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Original Research Article

Prevalence of vitamin D deficiency in postmenopausal women and its association with fasting blood sugar

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ABSTRACT

Background: Vitamin D is indispensable for human body as it caters for both skeletal as well as extra-skeletal needs, especially in postmenopausal women. Aim of this study was to know the prevalence of vitamin D deficiency among apparent healthy postmenopausal women and to find its association with fasting blood sugar.
Methods: This was a cross-sectional observational study of postmenopausal women attending Gynae OPD of Sri Ram Murti Smarak Institute of Medical Sciences, Bareilly, over a period of six months. Apparently healthy postmenopausal women were selected after satisfying inclusion-exclusion criteria and were subjected to fasting blood sugar and serum 25-hydroxy-vitamin D level. They were categorized as vitamin D deficient, insufficient or sufficient according to corresponding levels of <20ng/ml, 20-30ng/ml or >30ng/ml respectively. Upper reference level for fasting blood sugar was taken as 110mg/dl. Statistical analysis was done to see the association between vitamin D deficiency and fasting blood sugar.
Results: Mean age of study group was 56.9 years and the average age of attainment of menopause was 50.3 years. Prevalence of vitamin D deficiency (57.4%) including insufficiency (13%) among postmenopausal women was high 70.4%, but there was no association between hypovitaminosis D and fasting blood sugar (p=0.949).
Conclusions: Despite high prevalence of vitamin D deficiency among Indian postmenopausal women, there is no correlation between it and fasting blood sugar.

Keywords: Diabetes, Fasting blood sugar, Hypovitaminosis D, Menopause, Postmenopausal, Vitamin D

INTRODUCTION

Menopause is a natural process of aging, when menstruation and fertility come to an end. Usual age-range of menopause is 45-55 years, and average age is 51years. Diagnosis is typically made retrospectively after the woman has missed her menses for 12 consecutive months. Though it is not a disease, it causes many profound changes in a female body. Not only menopausal symptoms and those related to uro-genital atrophy are quite common due to estrogen deprivation state, but many chronic and metabolic diseases become prevalent during this phase of life like cardio-vascular disease, diabetes, osteoporosis and cancers.

Studies have reported high prevalence of vitamin D deficiency in this group of women and a few has reported its association with diabetes and metabolic syndrome.[1] Worldwide the prevalence of vitamin D deficiency is 70-100% in general population among all socio-economic status.[2] In India, the community-based studies done on apparently healthy controls reported a prevalence ranging from 50% to 94% with 53.4% in postmenopausal women

increasing up to 82% in rural postmenopausal women.[3,4] Apart from skeletal manifestations, vitamin D deficiency has been associated with increased risk of type 2 diabetes mellitus, insulin resistance, and decreased insulin production, and with syndrome X.[5,6] Hence, this study was performed to find the prevalence of vitamin D deficiency among postmenopausal women and to find if there is any association between it and fasting blood sugar.

METHODS

This was a cross-sectional observational study of postmenopausal women attending gynae OPD from Dec 2018 to May 2019. Apparently healthy postmenopausal women without any prolonged medical illness like diabetes, thyroid, hepato-renal disease, malignancy, or without any surgical illness were selected. Besides patients on HRT, steroids, bisphosphonates or any drugs affecting bone metabolism, smokers and alcoholics were excluded. Total number of postmenopausal women attending gynae OPD were 103 out of which 42 were excluded due to chronic medical illness, pre-malignant lesions and age more than 70 years, thus the final study population was 61 postmenopausal women. After complete history-taking and clinical examination they were subjected to fasting blood sugar and serum 25-hydroxy vitamin D [25(OH)D] estimation. They 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. Regarding fasting blood sugar, normal reference range was selected as 70-110 mg/dl.

Statistical analysis

Statistical analysis was done with Chi-square test to see the association between fasting blood sugar and vitamin D deficiency and insufficiency.

