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Prevalence of vitamin D deficiency in east nimar region: An observational study

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Abstract: Vitamin D is a crucial fat-soluble vitamin with various functions. Its deficiency is widespread and affects individuals of all age groups. This study aimed to determine the prevalence of Vitamin D deficiency in different age groups and genders within the East Nimar region. A total of 236 participants were included, and their Vitamin D levels were measured using a Mindray CL-900i Chemiluminescence Immunoassay Analyzer. The results were stratified by age groups and gender. Among the 236 individuals, 47.9% were males and 52.1% were females. The study revealed that 86.4% of the subjects had insufficient or deficient levels of Vitamin D, while only 13.6% had sufficient levels. Specifically, 33.5% of the cases had Vitamin D deficiency, and 57.2% had Vitamin D insufficiency. Vitamin D deficiency was observed in 51.80% of individuals with higher sun exposure and 75% of those with lower exposure. Among supplement users, 45.2% had Vitamin D deficiency, whereas among non-users, the rate was 69.58%. The findings underscore the high prevalence of Vitamin D deficiency in India. Considering the inadequate dietary intake of Vitamin D in the Indian population, measures such as food fortification, Vitamin D supplementation, and exposure to sunlight (especially in the morning) are crucial to address this issue and prevent the complications associated with Vitamin D deficiency.

Keywords: Fat soluble vitamin; Vitamin D deficiency; East nimar.

1. Introduction

Vitamin D is an important fat-soluble vitamin that plays a crucial role in the human body [1]. It exists in two main forms: cholecalciferol (D3) and ergocalciferol (D2) [2], with Vitamin D3 commonly referred to as Vitamin D. When the skin is exposed to sunlight, it synthesizes approximately 90% of the body's required Vitamin D, while the remaining 10% is obtained from endogenous sources [3]. This vitamin is essential for maintaining normal blood levels of calcium and phosphate, which are vital for bone mineralization, muscle contraction, nerve conduction, and various cellular functions. Additionally, Vitamin D plays a significant role in supporting immune function [3,4].

In terms of dietary sources, Vitamin D can be obtained from fish, supplements, and fortified foods. However, the primary mechanism of obtaining Vitamin D is through the skin's synthesis upon exposure to sunlight. This process involves the conversion of 7-dehydrocholesterol in the skin to Vitamin D3, which is then released into the bloodstream in a bound form under the catalyzation of ultraviolet B (UV-B) radiation with a wavelength range of 290-320 nm [3–5]. Once in the blood, Vitamin D3 travels to the liver, where it is converted to 25-hydroxyvitamin D [25(OH)D]. Further hydroxylation occurs in the kidneys, resulting in the formation of 1,25-dihydroxyvitamin D, the most active form of Vitamin D. The synthesis of 1,25-dihydroxyvitamin D, which is regulated by parathyroid hormone, is further enhanced by low serum phosphate concentrations and low serum calcium levels. It is important to note that severe Vitamin D deficiency can lead to the development of rickets, a condition characterized by impaired bone growth and mineralization.

To assess an individual's Vitamin D status, serum diagnostic levels are used as guidelines [6,7]. These levels are categorized as follows: deficiency (<20 ng/ml), insufficiency (21-29 ng/ml), sufficiency (>30 ng/ml), and toxicity (>150 ng/ml).

By understanding the significance of Vitamin D and its various sources, we can better appreciate the importance of maintaining adequate levels of this essential vitamin for overall health and well-being.

2. Material and methods

This study was done in Sodani Diagnostic Clinic, Khandwa during the period from April 2022 to March 2023. This study included 236 individuals, with their informed consent and throughout the study duration all ethical considerations were taken care of. We measured the Vitamin D levels using a Mindray CL-900i Chemiluminescence Immunoassay Analyzer. Venous blood samples were collected in clot activator serum tube and tested within 1 hour of collection to minimize variations due to sample aging. Serum was separated from clotted sample, Vitamin D estimation was done and results were noted. Results were distributed according to age groups and gender.

3. Results

The variation of Vitamin D levels with respect to different age groups is presented in Table 1. The study included a total of 236 individuals, comprising 47.9% males and 52.1% females. Among the participants, 86.4% exhibited Vitamin D insufficiency and deficiency, while 13.6% had sufficient Vitamin D levels.

Specifically, out of the 236 cases analyzed, 33.5% were found to have Vitamin D deficiency, and 57.2% had Vitamin D insufficiency.

Table 2 illustrates the incidence of Vitamin D deficiency among individuals with varying levels of sunlight exposure. Notably, individuals with greater exposure to sunlight had a prevalence of 51.80% for Vitamin D deficiency, while those with reduced exposure showed a higher prevalence of 75%. Furthermore, the data indicates that Vitamin D insufficiency was observed in 45.2% of individuals who consumed Vitamin D supplements, whereas the prevalence rose to 69.58% among those who did not take any supplements.

These findings shed light on the prevalence of Vitamin D deficiency and insufficiency among different subgroups, highlighting the impact of sunlight exposure and supplementation practices on Vitamin D status.

