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Vitamin D Deficiency and its Clinical Implications in Adults

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Abstract **Original Research Article**

Background: Vitamin D plays a vital role in skeletal health, calcium metabolism, and immunological functions. Despite abundant sunlight in South Asia, deficiency has emerged as a significant public health concern, leading to musculoskeletal, metabolic, and neuropsychiatric disorders. ***Objective:*** To determine the prevalence and clinical implications of Vitamin D deficiency among adults attending Dhaka Medical College Hospital. ***Methods:*** A cross-sectional study was conducted over six months among 50 adult patients. Serum 25-hydroxyvitamin D [25(OH)D] levels were measured. Sociodemographic characteristics, lifestyle factors, and clinical symptoms were assessed using structured questionnaires. Data were analyzed using descriptive statistics and chi-square tests, with significance set at $p<0.05$. ***Results:*** Among the participants, 76% were Vitamin D deficient (<20 ng/mL), 16% insufficient (20–29 ng/mL), and only 8% sufficient (≥30 ng/mL). Deficiency was more prevalent among females (83.3%) than males (65%) and higher in urban residents (79.4%) compared to rural (68.7%). Common clinical manifestations included generalized weakness (70%), bone pain (62%), and muscle cramps (54%). Socioeconomic disparities showed higher deficiency among low-income groups (91.7%). ***Conclusion*:** Vitamin D deficiency is highly prevalent among Bangladeshi adults, with significant clinical manifestations and sociodemographic associations. Urgent public health interventions, including awareness programs, supplementation, and dietary fortification, are needed to address this neglected yet critical health issue.

Keywords: Vitamin D deficiency, Hypovitaminosis D, Clinical manifestations, Bone health, Sunlight exposure.

INTRODUCTION

Vitamin D is a fat-soluble secosteroid hormone that plays a vital role in calcium and phosphorus metabolism, skeletal health, and immunomodulation. It is synthesized in the skin upon exposure to ultraviolet B (UVB) radiation, while dietary intake from fish, fortified foods, and supplements serves as a secondary source. Despite its importance, Vitamin D deficiency has emerged as a global public health issue, affecting more than one billion people worldwide [1]. Low serum 25-hydroxyvitamin D [25(OH)D] concentrations are associated with rickets in children, osteomalacia in adults, and increased susceptibility to osteoporosis and fractures [2]. Beyond bone health, deficiency has been implicated in immune dysfunction, metabolic disorders, cardiovascular disease, and certain malignancies [3]. The burden of Vitamin D deficiency varies across regions, with prevalence estimates ranging between 30% and 80% depending on geography, cultural practices, and dietary habits [4]. In South Asia, high rates have been reported despite abundant sunlight, largely due to lifestyle factors such as limited outdoor exposure, use of sun-protective clothing, and inadequate dietary intake [5]. A study in India revealed that more than 70% of adults had insufficient Vitamin D levels, particularly among urban populations [6]. Similarly, in Pakistan, deficiency has been documented in over 80% of adults, with significant associations with musculoskeletal complaints and fatigue [7]. These findings suggest that

Vitamin D deficiency in South Asia is under-recognized and under-treated. In Bangladesh, evidence also indicates a high prevalence of Vitamin D deficiency across different demographic groups. Research conducted in Dhaka demonstrated that more than 60% of adults had suboptimal Vitamin D levels, despite adequate sunshine availability [8]. Factors contributing to this paradox include air pollution, reduced outdoor activity, and socioeconomic barriers to accessing Vitamin D-rich foods. Women and elderly individuals are disproportionately affected due to cultural practices and reduced cutaneous synthesis capacity [9]. The implications are significant, as deficiency not only contributes to musculoskeletal morbidity but may also play a role in the pathogenesis of diabetes, hypertension, and infectious diseases such as tuberculosis [10]. Globally, recognition of Vitamin D deficiency as a modifiable risk factor has stimulated interest in screening and supplementation strategies. The Endocrine Society recommends maintaining serum 25(OH)D concentrations above 30 ng/mL to optimize health outcomes. However, consensus on optimal cut-offs, supplementation regimens, and population-based screening remains debated. In Bangladesh, routine screening for Vitamin D deficiency is not yet standardized, and supplementation practices remain inconsistent. This gap highlights the need for context-specific research to understand the clinical spectrum of Vitamin D deficiency in local populations. Despite growing literature on the global burden of Vitamin D deficiency, limited studies have explored its clinical presentations in Bangladeshi adults. Most available research focuses on biochemical prevalence, with relatively less attention given to symptomatology and associated risk factors. Understanding the clinical manifestations, including musculoskeletal pain, generalized weakness, and neuropsychiatric complaints, is crucial for timely recognition and management [11]. Moreover, identifying local risk factors such as dietary patterns, socioeconomic determinants, and comorbidities can help shape preventive and therapeutic interventions tailored to the Bangladeshi context.

