

Vitamin D Insufficiency among the Adult Women of remote areas of Pakistan

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ABSTRACT:

Objectives: Vitamin D efficiency is widely prevalent even in tropical countries like Pakistan, where there is plentiful sunshine. Vitamin D deficiency is more common in middle age and elderly females. **Methods:** Our study was a community-based cross-sectional study that was conducted from December 2018 to March 2019. This study was conducted in multiple villages in the remote area of Hyderabad district of Pakistan. In this study, we included 388 women age above 40 years. Multistage random sampling was used for this study. Each participant was interviewed and recorded on organized proforma. SPSS version 25 was used for data entry and analysis. Participants with laboratory report of having less than 30ng/ml 25OH vitamin D were said to have vitamin D insufficiency (VDI).

Results: In our study out of 388 contributors, 70.6% of participants had Vitamin D Insufficiency (VDI) (51.0%). The mean (SD) age of the participant was 54 years. Mean (SD) sun exposure was 120(59.2) minutes. 148 (38.1%) were obese. Only 146 (37.6%) were on satisfactory diet. Test results revealed decreasing sun light exposure, over weight and inadequate diet as significant factors of Vitamin D insufficiency.

Conclusion: In our study we identified important causes associated with VDI in remote areas of Pakistan. We propose all females of age above 40 years should take diet rich in Vitamin D, adequate sun exposure and regularly taking vitamin D supplements and maintain body weight to help to control the VDI significantly.

Key words: Vitamin D insufficiency, vitamin D Deficiency, Sunlight Exposure

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Introduction:

Vitamin D plays major role in Calcium homeostasis. It is fat-soluble vitamin and is also called as “anti-rachitic factor” or “Sunshine vitamin”². The Human body gets sufficient vitamin D either from sunlight exposure or from diet. When our skin is exposed to sun it produces around 80-90% of Vitamin D³. Fish, egg yolk, beef liver and fortified dairy products are important source of vitamin D³.

Vitamin D deficiency is a recognized pandemic. Even in a tropical country like Pakistan, vitamin D deficiency is widely prevalent in spite of overflowing sunshine. Various studies from different parts of Pakistan and other countries have highlighted that vitamin D insufficiency or deficiency across different age groups range from 70–100%⁴. Adult females, particularly above 40 years of age, are mostly affected.

This is the most under diagnosed and undertreated nutritional deficiency in the world^{5,6}. In Pakistan, vitamin D insufficiency (VDI) is not a National Health Priority (NHP). Of the NHPs, the most

important is the supplementation of pregnant women with calcium and vitamin D tablets. However, the adult and geriatric population that is mostly vulnerable has been ignored. Although VDI has increasingly become an important public health issue, it is not included in any national health program.

There is much work needed to research regarding VDI in remote areas of Pakistan and specifically in the rural community. This study was conducted to quantify the burden of VDI and find out its predictors among women above 40 yrs age.

METHODS:

This was a cross-sectional, community based observational study, conducted over a period of four months (December 2018 to March 2019). The Data was collected on designed proforma and women above 40 years of age were questioned and recorded. This study was conducted in multiple villages of remote areas of Hyderabad City of Pakistan.

In this study 388 women of age above 40 years were included, and those who had multiple medical problems (Diabetes, Renal insufficiency, cardiac disease, etc.), pregnancy and lactating women, and those who were already on vitamin D supplementation since more than one year were not included in the study.

Written and informed consent was taken from all women who agreed to be part of the study. Sample size was calculated to be around 388. Multistage random sampling was done. In the first stage, 5 villages were selected randomly from each Union Council. Women aged above 40 years were selected from villages, and the number of participants from each village was calculated by Population Proportionate to Size sampling method. Following this, the required number of samples was drawn from the list of women from each village using the simple random sampling method. If the selected individual did not meet the selection criteria or could not be contacted in two visits, simple random sampling without replacement was done to select another study participant.