Table 1. Vitamin D levels variation with age groups (n= no. of subjects) (Total = 236)

Age Group	Deficiency (<20 ng/ml) (n=79)		Insufficiency (21-29 ng/ml) (125)		Sufficiency (30-150 ng/ml) (32)	
	Male (n=48)	Female (n=31)	Male (n=45)	Female (n=80)	Male (n=20)	Female (n=12)
Child (0-16 yrs)	4 (1.7%)	3 (1.3%)	3 (1.3%)	5 (2.1%)	4 (1.7%)	2 (0.9%)
Young Adults (17-30 yrs)	10 (4.2%)	6 (2.5%)	12 (5.1%)	20 (8.5%)	5 (2.1%)	3 (1.3%)
Middle-aged adults (31-45 yrs)	16 (6.7%)	10 (4.2%)	17 (7.2%)	28 (11.8%)	5 (2.1%)	4 (1.7%)
Old-aged Adults (Above 45 yrs)	18 (7.7%)	12 (5.1%)	13 (5.5%)	27 (11.5%)	6 (2.5%)	3 (1.3%)

Table 2

Parameter	Total no. of patients	No. of patients With vitamin D <20 (%)
Exposure to sun		
More	112	58 (51.80)
Less	124	93 (75)
Supplements		
Yes	62	28 (45.2)
No	174	121 (69.58)

4. Discussion

Vitamin D deficiency can have various consequences, particularly affecting bone health. In children, Vitamin D deficiency leads to rickets, characterized by defective bone mineralization, muscle weakness, and bone pain. In adults, inadequate dietary intake of Vitamin D results in poor calcium absorption from the diet, increased calcium resorption from the bone and kidney, reduced bone mineral density, and increased risk of osteoporosis, osteomalacia, muscle weakness, and falls [8]. Our results indicate that 71.4% of children

exhibited Vitamin D insufficiency and deficiency, which is consistent with the findings of Kapil et al. in 2017 [10]. Additionally, among middle-aged and older individuals, 88.6% had Vitamin D insufficiency and deficiency, which correlates with the studies conducted by Suryanarayana et al. in 2018 [9], Rattan et al. in 2016 [11], Bachhel et al. in 2015 [12], and Agrawal and Sharma in 2013 [13].

These findings are based on two studies. The first study, conducted at Medanta in Gurgaon by Kritiar et al., revealed that 93% of the subjects had 25(OH) vitamin D deficiency. Among them, 34% were insufficient, while 59% had frank deficiency. In the second study, conducted in Ballabgarh district, a prevalence rate of 90.8% for vitamin D deficiency (defined as levels below 20 ng/ml) was reported, with only one out of 381 participants identified as having adequate vitamin D levels [14].

According to the International Osteoporosis Foundation's report, a significant proportion of individuals in North India, including 96% of neonates, 91% of healthy school girls, 78% of healthy hospital staff, and 84% of pregnant women, were affected by hypovitaminosis D. In contrast, the prevalence of vitamin D insufficiency in southern India was estimated to be around 40% in males and 70% in females. Furthermore, a notable disparity in the prevalence of vitamin D deficiency was observed between rural and urban areas, which could be attributed to the diversity of occupations within the population [15].

In a study by Tandon et al., the mean vitamin D level in the study population was found to be 26.86 ng/ml. Assessment of the cohort's vitamin D status revealed that 53.35% had a deficiency, 19.48% had an insufficiency, and 26.83% exhibited adequate vitamin D levels [16].

The study conducted by Sachan et al. involved the examination of 207 pregnant women receiving care at Queen Mary Hospital, King George Medical University Lucknow. The aim was to determine maternal vitamin 25(OH)D levels and cord blood vitamin 25(OH)D levels in neonates. The findings revealed that 42.5% of the female participants had a vitamin D level below 10 ng/ml, and approximately 66.7% had a level below 15 ng/ml. Further analysis showed a significant difference in cord blood 25-hydroxyvitamin D (25(OH)D) levels between women with a concentration below 10 ng/ml and those above 10 ng/ml. The former group had a mean level of 5.2$\pm$3 ng/ml, while the latter group had a mean level of 11.8$\pm$5 ng/ml [17].

In the study conducted by Goswami et al., it was found that individuals in Delhi, despite ample sunlight exposure, exhibited vitamin D deficiency even when considered healthy. Possible reasons for this include skin pigmentation, insufficient direct sunlight exposure, diets high in phytate and low in calcium, pregnancy, and reduced sunlight exposure during winter months, all of which can affect vitamin D levels [18].

The use of sunscreen may also contribute to lower vitamin D levels. Several authors have reported that sunscreen inhibits the absorption of UV-B radiation, reducing sunburn and subsequently decreasing vitamin D stores [19]. Matsuka et al. conducted a study that demonstrated a potential correlation between prolonged sunscreen use and reduced vitamin D levels in certain individuals over an extended period [20].

5. Conclusion

In conclusion, Vitamin D deficiency is highly prevalent in India, with a significant portion of the population affected. The typical Indian diet often fails to meet the daily requirement of Vitamin D, contributing to the widespread deficiency. Regular estimation of Vitamin D levels can aid in the early detection and evaluation of deficiency, allowing for timely intervention. It is important to address this issue due to the numerous complications associated with Vitamin D deficiency.

To combat Vitamin D deficiency, implementing strategies such as food fortification, Vitamin D supplementation, and increased exposure to sunlight, especially in the morning, are crucial. Fortifying commonly consumed foods with Vitamin D can help improve the population's overall intake. Additionally, Vitamin D supplements can be recommended to individuals at high risk or with known deficiencies. Encouraging sunlight exposure, particularly during the morning hours when UV-B radiation is optimal, can also contribute to adequate Vitamin D synthesis in the body.

By prioritizing these measures, healthcare providers, policymakers, and individuals can work together to combat Vitamin D deficiency in India and reduce the associated health risks. Taking proactive steps to address this issue will have a positive impact on public health and well-being.

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