MATERIALS AND METHODS

This study was designed as a cross-sectional, hospital-based observational study. It was conducted over a period of six months, from January 2025 to June 2025. The study was carried out in the Department of Medicine at Dhaka Medical College Hospital (DMCH), one of the largest tertiary care hospitals in Bangladesh. The target population comprised adult patients attending outpatient and inpatient services who were suspected of having Vitamin D deficiency based on clinical symptoms. A total of 50 patients were included in the study. The sample size was determined based on feasibility within the study timeframe. Participants were recruited using purposive sampling, ensuring representation across age groups and both sexes among adult patients.

Inclusion Criteria

- Adults aged 18 years and above.
- Patients presenting with clinical features suggestive of Vitamin D deficiency (e.g., bone pain, muscle weakness, fatigue).
- Willingness to participate with written informed consent.

Exclusion Criteria

- Patients with known chronic liver or kidney disease.
- Individuals on medications affecting Vitamin D metabolism (e.g., corticosteroids, anticonvulsants).
- Pregnant or lactating women.
- Patients already receiving Vitamin D supplementation within the last 3 months.

Data Collection Procedure

A structured questionnaire and clinical examination checklist were used for data collection. Demographic information (age, sex, residence, socioeconomic status) and lifestyle factors (dietary habits, sunlight exposure, clothing style) were recorded. Detailed medical history and clinical symptoms were documented. Physical examination emphasized musculoskeletal findings. Venous blood samples were collected to measure serum 25-hydroxyvitamin D [25(OH)D] levels using enzyme-linked immunosorbent assay (ELISA).

Statistical Analysis

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics were applied to summarize baseline characteristics. Continuous variables were presented as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Cross-tabulations and chi-square tests were employed to assess associations between Vitamin D status and clinical/demographic factors. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 50 adult patients were included. The mean age was 42.6 ± 13.4 years, ranging from 19 to 70 years. The majority were females (60%, n=30) compared to males (40%, n=20). Most participants were from urban areas (68%) and belonged to middle socioeconomic status (54%) (Table 1).

Table 1: Baseline Demographic and Socioeconomic Characteristics of Participants (n=50)

Characteristic	Frequency (n)	Percentage (%)
Age Group (years)		
18–30	12	24.0
31–45	18	36.0
46–60	14	28.0
>60	6	12.0
Sex		
Male	20	40.0
Female	30	60.0
Residence		
Urban	34	68.0
Rural	16	32.0
Socioeconomic Status		
Low	12	24.0
Middle	27	54.0
High	11	22.0

Overall, 76% (n=38) of participants had Vitamin D deficiency, while 16% (n=8) had insufficiency, and only 8% (n=4) were Vitamin D sufficient (Table 2).

Table 2: Distribution of Serum Vitamin D Status (n=50)

Vitamin D Status	Frequency (n)	Percentage (%)
Deficient (<20 ng/mL)	38	76.0
Insufficient (20–29)	8	16.0
Sufficient (≥30)	4	8.0

The most common symptoms were generalized weakness (70%), bone pain (62%), and muscle cramps (54%). Neuropsychiatric symptoms such as fatigue and low mood were also frequently observed (Figure 1).

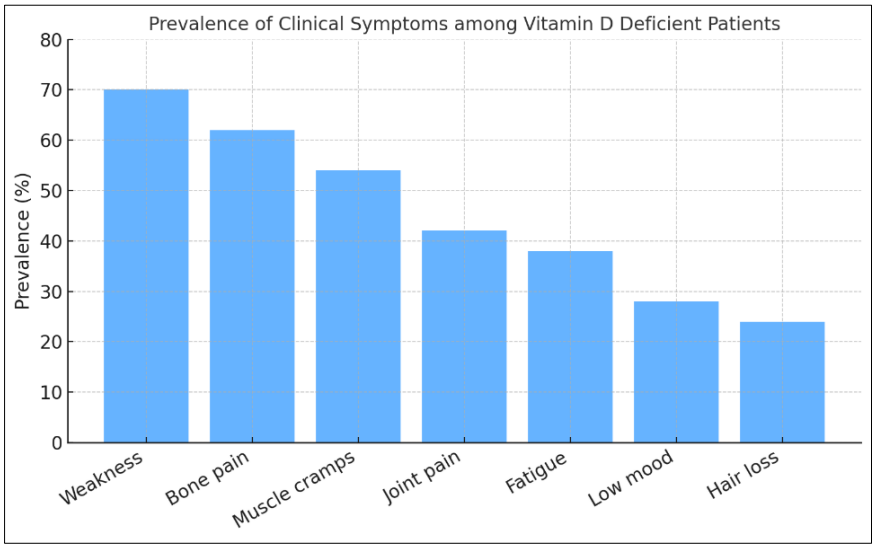

Figure 1: Clinical Symptoms Associated with Vitamin D Deficiency (n=50)