Pre-designed, pre-tested structured proforma was used to collect the data. Face validity and content validity of the instrument were ascertained by experts of the institution from which the authors were affiliated. The height and weight of the women were measured using standard measurement gauges. In the past 7 days, individuals who consumed fish, egg yolk, milk, or dairy products for more than 3 days were considered to have satisfactory diet rich in vitamin D. In our study participants with Mass Index (BMI) ≥ 25 kg/m² were reported as overweight/obese⁷ Laboratory investigation of serum for 25-Hydroxyvitamin D [25(OH)D] was done. Individuals with 25OH Vitamin D <30 ng/ml were categorized into the VDI group⁸

Data entry and analysis was performed using the statistical software SPSS Version 25. Descriptive statistics (mean \pm Standard Deviation [SD] and median for the continuous variables and Frequency in percentage for the categorical variables) was used to describe the socio demographic characteristics, regular sun exposure, dietary pattern, tobacco use, and multiple medical problems profile. Univariate and multivariable logistic regressions were

used to determine the factors related with VDI. Results were considered significant at $P < 0.05$ level.

Ethical approval was obtained from the Institutional Ethics Committee. At the end of the study, patients with VDI were treated and advised about the preventive measures.

Results:

Out of 388 participants, 186 (47.9%) belonged to the 40–49 age group. Mean (SD) age of the participants was 54 years. Among them, 344 (88.6%) were married. Furthermore, 204(52.6%) lived in joint families, while 224 (57.7%) were educated up to primary.

196 participants (50.5%) belonged to middle class families. Daily sun exposure was 120(59.2) minutes. 162 participants (41.7%) were current tobacco/supari chewers, while 12 participants (3%) had a history of smoking. 164 women (42.3%) had menopause. The proportion of women with overweight/obesity was 38.1%. In the past 7 days, 122 (31.4%) consumed fish for more than 3 days and 112 (28.8%) ate egg yolk for more than 3 days, only 70 (18.0%) had milk and dairy products for more than 3 days. In our study 114 (29.4%) had sufficient vitamin D (≥ 30 ng/ml), while 198 (51.0%) had insufficient vitamin D (20-29.99ng/ml) and 76(19.6%) had deficient vitamin D (<20ng/ml) Table-1. The mean (SD) vitamin D level was 25.9 (5.21) ng/ml. Overall, the proportion of women suffering from VDI was 70.6%. In this study it was evident that factors such as the increasing age, education up to primary, the less exposure of sunlight, menopause, obesity and unsatisfactory diet were significantly associated with VDI, P values less than 0.05 was considered significant. After adjusting for all the independent variables, only less sun exposure daily, obesity, and unsatisfactory food intake were significant predictors of VDI.

Table 1. Descriptive statistics			
	mean	minimum	maximum
mean age	54+10.66	40	78
mean vit d	25.9+5.21	7	48

