

Assessment of Vitamin-D Levels and Their Relationship to Dietary Habits and Sociodemographic Characteristics

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<https://doi.org/10.62345/jads.2024.13.4.87>

Abstract

Vitamin-D deficiency (VDD) is a global public health issue affecting individuals across all age groups, including adolescents. It is primarily synthesized through skin exposure to sunlight, with dietary intake playing a supplementary role. Various sociodemographic factors, including maternal education, gender, and lifestyle, significantly influence vitamin-D levels. To evaluate the vitamin D levels of adolescents and investigate their associations with dietary habits and sociodemographic characteristics in patients attending outpatient clinics at Northwest General Hospital and Research Centre Peshawar, Pakistan. This cross-sectional study was conducted from June 2023 to March 2024 on 230 patients aged 15-50 years presenting with symptoms suggestive of vitamin D deficiency. Participants completed a structured questionnaire detailing sociodemographic information and dietary habits, while serum vitamin D levels were assessed using standard biochemical assays. Data were analyzed using SPSS version 25. The majority of participants (61%) were aged 15-35, and females constituted 63% of the sample. Only 26.8% had sufficient serum vitamin D levels, 37.7% were insufficient, and 35.5% were deficient. Maternal education significantly correlated with vitamin D status, as 52% of mothers had completed graduate or postgraduate studies. Dietary habits revealed limited consumption of vitamin D-rich foods, with the majority reporting infrequent intake. Vitamin D deficiency is highly prevalent among adolescents in the study population, with sociodemographic factors such as gender, maternal education, and dietary habits playing critical roles.

Keywords: Vitamin-D Deficiency, Adolescents, Dietary Habits, Socio-Demographic Characteristics, Public Health, Maternal Education.

Introduction

Vitamin D, often referred to as "The Sunshine Vitamin," is primarily obtained through exposure to sunlight. When human skin is exposed to ultraviolet (UV) radiation, it undergoes photo isomerization of 7-dehydrocholesterol (7DHC), resulting in the creation of pre-vitamin D₃ (Webb, 2006). Research suggests that 20,000 IU of vitamin D, equivalent to the recommended amount of sun exposure, can cause a slight reddish tinge on the skin (1MED) after 24 hours (Holick, 2010).

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Despite its importance, vitamin D deficiency (VDD) is a widespread issue affecting adults and children worldwide.

While some foods, such as milk, cereal, yoghurt, orange juice, margarine, shitake mushrooms, salmon, tuna, and hardboiled eggs, contain vitamin D, they do not provide sufficient amounts for adults and children (Hilger et al., 2014). The consequences of low vitamin D levels can be severe, particularly in youngsters, where it can lead to rickets. Furthermore, vitamin D receptors are present in various human organs, including the brain, heart, skin, gonads, prostate, and breast, as well as the small intestine, colon, activated T and B lymphocytes, β islet cells, and mononuclear cells (Holick & Chen, 2008).

Vitamin D insufficiency has become a significant global public health problem, affecting over a billion people worldwide (Holick, 2007). Contrary to previous assumptions, this issue is not limited to Western nations. Studies have shown that up to 40% of people in South Asia have a severe deficiency (<10 ng/mL), while only 20% of the healthy population has inadequate levels of vitamin D (<20 ng/mL) (Arya et al., 2004). Several factors contribute to insufficient vitamin D levels, including limited sun exposure, air pollution, skin tone, mother's educational background, and clothing choices (Tolppanen et al. 2012). Additionally, exclusive breastfeeding can lead to low infant vitamin D levels.

This study aims to assess the vitamin D levels of patients presenting to the outpatient department of Northwest General Hospital and Research Centre Peshawar and its relation to demographics and dietary habits.

Methodology

This study was conducted at Northwest General Hospital and Research Centre Peshawar, Pakistan, from June 2023 to March 2024, from the patients visiting medical and orthopaedics outpatient clinics for whom serum vitamin D test was advised either because patients were having to present complaints of body aches or having suspicion of low serum vitamin D due to lifestyle and eating habits. Patients having an age range of 15-50 years, no bony cancers or metastasis, and those who were willing to answer the questions/fill the questionnaire were included, while those at the extreme ages recently took vitamin D supplements, especially the two Lacs International Unit Vitamin D injections or capsules. Those having some sort of bone-related chronic disease were excluded to remove the bias. Data entry and analysis were carried out through SPSS version 25.

The total number of participants included in this study was 230. All the participants answered the questionnaire, which sought sociodemographic characteristics and other information. Dietary habits were asked by asking the type of food intake the participants were having per day/week, and the frequency was calculated as shown in table 1 below.