RESULTS

Out of total 103 postmenopausal women attending gynae OPD during the study period, only 61 women were found eligible for study after satisfying inclusion-exclusion criteria. We divided these postmenopausal women according to their age into five years age-groups, starting from 50 years to 70 years of age. Most common age-group was 55-60 years accounting for 49% followed by 50-55 years age-group making 41%, thus together adding up to 90% of study population (Figure 1). This shows the authenticity of study population. Mean age of study group was 56.9 years.

Their average age of attainment of menopause was 50.3 years. Majority were multiparas with second and third parity being most common thus together making up to 60% of study population (Figure 2). This rule out any bias on result due to infertility or its treatment, if nulliparous women would have added. All were having spontaneous conception.

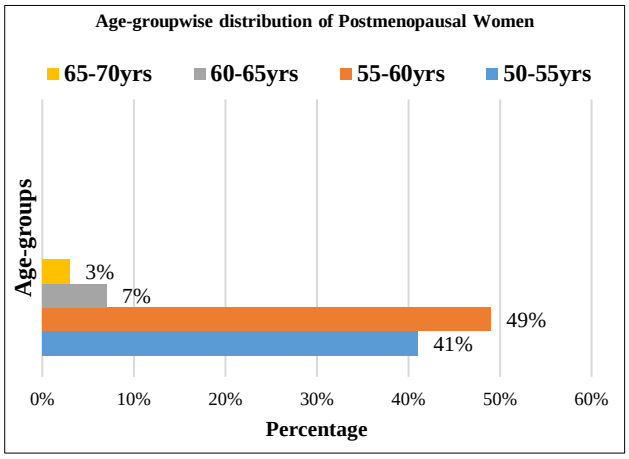

Figure 1: Age-wise distribution of study population.

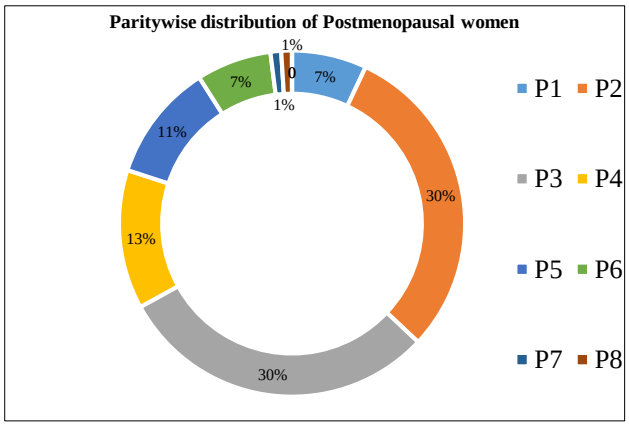

Figure 2: Parity-wise distribution of study population.

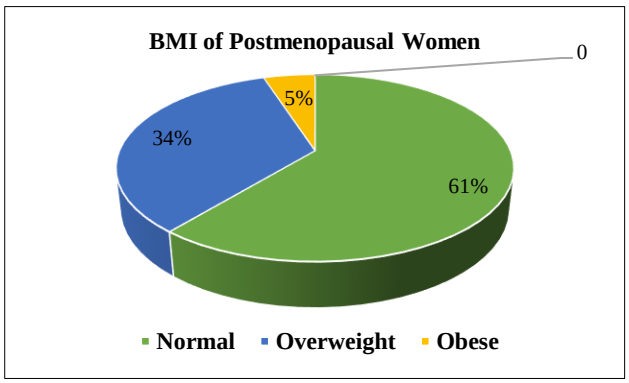

Figure 3: Body-mass-index distribution of study population.

Regarding body-mass index (BMI) status 34% were overweight (25-29.9kg/m^2), 5% were obese (BMI≥30kg/m^2) and rest 61% were of normal BMI (19-24.9kg/m^2) (Figure 3). Their average BMI came to be 24.12kg/m^2. Though majority were of normal BMI, 39% were having increased BMI. This could be a confounding factor as increased BMI is one of the risk factors for

diabetes. But when we tried to find any association between BMI and vitamin D deficiency independent of fasting blood sugar, the 'p' value was insignificant (p=0.954) (Table 1).