Deficiency was more prevalent among females (83.3%) compared to males (65%). Urban participants also showed higher deficiency (79.4%) than rural participants (68.7%) (Table 3).

Table 3: Association of Vitamin D Deficiency with Demographic Characteristics (n=50)

Variable	Category	Deficiency n (%)	p-value
Sex	Male	13 (65.0)	0.042 *
	Female	25 (83.3)	
Residence	Urban	27 (79.4)	0.118

Variable	Category	Deficiency n (%)	p-value
	Rural	11 (68.7)	
Socioeconomic	Low	11 (91.7)	0.037 *
	Middle	20 (74.1)	
	High	7 (63.6)	

(*p <0.05 considered significant)

Those with inadequate sunlight exposure (<15 minutes/day) had significantly higher rates of deficiency compared to those with adequate exposure (p=0.021) (Table 4).

Table 4: Relationship between Sunlight Exposure and Vitamin D Status (n=50)

Sunlight Exposure	Deficiency n (%)	Insufficiency n (%)	Sufficiency n (%)	p-value
Inadequate (<15 min/day)	29 (87.8)	3 (9.1)	1 (3.0)	0.021 *
Adequate (≥15 min/day)	9 (56.2)	5 (31.3)	2 (12.5)	

(*p <0.05 considered significant)

DISCUSSION

The present study assessed the prevalence and clinical implications of Vitamin D deficiency among adults attending Dhaka Medical College Hospital. The findings demonstrate a high burden of Vitamin D deficiency, affecting 76% of participants, with insufficiency observed in an additional 16%. These results highlight Vitamin D deficiency as a significant public health concern in Bangladeshi adults, consistent with growing global and regional evidence. The prevalence of deficiency identified in this study is in line with findings from other South Asian populations. In India, more than 70% of adults have been reported to be Vitamin D deficient, particularly in urban settings. Similarly, studies in Pakistan documented deficiency rates exceeding 80% among adults. In Bangladesh, earlier research by Islam et al [8] also reported that over 60% of adults in Dhaka had insufficient Vitamin D levels, confirming that the present study's results align with national data. Such persistently high prevalence, despite abundant sunlight, underscores a paradox that has been attributed to limited outdoor activity, conservative clothing practices, and air pollution reducing UVB exposure [12]. Sex-related differences were observed in this study, with females exhibiting significantly higher deficiency (83.3%) compared to males (65%). This finding is consistent with reports from South Asia and the Middle East, where sociocultural norms limit sunlight exposure for women [9]. Reduced dietary intake of Vitamin D-rich foods and physiological factors such as lower cutaneous synthesis efficiency may also contribute [13]. This gender disparity has important implications, as women with deficiency are at greater risk of osteoporosis, fragility fractures, and reproductive health complications. Socioeconomic status also demonstrated a significant association with Vitamin D deficiency. Participants from low-income groups exhibited the highest rates (91.7%), followed by those from middle (74.1%) and higher socioeconomic classes (63.6%) [14]. These differences may reflect disparities in dietary diversity, access to fortified foods, and healthcare utilization. Similar findings were reported in a study from Nepal, which linked low socioeconomic status to poor micronutrient intake and higher risk of Vitamin D deficiency [15]. These results emphasize the need for nutritional interventions targeted at vulnerable populations. Clinical manifestations were prominent among Vitamin D-deficient participants, with generalized weakness (70%), bone pain (62%), and muscle cramps (54%) being the most frequent. These symptoms are consistent with the established musculoskeletal effects of Vitamin D deficiency, including impaired calcium homeostasis and secondary hyperparathyroidism. Joint pain, fatigue, and mood disturbances, reported in nearly one-third of participants, align with emerging evidence linking Vitamin D to neuromuscular and neuropsychiatric health [16]. Notably, hair loss was reported by 24% of patients, which has been described in some studies as a potential dermatological manifestation associated with deficiency [17,18]. Sunlight exposure emerged as a critical determinant of Vitamin D status. Participants with inadequate exposure (<15 minutes/day) were significantly more likely to have deficiency compared to those with adequate exposure. This supports global findings that sunlight is the primary determinant of Vitamin D status, accounting for up to 90% of circulating 25(OH)D levels [1,19]. A study in the Middle East similarly reported that limited sunlight exposure, due to cultural clothing and indoor lifestyles, was the strongest predictor of deficiency [20]. The present findings suggest that public health interventions promoting safe sunlight exposure may substantially reduce deficiency rates in Bangladesh. The clinical and public health implications of these findings are substantial. Vitamin D deficiency contributes to a wide spectrum of morbidities, including osteoporosis, cardiovascular disease, diabetes, and immune dysregulation [21]. In South Asia, where infectious diseases such as tuberculosis remain prevalent, Vitamin D deficiency has been implicated as a potential risk factor for susceptibility and disease severity [10]. This highlights the importance of integrating Vitamin D status assessment into broader preventive and therapeutic strategies within healthcare systems. Several factors contribute to the persistence of Vitamin D deficiency in Bangladesh. Urbanization,

