ORIGINAL ARTICLE

Prevalence of vitamin d deficiency among Indian menopausal women and its correlation with diabetes: A first Indian cross sectional data

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ABSTRACT

Aim and Objective: To evaluate prevalence of Vitamin D deficiency and establish any correlation between diabetes and vitamin D deficiency among postmenopausal women. **Materials and Methods:** The 25-hydroxy vitamin D [25 (OH) D] concentrations were measured by competitive in-vitro quantitative immunoassay. The subjects were classified as vitamin D-deficient, insufficient or sufficient on the basis of 25 (OH) D concentrations of < 20 ng/mL, 20–30 ng/mL or > 30 ng/mL respectively. The apparently normal postmenopausal women (PMW) were subjected to fasting blood sugar levels to analyse any correlation between vitamin D deficiency and diabetes. **Results:** Vitamin D deficiency was observed in 53.35% of the population, 19.48% had insufficiency and 26.83% had adequate Vitamin D levels. In 12.14% of the study population fasting blood glucose was > 110 mg/dl and rest of the subjects were between the normal range which is 70–110mg/dl. Correlation between raised blood sugar levels and Vitamin D deficiency among PMW was non-significant (P = 0.324). **Conclusion:** High prevalence of vitamin D deficiency exists among apparently healthy Indian PMW. However, the current study failed to show any statistical correlation between vitamin D deficiency and existence of diabetes, which may be due to small sample size.

Key Words: Chronic diseases, deficiency, diabetes, postmenopausal women, vitamin D

INTRODUCTION

Vitamin D deficiency is a worldwide epidemic health problem, with a range of prevalence in between 70%–100% in the general population.[1] Whereas, among Indian population with low dietary calcium intake, a prevalence of varying degrees (50–90%) has been reported.[2] Most of the researchers have uniformly reported a high prevalence of vitamin D deficiency, in various groups of the population like healthy school children, adolescents, rural girls, pregnant women and health care professionals.[3-5]

Studies do exist reporting high prevalence of Vitamin D deficiency among postmenopausal women (PMW) from western world and India but data still remain scanty[6-10]

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Secondly, Vitamin D deficiency and diabetes mellitus are widely prevalent diseases during menopause. Furthermore few epidemiological studies have shown an association of vitamin D deficiency and increased risk of chronic diseases like cancer, cardiovascular disease, type 1 and 2 diabetes (T1D, T2D) suggesting that that vitamin D deficiency not only affects musculoskeletal health but also affects a wide range of acute and chronic diseases.[11]

To best of our knowledge, no study exists from India evaluating correlation between diabetes and vitamin D deficiency among PMW. Moreover, such a data will be of immense use for the Indian health care providers.

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MATERIALS AND METHODS

This cross sectional, 1 - year - analysis, from Jan 2011–Jan 2012 was carried out among apparently healthy postmenopausal subjects (with 1 year of menstruation cessation) without known history of diabetes, thyroid, renal or hepatic disease or malignancy. Patients with history of surgery, hospitalization, or major medical illness within the past 1 year were excluded from the study. Patients on hormone replacement therapy, glucocorticoids, biophosphonates, teriparatide and other drugs affecting bone metabolism were excluded as well. Surgical and other iatrogenic causes of menopause were also excluded from the current study.

Intake of conventional calcium/vitamin D supplements was not considered an exclusion criterion. All subjects were enrolled after taking a written informed/voluntary consent. The 25-hydroxy vitamin D [25 (OH) D] concentrations were measured by competitive in-vitro quantitative immunoassay in human serum using Elecsys & Cobas e analyzers (Roche) kit. Inter-assay Coefficient of Variability (CV) was 9.9% and intra-assay CV was 5.7% in the current analysis.

The minimal detectable limit of the 25 (OH) D assay was 1.5 ng/mL. The subjects were classified as vitamin D-deficient, insufficient or sufficient on the basis of 25 (OH) D concentrations of < 20 ng/mL, 20–30 ng/mL or > 30 ng/mL respectively, according to recent consensus.[12,13]

Subjects were included in a cross-sectional manner from general population. The apparently normal PMW were subjected to fasting blood glucose level tests and Vitamin D levels to analyze any correlation between the two states. After Inclusion in the study they were called on next day for fasting blood samples. Blood glucose levels were estimated by glucose oxidase method and normal reference range was defined as 70–110 mg/dl.