Table 1: Frequency of vitamin D rich food consumption

Frequent	Every day (at least once) or five to seven times each week
Occasional	Once a week or two to four times a week
Rare	Every month or up to three times every month
Never	Not eaten ever.

Routinely serum vitamin D test was advised for these patients as well. This serum vitamin D test was advised for the study purpose but the patients for whom vitamin D tests were advised were included in the study.

There are several methods for classifying or defining what is sufficient or insufficient for 25 (OH) D circulation. The Institute of Medicine [9] defined vitamin D deficiency as ≤ 12 ng/mL (≤ 30 nmol/L) and vitamin D sufficiency as >20 ng/mL (>50 nmol/L) (Table 2). In this study, it served as a cutoff criterion for the amount of circulating 25(OH) D. According to these recommendations, children and adolescents should consume 600 IU/d of vitamin D every day and 400 IU/d of vitamin D on average as per the Institute of Medicine.

Table 2: Serum Vitamin D status

Status	Level (nmol/L)	Level (ng/L)
Sufficient	>50	>20
Insufficient	30-50	12-20
Deficient	<30	<12

Results

Table 3 presents demographic information about our 230 study participants, providing insight into their age, gender, and religious affiliations. The majority of the individuals, 61%, fall within the age range of 15-35 years old, while 39% are between 36-50 years old. In terms of gender, the group is predominantly female, with 63% of the individuals identifying as female, while 37% are male. Additionally, the table reveals that the group is overwhelmingly Muslim, with 98.5% of the individuals identifying as such, and only 1.5% identifying as Non-Muslims as shown below.

Table 3: Demographics of participants

Parameter	n (%)
Age (years)	
15-35	61%
36-50	39%
Gender	
Male	37%
Female	63%
Religion	
Muslims	98.5%
Non-Muslims	1.5%

The education level of the mother of these individuals vary. 52% of the mothers have graduated or pursued post-graduation, indicating a strong emphasis on higher education within this group. Additionally, 20% have completed higher secondary school, while 11% have passed secondary school or below, and 17% have only completed primary education or below as shown in table 4 below.

Table 4: Education level of mother

Education level	Percentage
Graduated/Post graduated	52%
Higher secondary School passed	20%
Secondary School passed or below	11%
Primary pass or below	17%

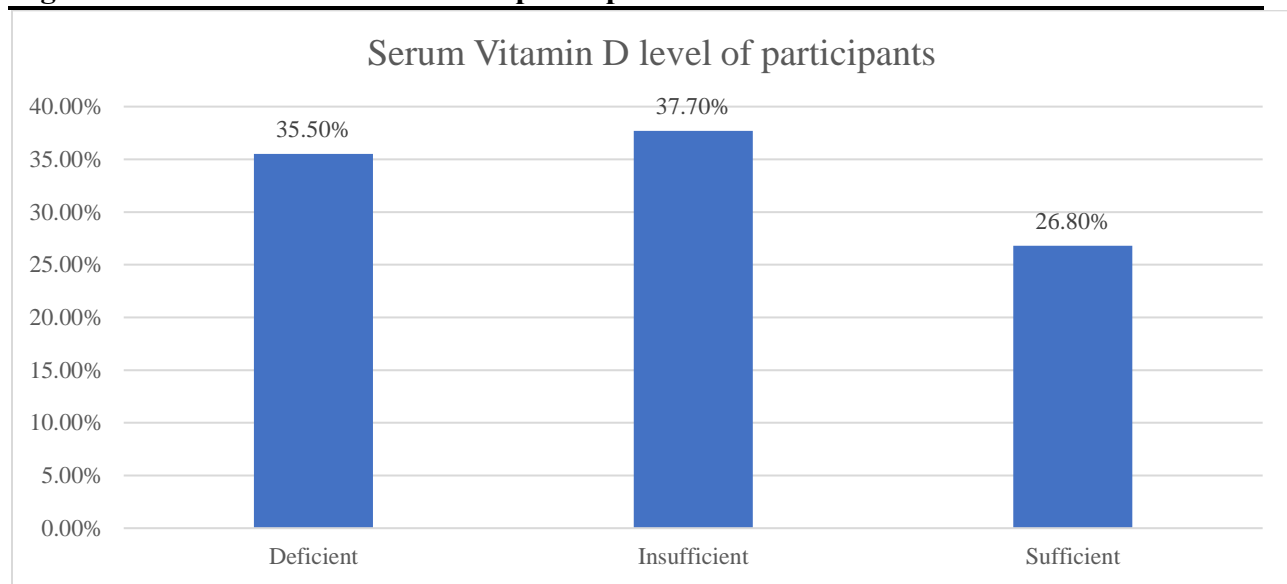
The education level of the fathers of the participants is given in table 5 below. 79% of the individuals have graduated or pursued post-graduation, indicating a strong emphasis on higher education within this group. Only 5% having completed higher secondary school, 9% having passed secondary school or below, and 7% having only completed primary education or below.

