

## Vitamin D Levels in Pakistani Adults Attending Family Practice Clinics

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### Abstract

#### Background

Vitamin D deficiency is a global public health concern, with especially high prevalence rates in South Asian countries, including Pakistan. Despite abundant sunlight, low vitamin D levels are frequently observed among the population, which may contribute to musculoskeletal and systemic health problems.

#### Objective

To determine the prevalence of vitamin D deficiency among adults attending family practice clinics in Pakistan and to explore demographic and lifestyle factors associated with low serum vitamin D levels.

#### Methods

This cross-sectional study involved adult patients (aged  $\geq 19$ ) visiting family practice clinics in urban and semi-urban areas. Serum 25-hydroxyvitamin D [25(OH)D] levels were measured, and a structured questionnaire was used to collect demographic and lifestyle data. Vitamin D levels were categorized as deficient ( $< 22$  ng/mL), insufficient (20–30 ng/mL), and sufficient ( $\geq 30$  ng/mL).

#### Results

Among 360 participants, 62.2% had vitamin D deficiency, 27.9% had insufficiency, and only 14% had sufficient levels. Women, individuals with lower sun exposure, and those who wore covered clothing had significantly lower levels. Educational status and dietary habits also showed associations with vitamin D status.

## Conclusion

Vitamin D deficiency is highly prevalent among Pakistani adults attending family practice clinics. Public health strategies including awareness campaigns, supplementation, and lifestyle modifications are needed to address this widespread issue.

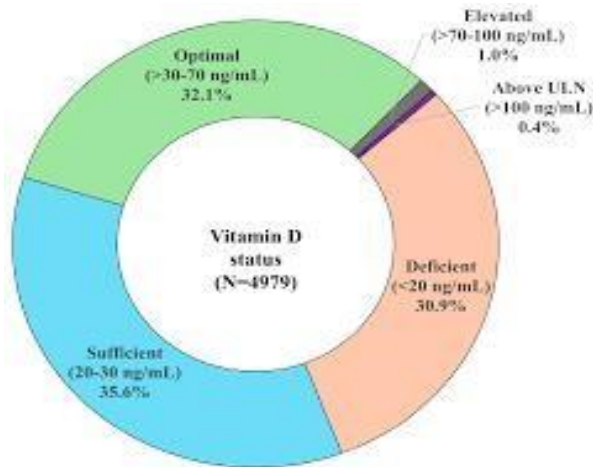
**Keywords:** Vitamin D, deficiency, cross sectional study, muscle skeletal

## Introduction

Vitamin D, a fat-soluble vitamin synthesized primarily through sunlight exposure, plays a critical role in calcium metabolism, bone health, immune function, and various cellular processes [1]. Despite Pakistan's geographic advantage with ample sunlight throughout the year, studies have consistently reported widespread vitamin D deficiency across all age groups [2]. This paradox highlights complex interplays of cultural practices, clothing styles, air pollution, skin pigmentation, dietary habits, and urban living that may contribute to inadequate cutaneous synthesis or poor dietary intake [3]. In Pakistan, particularly among urban populations, limited outdoor activities and excessive sun avoidance practices due to cultural norms or cosmetic preferences have further reduced sun exposure [4].



Furthermore, vitamin D–fortified foods are not widely consumed, and routine screening for deficiency is not common in primary care settings. The clinical consequences of prolonged deficiency include osteomalacia, muscle weakness, increased risk of fractures, and a potential link with chronic illnesses such as diabetes, cardiovascular diseases, and autoimmune disorders [5]. While some population-based surveys have explored vitamin D deficiency in children and women of reproductive age, there remains a lack of robust data on vitamin D status in the general adult population attending family medicine clinics where a remarkable proportion of preventive and primary care services are delivered [6].



Understanding the prevalence and risk factors associated with vitamin D deficiency in this setting is crucial for early identification and intervention [7]. This study aims to determine the distribution of serum vitamin D levels among adult patients presenting to family practice clinics in Pakistan [8]. It also investigates associations between vitamin D status and demographic or lifestyle variables to help inform primary care physicians and public health practitioners about targeted prevention and management strategies.

### Methodology

A cross-sectional study was conducted in five family practice clinics across Karachi and Lahore from January to April 202. Adults aged 1 and above presenting for non-emergency visits were recruited using convenience sampling. Written informed consent was obtained. A structured questionnaire collected data on demographics (age, gender, education), sun exposure (average daily exposure, clothing habits), dietary intake (consumption of dairy and vitamin D-rich foods), physical activity, and use of supplements. Blood samples were collected for measuring serum 27(OH)D levels using chemiluminescent immunoassay. Vitamin D status was classified as deficient (<22 ng/mL), insufficient (20–30 ng/mL), or sufficient ( $\geq$ 30 ng/mL), based on Endocrine Society guidelines. Statistical analysis was performed using SPSS v25. Frequencies and percentages were reported for categorical variables, and chi-square tests were used to evaluate associations between vitamin D levels and demographic/lifestyle factors. A p-value of <0.04 was considered statistically significant.