Fasting blood was collected and 2 mL serum prepared and collected using standard sampling tubes containing separating gel before subjecting them for analysis for vitamin D levels. The data was analysed by one laboratory after standardization.

Statistical Analysis

The data was categorised as mean ± SD and N (%) and correlation between vitamin D and diabetes was established by using Pearson Coefficient Correlation Test. The *P* value (2 tailed) < 0.05 was considered significant.

RESULTS

Total of 312 PMW participated in the current study. Mean age of study population was 56.22 with mean ± SD number of menopausal symptoms were 3.170 ± 1.16. The most common menopausal symptoms in the current study are depicted in Table 1.

Mean vitamin D levels of the study population was 26.86 ng/ml and mean fasting blood glucose levels was 134.52 ± 17.56 mg%. While evaluating the vitamin D status of the study population 53.35% of the population has vitamin D deficiency, 19.48% had insufficiency and 26.83% had adequate vitamin D levels [Table 1].

Out of the study population 12.14 % had fasting blood glucose > 110 mg/dl and rest of the population was between the normal range (70–110 mg/dl). The age - wise distribution of the population and their vitamin D levels and fasting blood glucose levels are depicted in Table 2. The correlation between raised blood glucose levels and vitamin D deficiency among PMW was non-significant *P* = 0.324 [Table 3].

DISCUSSION

Vitamin D deficiency is reported in epidemic proportions, with a prevalence of 70%–100% in the general population both in urban and rural settings and across all socioeconomic strata.[1]

Studies similar to the current study carried in past have reported very high prevalence of vitamin D deficiency

Table 1: Profile of study population

Study Parameters
N=312
Mean Age of Study Population=56.22
Urban:Rural=213 (68.05%):100 (31.94%)
Mean Number of symptoms=3.170±1.16
Most Common Symptoms
Fatigue, lack of energy, rheumatic pain=38%
Cold hand and feet=18%
Urogenital Symptoms=18%
Cold sweats, weight gain, irritability and nervousness=13%
Palpitation of heart, excitable/anxiety/Insomnia=12%
No symptoms=32%
Mean Vitamin D levels of Total Population=26.86 ng/ml
Mean Fasting Blood Glucose levels ±SD of total Population–134.52±17.56 mg%
Vitamin D Status of the study Population
Deficiency <20 ng/ml=167 (53.35%)
Insufficiency 20-30 ng/ml=61 (19.48%)
Adequacy >30 ng/ml=84 (26.83%)
Fasting Blood Glucose >110 mg/dl; *N*=38 (12.14%)
Fasting Blood Glucose between 70-110 mg/dl; *n*=274 (87.59%)

Table 2: Age wise distribution of vitamin D levels and diabetes

Age wise distribution	N (%)	Mean vitamin D levels	Vitamin D deficiency/ insufficiency/ adequacy n (%)	DM in Vit D deficiency Plus insufficiency (%)
45-50	120(38.33)	26.63	61(19.48)/28(8.94)/31(9.90)	6(1.91)
51-60	113(36.10)	26.83	72(23.08)/16(5.11)/25(7.98)	6(1.91)
>60	81(25.87)	26.86	35(11.18)/17(5.43)/28(8.94)	11(3.51)

Table 3: Correlation between vitamin D deficiency and diabetes

DM	n (%)	Normal n (%)
Vitamin D deficiency/insufficiency	23 (7.34)	206 (65.49)
Mean fasting blood glucose levels±SD (mg%)	176.02±6.56 mg	97.65±7.9
Vitamin D adequacy	15 (5.11)	68 (21.72)
Mean fasting blood glucose levels±SD (mg%)	165.42±7.56	99.65±7.9

r (Pearson correlation)- 0.110 P Significance (2-tailed) 0.324 NS

among PMW from western world and India.[6-10]

In a study from Europe carried among women aged over 80 years, the prevalence of 25 (OH) D inadequacy was 80.9% and 44.5% when considering cut-offs of 75 and 50 nmol/L, respectively.[6]

Results similar to our study were reported among urban central south Chinese PMW indicating 72.1% women to be vitamin D deficient [25 (OH) D < 50 nmol/L].[14]

Vitamin D deficiency was seen in 83.7% of the subjects (≤ 20 ng/mL) at baseline among Indian PMW as reported by one of the recent Indian study.[15]