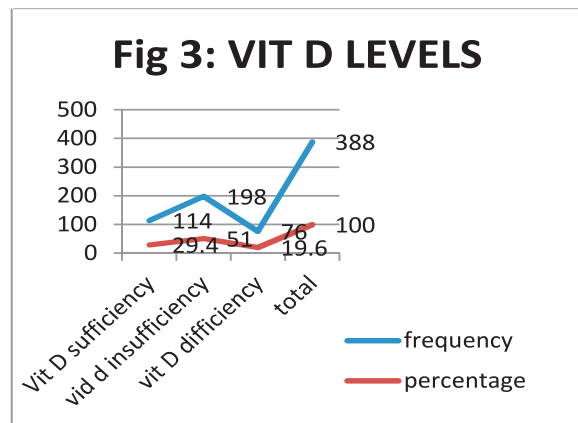
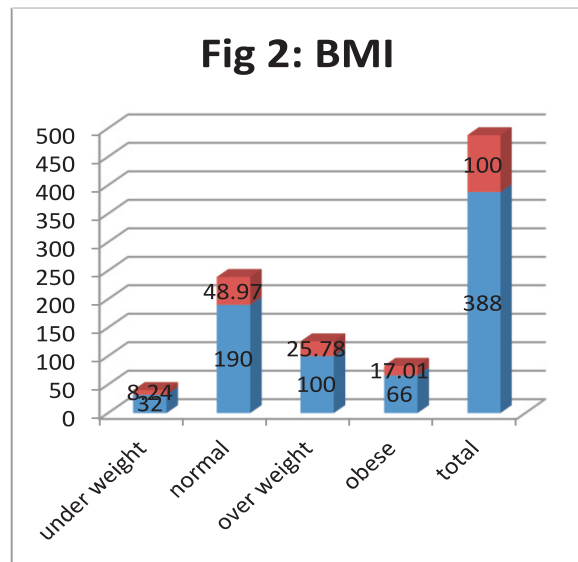
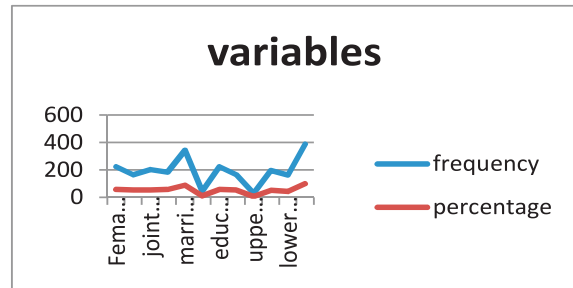
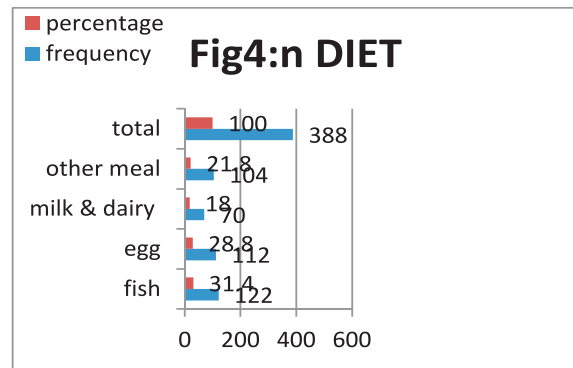
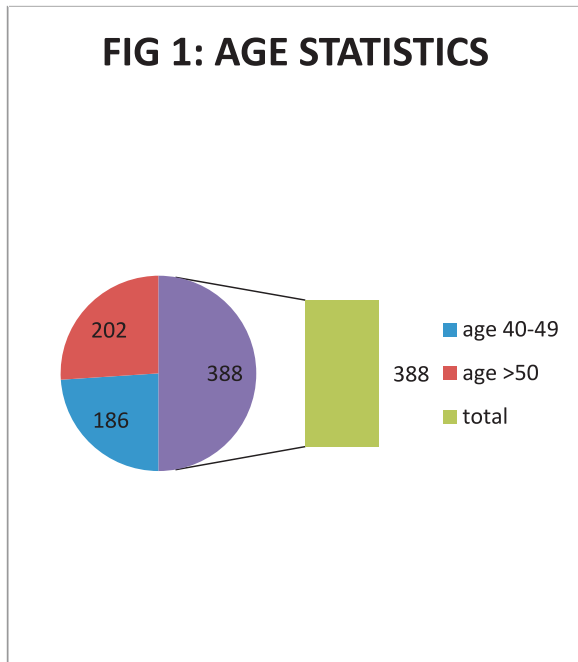


Table 2: Vitamin D status in participant D levels (n=388)

Vitamin D standing	Vitamin D position	n (%)
Vit: D sufficiency	Sufficient	114 (29.4%)
VDI	Insufficient	198 (51.0%)
	Deficient	76 (19.6%)

Discussion:

Our study suggest that there is very high incidence of vitamin D insufficiency in Pakistani females specially those who live in remote areas which is consistent with reported values of vitamin D insufficiency/deficiency in a few earlier studies carried out in Pakistan^{9,10}. "A study in Islamabad comprised 737 subjects."¹¹ Though the selection of subjects was not through randomization in that study, but in our study we tried to use systematic random sampling strategy to select our subjects, therefore making our estimates more robust. In the same way, another study with a large sample size (n=4, 788) but almost all the individuals look like to have been referred by their primary care physicians for assessment of vitamin D status for a problem and, as such, they cannot be considered healthy individuals⁷, in this study all subject were healthy with no any chronic disease.