Table 1: Association between BMI and vitamin D deficiency.

BMI/Vitamin D deficiency (+ Insufficiency)	Present (< 30 ng/ml)	Absent (>30 ng/ml)	Total
Normal (18.9 - 24.9 kg/m^2)	26	11	37
Increased (≥ 25 kg/m^2)	17	7	24
Total	43	18	61

p-value = 0.954

Table 2: Association between serum vitamin D level and fasting blood sugar in postmenopausal women.

Vitamin-D level / FBS(Diabetes)	≥110mg/dl (Present)	<110mg/dl (Absent)	Total
Normal / Sufficient (>30ng/ml)	3	15	18
Insufficient (20-30ng/ml)	1	7	8
Deficient (<20ng/ml)	6	29	35
Total	10	51	61

p-value = 0.949

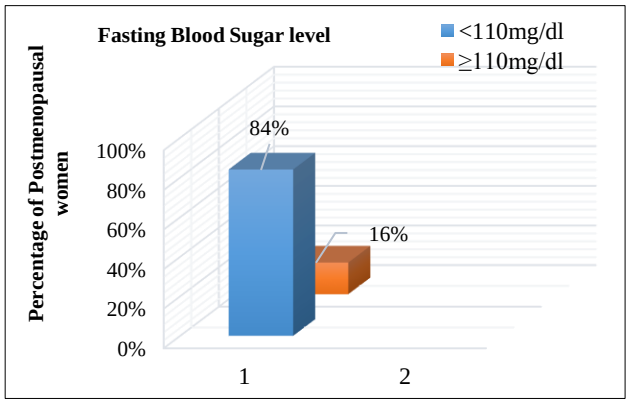

Figure 4: Fasting blood sugar estimation of postmenopausal women.

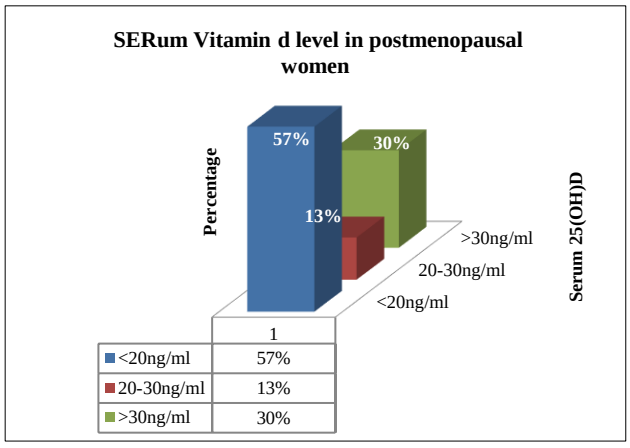

Figure 5: Vitamin D deficiency / Insufficiency / Sufficiency in postmenopausal women.

Only 16.4% of postmenopausal women had fasting blood sugar more than 110mg/dl (Figure 4). This shows that either they were asymptomatic pre-diabetic or in latent phase, but none had more than 126mg/dl which itself alone is sufficient to diagnose a case of diabetes, according to American Diabetes Association. Mean fasting blood sugar was 99.9mg/dl.

While elaborating the status of vitamin D, 35 out of 61 i.e. 57.4% had deficient levels i.e. less than 20ng/ml, 13% had insufficient levels i.e. between 20-30ng/ml and 30% had sufficient levels i.e. more than 30ng/ml (Figure 5). Thus, the prevalence of vitamin D deficiency including insufficiency in postmenopausal women was 70.4%. Average serum vitamin D [25(OH)D] was 25.3ng/ml.

