
31-40	40 (87.0)	6 (13.0)
41-50	78 (87.6)	11 (12.4)
51-60	74(81.3)	17 (18.7)
> 60	49 (87.5)	7 (12.5)
Gender		
Males	109(75.6)	35 (24.4)
Females	145 (93.0)	11 (7.0)
Religion		
Hindu	78 (86.7)	12 (13.3)
Muslim	176 (83.8)	34 (16.2)
Education		
Illiterate	38 (70.4)	16 (29.6)
Primary school	16 (88.9)	2 (11.1)
Middle school certificate	8 (88.9)	1 (11.1)
High school certificate	134 (87.6)	19 (12.4)
Intermediate/post high school diploma	41 (91.1)	4 (8.9)
BA/BSC/Postgraduate & above	17 (81.0)	4 (19.0)
Occupation		
Unemployed	49 (86.0)	8 (14.0)
Unskilled worker	25 (92.6)	2 (7.4)
Semi-skilled worker	157 (83.0)	32 (17.0)

Skilled worker	21 (87.5)	3 (12.5)
Clerk, shop owner, farm owner	2 (66.7)	1 (33.3)
Monthly Per capita Income(INR)		
<1250	132 (85.2)	23 (14.8)
>1250	122 (84.1)	23 (15.9)
Socio-economic status		
Lower	4 (66.7)	2 (33.3)
Upper lower	63 (80.8)	15 (19.2)
Lower middle	187 (86.6)	29 (13.4)
BMI (Kg/m^2)		
<18.5	2 (100.0)	0 (0.0)
18.5-22.9	122 (84.7)	22 (15.3)
23-24.9	88 (91.7)	8 (8.3)
25-29.9	39 (72.2)	15 (27.8)
>30	3 (75.0)	1 (25.0)

Table-1 shows distribution of characteristics among subjects (n=300).

Table-2: Bio-chemical parameters in subjects (n=300)

Lab test values	Mean ± S.D. Vitamin D deficiency		'p'
	Present (n=254)	**Absent (n=46)**	
Serum 25-hydoxyvitamin D(ng/ml)	19.2+18.9	45.7+13.8	**<0.0001**
Fasting Plasma Glucose(mg %)	138.8+32.4	131+36.5	0.14
HbA1c (%)	7.5+1.7	7.2+1.5	0.26
Serum Cholesterol(mg %)	216+38.0	185.7+ 42.09	**<0.0001**
Triglycerides(mg %)	174.5+49.2	151.5 + 50.1	**0.004**
Low Density Lipoprotein(mg %)	152.5+30.1	136.8 +34.0	**0.001**
High Density Lipoprotein(mg %)	36.6+7.8	40.6 +8.9	**0.001**

Table-2 shows values of bio-chemical parameters in subjects.

Table-3: Association of various characteristics with Vitamin D deficiency (n=300)

Characteristics	Vitamin D deficiency		OR, 95% C.I.	'p'
	Present (254) No. (%)	**Absent (46) No. (%)**		
Age (years)				
>50	125 (85.0)	22 (15.0)	1.05, 0.56-1.98	0.8
<50	129 (84.3)	24 (15.7)		
Gender				
Females	145 (93.0)	11 (7.0)	4.23, 2.06-8.71	**<0.0001**
Males	109(75.6)	35 (24.4)		
Education				
Educated >8th class	192 (87.7)	27 (12.3)	2.17, 1.13-4.18	**0.02**
Educated <8th class	62 (76.5)	19 (23.5)		
Socio-economic status				
Lower middle	185 (85.6)	31 (14.4)	1.29, 0.66-2.54	0.5
Lower and Upper lower	69 (82.1)	15 (17.9)		
Exposure to sunlight				
Inadequate (<15minutes/day)	110 (90.2)	12 (9.8)	2.16, 1.07-4.37	**0.04**
Adequate (>15minutes/day)	144 (80.9)	34 (19.1)		
Dietary Habits				
Vegetarian	242 (86.1)	39 (13.9)	3.61, 1.34-9.75	**0.01**
Non-vegetarian	12 (63.2)	7 (36.8)		
Family history of diabetes				
Present	69 (88.5)	9 (11.5)	1.53, 0.70-3.34	0.3
Absent	185(83.3)	37 (16.7)		