Our study suggests that the decreasing duration of sun exposure is significantly associated with VDI. This finding is similar to that of a study¹¹ conducted among 640 rural patients in Mahad, Maharashtra in India 2017, which identified that women with dark complexion, those who wear Burkha, women who get inadequate exposure to sunlight, and those with diabetes were the significant predictors of Vitamin D deficiency. Gender and hypertension were not significantly associated with vitamin D deficiency.

Another multi ethnic sample study of Asian adults also found that females, smokers, alcoholics, diabetes patients, young people, those with higher BMI or HbA1c, people who had no education and poor income levels are significantly associated with VDI¹². This can be explained by the fact that vitamin D, a fat-soluble vitamin, gets sequestered inside

the adipose tissue (found more in obese individuals), resulting in pseudo VDI in the blood. Various public health impacts of vitamin D deficiency require urgent attention. It is evident that vitamin D not only has a bearing on bone health, but also plays a crucial role in the overall health of an individual, right from its effect on glycemic control, immunity, cardiovascular diseases, neuromuscular function, pregnancy, and other aspects of health. An epidemiological study conducted in the United States among a cohort of 903 healthy individuals suggested that people with vitamin D deficiency may be at a much greater risk of developing diabetes¹³. It has been implicated that in people who suffer from cardiovascular diseases, maintenance of normal serum 25(OH) vitamin D level could reduce their mortality risk as a result of the disease by 30%¹⁴. In the current global scenario, where non-communicable diseases have achieved pandemic potential to cause death by cardiovascular diseases, it has been recognized vitamin D₃ significantly reduces the level of oxidative stress on the cardiovascular system¹⁵. Moreover, it has been implicated that deficiency of vitamin D₃ increases the chances of heart attacks¹⁵. The increasing prevalence of obesity and physical inactivity, and decreased sun exposure due to lifestyle changes and unhealthy diet have all added to the increasing prevalence of VDI. The knowledge about the importance to maintain an adequate level of vitamin D is an emerging essential domain among the primary care physicians and is imperative to improve public health. The main strength of the study was that it was conducted among women from the rural community and multistage random sampling, along with design effect was used to arrive at an apt sample size with generalizability of results. The study investigated 25OH Vitamin D, which is the most sensitive indicator for an individual's vitamin D status. However, the study had its own limitations. As it was a cross-sectional study, temporal association could not be established. Body parts and their relation to sun exposure could not be assessed. Further, due to limited funds, the researchers were unable to conduct investigations like serum calcium, alkaline phosphatase, and Parathyroid Hormone (PTH), which are all important functional indicators of vitamin D status^{16,17}.

Vitamin D deficiency affects almost all body systems, local studies done in Sindh also shown very low levels of vitamin D deficiency in different dreadful diseases also. Vitamin D₃ levels are low in infertile males and are associated with semen parameter abnormalities significantly affecting the male fertility¹⁸

considerably low levels of vitamin D₃ were seen in Parkinson's disease.¹⁹

The need for improving the levels of vitamin D among the female population is both important and urgent. Emphasis must be given on promoting consumption of vitamin D rich foods and vitamin D supplements. They should also be encouraged to engage themselves in outdoor activities to increase exposure to sunlight. Women should be educated on the importance of maintaining optimum body weight and strict adherence to diabetes prevention and control measures. At the policy level, the provision for early diagnosis of vitamin D deficiency, framing of population based programs to provide affordable vitamin D supplements, and vitamin D fortified food will help improve the situation at large.

Conclusion:

In our study, we identified important causes associated with VDI in remote areas of Pakistan. We propose all females of age above 40 years should take a diet rich in Vitamin D, adequate sun exposure and regularly taking vitamin D supplements and maintain body weight to help to control the VDI significantly.

Limitation

the limitations of this study include the utilization of small data collection insufficient data management systems prohibited a comparison of vitamin D testing across the study centers. It is not a routine test and also not cost effective.

Recommendation

A national screening program should be launched along with screening at all ages group and childhood vitamin D supply should be door step population of public

Conflict of interest: nil

Funding: nil

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