Statistically, when correlation study was performed between vitamin D deficiency and fasting blood sugar among postmenopausal women using Chi-square test, there was no significant association between them (P=0.949) (Table 2). This shows that despite high prevalence of hypovitaminosis D, it is not associated with increased fasting blood sugar.

DISCUSSION

The prevalence of vitamin D deficiency in our study group was 70.4% which is comparable to other studies stating its high prevalence.[7-9] This finding is in concordance with another Indian study which says that high prevalence of vitamin D deficiency exists among apparently healthy Indian postmenopausal women.[9] However, they failed to show any statistical correlation between vitamin D deficiency and existence of diabetes.

Though our study was limited to postmenopausal women, many studies done on general female population i.e. females of reproductive age-group without any reference to menopausal status, state high prevalence (up to 98%)

of vitamin D deficiency in our country despite adequate sunlight exposure; concluding that cut-off level should be revised according to the need of Indian people and ICMR should also revise the recommended daily allowance to prevent from overtreatment.[10,11]

Regarding association between vitamin D deficiency and fasting blood sugar in postmenopausal women, studies are limited to diabetic postmenopausal women to see its relation with hypovitaminosis D, but not to apparent healthy postmenopausal women making it a confounding factor.[12] Like a study from Ghana reported high prevalence of hypovitaminosis D in postmenopausal diabetic women as compared to premenopausal diabetic women and hypovitaminosis D in the postmenopausal diabetic women was related to poorer glucose control. But this study was not epidemiological being restricted to diabetic women only.[13]

Similarly, one study reported lower vitamin D levels being associated with higher blood glucose values in Asian Indian women with pre-diabetes.[14] Again here, the study population was females of reproductive age-group and not post-menopausal women.

One study from India investigated the association of serum 25-hydroxyvitamin D (25-OHD) level with markers of insulin resistance (IR) in postmenopausal Indian women and concluded that there is a significant negative linear correlation between 25-OHD and BMI but there was no correlation between 25-OHD and parameters of IR. The significant negative linear correlation between 25-OHD and HOMA-IR was confounded by BMI.[15]

Contrary to our study, a study opined higher serum level of 25-hydroxyvitamin D (25[OH]D) is associated with a lower risk of developing type 2 diabetes mellitus, because it provides better glycaemic control, possibly by promoting greater insulin sensitivity, and also by improving pancreatic beta cell function. They concluded that lower serum 25(OH) D concentrations appear to be associated with a high blood glucose levels.[16] Here, the confounding factor was study population who varied from 35 to 73 years of age.

However, existing intervention studies are either negative or showed only limited beneficial effects. In a meta-analysis of 23 trials evaluating the effect of vitamin D supplementation on glycaemia, there was no effect of supplementation on glycaemia (19 trials) or measures of insulin resistance (12 trials).[17]

Despite controversial findings on association between hypovitaminosis D and fasting blood sugar, there are studies which depict the importance of serum vitamin D in bone mineral density, metabolic syndrome and cardiovascular risks, citing it as an important investigational tool.[18-20]

A study from China suggested that bioavailable 25(OH)D was a superior biomarker than total 25(OH)D regarding the bone metabolism, and that vitamin D intervention may improve the bone health in elderly populations.[21] This study suggests that we should try to seek the relevance of bioavailable 25(OH)D rather than total 25(OH)D to find its correlation with different parameters.

Limitation of our study was that it was restricted to hospital patients and small sample size. Hence, widespread randomized epidemiological studies are required to see its actual correlation with fasting blood sugar.

CONCLUSION

There is high prevalence of vitamin D deficiency among Indian postmenopausal women, but our study shows no correlation between hypovitaminosis D and fasting blood sugar. Besides, the cut-off level for vitamin D deficiency should be reviewed in Indian population looking at the scenario of adequate sunlight exposure, to prevent it from overtreatment and also for dietary modification. The role of bioavailable 25(OH) vitamin D should be ascertained rather than total 25(OH)D.

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