Similarly about 82% of the study group had varying degrees of low 25 (OH) D levels among Indian PMW who were on insufficient calcium and high in phytate diet.[7]

While comparing women of reproductive age (WR) group with PMW both, WR and in PMW 25 (OH) D deficiency (< 20 ng/ml), insufficiency (20–30 ng/ml) and replete states (> 30 ng/ml) were seen in 76%, 16.5%, 7.5% vs 70%, 23% and 7% respectively.[16]

Unlike our study PMW with established osteoporosis recoded serum vitamin D to be deficient in two third of patients.[17] Thereby, indicating that prevention and early detection of hypovitaminosis D is the key to reduce the incidence of osteoporosis among PMW.

In another study no evidence for a clinically important association between serum 25 (OH) D levels and menopause-related symptoms in PMW was observed. The current aspect was beyond the preview of the current study hence not studied.[10]

Interestingly results of current study pointed that commonest age affected with vitamin D deficiency is 51–60 years followed by 45–50 and least affected with vitamin D deficiency was above 60 years. The results are in accordance with the study of Asadi M *et al.*, (2013)[18] where in they showed a statistically significant positive correlation between vitamin D concentration and age in late postmenopausal period. The possible reasons for this may be increasing medical attention in the form vitamin D prophylaxis along with calcium supplementation being received by advancing age people worldwide.

Current study failed to establish any statistical correlation between vitamin D and diabetes unlike various previous studies. In women, diabetes risk significantly increases in the lowest 25 (OH) D quintile. In men, 25 (OH) D levels has not been shown associated with diabetes incidence.[19]

High prevalence of vitamin D deficiency in patients with type 2 diabetes mellitus (T2DM) and particularly in patients with T2DM and CVD has been reported.[20]

Healthy adults with higher serum 25 (OH) D levels had significantly lower 60 min, 90 min and 129 min postprandial glucose levels and significantly better insulin sensitivity than those who were vitamin D deficient.[21]

The researchers have also reported that with metformin, which improves insulin sensitivity by 13%, higher vitamin D status correlated with a 60% improvement in insulin sensitivity. In a recent clinical trial in women with T2D, vitamin D supplementation was shown to improve insulin sensitivity by 21%.[22]

Another study suggested that vitamin D deficiency is a potential risk factor for obesity and development of insulin resistance leading to T2D.[23]

Most recently Hirani V *et al.*,[24] documented that low levels of 25 (OH) D and active 1,25-Dihydroxyvitamin D is independently associated with T2DM in older Australian men.

These variations might be due to the fact that the above mentioned studies were largely epidemiological in nature with different study design taking all men and women

without definite age-group into account unlike our study being restricted to PMW.

However, in the study by Song BM *et al*.,[25] vitamin D has not been shown to be independently associated with insulin resistance in Korean men and women like our study.

Similarly, in a recent meta-analysis of prospective cohort studies no association between vitamin D intake and T2D has been established.[26]

In another study, no correlation was established between serum 25 (OH) D level with markers of insulin resistance (IR) in postmenopausal Indian women.[15]

The insulin resistance of the obese subjects who were vitamin D deficient and insufficient did not statistically differ from those with vitamin D sufficiency in the study of Torun E *et al*.[27] Low 25(OH) D levels were not related with higher insulin resistance in obese children and adolescents. In obese subjects, insulin resistance was affected more from BMI.

Chacko SA *et al*.,[28] documented that higher serum 25 (OH) D concentrations may be inversely associated with adiposity, triglycerides, triglyceride: high-density lipoproteins (HDL) cholesterol ratio, and metabolic syndrome but are not associated with low-density lipoproteins (LDL) and HDL cholesterol, insulin, glucose in PMW.

Dong JY *et al*.,[29] reported that vitamin D intake during early life although may be associated with a reduced risk of T1D. However, there is not enough evidence for an association between maternal intake of vitamin D and risk of T1D in the offspring.

Sample size of the study is very small to generalize results of this study to Indian population. The study has not taken other variable and risk factor into consideration for finding any correlation. However, it addresses a major nutrition related health problem in Indian population, which needs attention.

CONCLUSION

High prevalence of vitamin D deficiency exists among PMW. However, the current study failed to show any statistical correlation between vitamin D deficiency and existence of diabetes, which may be due to small sample size.

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