## Results

The demographic characteristics and corresponding vitamin D status of the 350 study participants. The majority were female (61.6%), among whom vitamin D deficiency was notably high at 68.0%, compared to 53.2% in males. Only 9.9% of females had sufficient vitamin D levels, underscoring a significant gender disparity. Age-wise, the highest proportion of participants belonged to the 31–50 age group (43.8%), with a deficiency rate of 63.7%, closely followed by the 18–30 group (62.8%) and those over 50 years (58.8%). This suggests that vitamin D deficiency is prevalent across all age groups, with younger adults being slightly more affected. Educational attainment also showed a marked impact: participants with education up to secondary level had a significantly higher deficiency rate (71.0%) compared to those with college-level education or above (56.2%). Additionally, the proportion of individuals with sufficient vitamin D levels was more than double in the higher-educated group (15.3%) compared to the lower-educated group (7.1%). These findings indicate that vitamin D deficiency is widespread, particularly among females, those with lower education levels, and individuals in their younger to middle adulthood.

**Table 1: Demographic Characteristics and Vitamin D Status of Participants (n=350)**

Variable	n (%)	Vitamin D Status		
		Deficient (%)	Insufficient (%)	Sufficient (%)
Gender				
Male	139 (39.4)	73 (53.2)	46 (33.6)	22 (15.2)
Female	213 (61.6)	143 (68.0)	48 (24.1)	22 (9.9)
Age Group				
18–30	113 (32.4)	69 (62.8)	31 (28.3)	13 (10.9)
31–50	151 (43.8)	95 (63.7)	42 (28.3)	16 (10.0)
>50	92 (26.8)	53 (58.8)	24 (26.6)	16 (16.6)
Education				

≤Secondary	141	99 (71.0)	33 (23.9)	11 (7.1)
(41.0)				
≥College	211	117 (56.2)	63 (28.5)	33 (15.3)
(61.0)				

**Table 2: Lifestyle Factors Associated with Vitamin D Deficiency**

Lifestyle Factor	Deficient (%)	p-value
Sun Exposure <15 min/day	79.4	0.001
Covered Clothing (Hijab/Niqab)	82.2	<0.002
Regular Dairy Intake	43.7	<0.002
Vitamin D Supplementation (Yes)	29.9	<0.002
Physical Activity (Sedentary)	66.5	0.016

### Discussion

The findings of this study reveal a strikingly high prevalence of vitamin D deficiency among adults attending family practice clinics in Pakistan [9]. In spite of geographical advantages with year-round sunshine, most participants failed to achieve sufficient serum vitamin D levels, reinforcing the paradox observed in previous national and regional studies [10]. Gender emerged as a strong determinant, with females being significantly more deficient than males. Cultural clothing practices, especially full body covering and indoor lifestyles, likely contribute to this disparity. Consistent with previous studies, individuals reporting minimal sun exposure were more likely to be deficient [11]. In urban Pakistani society, a preference for fair skin, use of sunblock, indoor occupations, and air pollution are additional barriers to effective sun-driven synthesis of vitamin D [12]. Education level also showed a notable correlation; participants with higher education had slightly better vitamin D levels. This may reflect improved health literacy, awareness of nutritional requirements, or access to supplementation. Additionally, participants who reported consuming dairy products regularly or taking vitamin D supplements had significantly lower rates of deficiency [13]. The association of vitamin D levels with age was less pronounced, although the oldest age group (>50 years) had marginally better status possibly due to more frequent health checkups and supplement use [14]. However, a concerning proportion across all

age brackets remained deficient, indicating a need for broader public health action. This study reinforces the role of primary care settings in screening and managing vitamin D deficiency [15]. Family physicians are uniquely positioned to identify at-risk individuals and provide guidance on supplementation, sun exposure, and dietary modifications. Moreover, routine testing and national awareness campaigns may help destigmatize sun exposure and promote healthier behaviors [16]. Limitations of the study include its cross-sectional design, limited geographic scope, and reliance on self-reported lifestyle factors.

Nevertheless, it provides valuable insight into the vitamin D status of Pakistani adults within a clinical context, highlighting an urgent public health issue.

### Conclusion

Vitamin D deficiency is alarmingly common among Pakistani adults visiting family practice clinics, particularly among women and those with low sun exposure. This calls for immediate action through targeted public health interventions, clinician education, and community-based awareness programs. Ensuring widespread access to affordable supplementation and food fortification may serve as essential tools in combating this silent epidemic.

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