BMI (Kg/m2)				
>23.0	132 (85.7)	22 (14.3)	1.18, 0.62-2.21	0.7
<23.0	122 (83.6)	24 (16.4)		

Table-3 shows association of socio-demographic characteristics, dietary factors and clinical parameters with Vitamin D deficiency.

Dietary intake of Vitamin D (mcg/day) in T2DM subjects with and without Vitamin D deficiency was 1.7 +0.2 and 2.9+0.19 respectively(p<0.0001).

Table-4: Logistic Regression analysis for determining factors associated with Vitamin D deficiency (n=300)

Predictor variables	Odds Ratio[1]	95% C.I.	'p'
Age>50 years	0.51	0.22-1.20	0.12
Female gender	0.40	0.17-0.90	**0.02**
Educated>8th class	2.51	0.88-7.17	0.08
Vegetarian diet	3.09	0.88-10.81	0.07
Inadequate sunlight exposure	3.95	1.50-10.40	**0.005**

[1]**Adjusted odds ratio**
Table-4 shows predictors of Vitamin D deficiency.

DISCUSSION
Age distribution findings of current study were similar to Alhumaidi M study(mean age:53.4+15.6years).[6] Higher degree of Vitamin D deficiency in females than males was noted in Korean National Health and Nutrition Examination Survey and Al-Zaharani M study.[7,8] In present study, Vitamin D intake below recommended intake could be because of vegetarian diet consumption with low Vitamin D.[9] Inadequate sunlight exposure finding of current study was similar to Korean study finding.[7]

Current study finding on higher prevalence of vitamin D deficiency in obese subjects corroborate with metanalysis findings by Pereira-Santos M (24% higher prevalence of vitamin D deficiency in overweight subjects).[10] Similar findings were supported by Pourshahidi LK review and Dong et al., study.[11,12]

Asian population has been found to be at risk of Vitamin D deficiency in study by Shaw NJ.[13] Present study finding of Vitamin D insufficiency prevalence is similar to Kumar RA et al., study (13.8% prevalence).[5] Similar prevalence findings were reported by Bayani MA et al., study (64.2% Vitamin D deficiency and 25% insufficiency).[14]

Current study finding on Serum Vitamin D level is consistent with Gagnon et al., study which reported lower mean serum concentration of Vitamin D in diabetics.[15] Similar mean Vitamin D levels (18.7+10.2ng/ml and 20.6+11.4ng/ml) were reported in Bayani MA et al., and Taheri study respectively.[14,16] Similar fasting plasma glucose levels was reported in Talaei A et al., study(137+36.54 mg%).[17] Nikooyeh B et al., study found similar HbA1c values(7.5+1.5mg%).[18] Similar finding of association of low levels of 25-hydroxycholecalciferol with dyslipidemia was found in Chaudhuri JR et al., study.[19]

Strengths and Limitations of study:
Present study aimed to find out multiple factors in Vitamin D deficient type 2 diabetics. Biochemical parameter results of our study are likely to be valid as these were performed in a single laboratory of medical college. Limitation of study is that cross-sectional analysis does not permit observation of trend of Vitamin D deficiency risk among subjects over time.

CONCLUSION
84.6% prevalence of Vitamin D deficiency in T2DM patients in Indian population despite adequate sunlight has potentially important public health implications. High level of vigilance for Vitamin D deficiency is required in female diabetics. Active interventions are required to increase awareness on importance of Vitamin D, need for sunlight exposure through lifestyle changes and adequate Vitamin D dietary intake by advising about its sources and supplementation.

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