Table 5: Education level of father

Education level	Percentage
Graduated/Post graduated	79%
Higher secondary School passed	5%
Secondary School passed or below	9%
Primary pass or below	7%

Figure 1 below shows the serum vitamin D status of the participants. As shown in the figure, only 26.8% of the individuals were having sufficient levels of serum vitamin D while 37.7% were having insufficient while 35.5% with deficient serum vitamin D levels.

Figure 1: Serum Vitamin D status of participants



Discussion

The results of this study shed crucial light on teenagers' vitamin D levels and how they relate to their eating patterns and sociodemographic traits. Only 26.8% of patients in our study had adequate serum vitamin D levels, indicating a high prevalence of vitamin D insufficiency and deficiency. These results highlight the pervasiveness of vitamin D insufficiency (VDD) as a public health concern and are consistent with regional and worldwide trends. Similar patterns are reported by studies conducted in South Asia, especially Pakistan, where a significant portion of the population suffers from VDD (Mokhtar et al 2018).

The study's preponderance of women (63%) and their increased vulnerability to lower vitamin D levels support earlier research suggesting sociocultural practices that disproportionately affect

women, such as limited sun exposure because of clothing habits and traditional gender roles (Andıran et al., 2012). Furthermore, participants whose mothers had lower levels of education also had a higher prevalence of VDD, which is in line with other studies showing that maternal education is a significant factor in determining the nutritional and health outcomes of children and adolescents (Ross et al., 2011).

This study's finding that dietary practices and vitamin D status are related supports previous research. Even while vitamin D-rich foods such eggs, fish, and fortified goods were reported to be consumed, dietary intake was not enough to reach the necessary levels. This result is in line with research by other authors (Asadi et al. 2019) which show that exposure to sunlight has a greater impact on total vitamin D levels than food. The necessity for extra steps, including supplementation or lifestyle modifications, is highlighted by the limited influence that diet has in preserving appropriate vitamin D levels.

Additionally, the participants' sociodemographic traits—such as the educational attainment of their parents—emphasize the significance of education in relation to health outcomes. Participants in our study were more likely to have higher vitamin D status if their parents had completed or pursued higher education. More health literacy and easier access to tools that support healthy habits are probably to blame for this. Higher parental education is associated with better dietary diversity and health outcomes, according to similar findings from other studies carried out in developing nations (Islam et al 2022).

Concerns regarding the long-term health consequences for teenagers, such as an elevated risk of rickets, osteoporosis, and other chronic illnesses, are raised by the high prevalence of inadequate and deficient vitamin D levels in this study. The necessity for focused interventions is further highlighted by comparisons with research done in nearby nations, which show a similar frequency of VDD among teenagers (Kapil et al 2017). Promoting the use of fortified foods, establishing school-based supplementation programs, and raising awareness of the value of sun exposure should be the main goals of public health initiatives.

The results of this study are in line with worldwide patterns, but they also draw attention to the particular difficulties that Pakistani populations face because sociocultural and environmental factors have a big influence on vitamin D levels there. To address this urgent public health concern, future research should examine the efficacy of interventions such public awareness campaigns, fortification, and supplementation. Furthermore, longitudinal research is required to evaluate the long-term effects of low vitamin D levels on the health outcomes of adolescents.

Conclusion

With only 26.8% of adolescents exhibiting adequate serum vitamin D levels, this study emphasizes the high incidence of vitamin D deficiency and insufficiency among this demographic. The results, which relate vitamin D level to dietary practices, sociodemographic traits, and sociocultural influences, highlight the complex nature of the problem. Particularly at risk are women, teenagers with parents who are less educated, and people who don't get much sun exposure. Alternative treatments are necessary since dietary consumption of foods high in vitamin D is still insufficient to reach recommended levels. Important public health initiatives include raising awareness, supporting fortified foods, promoting safe sun exposure, and putting supplementing programs into place. To address this urgent health issue and lessen the long-term health effects of vitamin D insufficiency in teenagers, a thorough, culturally sensitive strategy is needed.

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