reduced outdoor activity, air pollution, and dietary insufficiency are central drivers. Traditional diets in Bangladesh are low in Vitamin D-rich foods such as fatty fish and fortified dairy products, further compounding the risk [22]. Moreover, there is currently no national policy on routine screening or supplementation, unlike in some high-income countries where fortification programs have reduced deficiency prevalence [23]. Context-specific strategies, including dietary fortification, supplementation for high-risk groups, and awareness campaigns on sunlight exposure, are warranted. This study has several limitations. The sample size was relatively small (n=50), and patients were recruited from a single tertiary hospital, which may limit generalizability to the wider Bangladeshi population. Biochemical measurements were restricted to serum 25(OH)D levels without assessment of parathyroid hormone or calcium status, which could have provided additional insights. Furthermore, the cross-sectional design precludes causal inference between risk factors and deficiency. Despite these limitations, the study provides valuable insights into the burden and clinical presentations of Vitamin D deficiency in Bangladeshi adults, highlighting areas for intervention.

CONCLUSION

This study demonstrates that Vitamin D deficiency is highly prevalent among adults attending Dhaka Medical College Hospital, with more than three-quarters of participants affected. Women, individuals from lower socioeconomic backgrounds, and those with inadequate sunlight exposure were disproportionately impacted. Common clinical manifestations included generalized weakness, bone pain, and muscle cramps, consistent with the established musculoskeletal consequences of deficiency. The findings highlight that Vitamin D deficiency in Bangladesh is not only widespread but also clinically significant, contributing to both physical and neuropsychiatric morbidity. Given the absence of routine screening and limited awareness, Vitamin D deficiency remains under-recognized in clinical practice. Public health interventions promoting safe sunlight exposure, dietary diversification, and supplementation for high-risk groups are urgently needed. Furthermore, larger population-based studies are warranted to establish prevalence patterns, explore long-term health impacts, and inform the development of national guidelines for prevention and management.

REFERENCES

1. Holick, M.F., 2017. The vitamin D deficiency pandemic: approaches for diagnosis, treatment and prevention. Reviews in Endocrine and Metabolic Disorders, 18(2), pp.153–165.
2. Bikle, D.D., 2014. Vitamin D metabolism, mechanism of action, and clinical applications. Chemistry & Biology, 21(3), pp.319–329.
3. Bouillon, R., Marcocci, C., Carmeliet, G., Bikle, D., White, J.H., Dawson-Hughes, B., Lips, P., Munns, C.F., Lazaretti-Castro, M., Giustina, A. & Bilezikian, J., 2019. Skeletal and extraskeletal actions of vitamin D: current evidence and outstanding questions. Endocrine Reviews, 40(4), pp.1109–1151.
4. Cashman, K.D., Dowling, K.G., Škrabáková, Z., Gonzalez-Gross, M., Valtueña, J., De Henauw, S., Moreno, L.A., Damsgaard, C.T., Michaelsen, K.F., Mølgaard, C., Jorde, R., Grimnes, G., Moschonis, G., Mavrogianni, C., Manios, Y., Thamm, M., Mensink, G.B.M., Rabenberg, M., Busch, M.A., Cox, L., Meadows, S., Goldberg, G., Prentice, A., Dekker, J.M., Nijpels, G., Pilz, S., Swart, K.M.A., van Schoor, N.M., Lips, P. & Kiely, M., 2016. Vitamin D deficiency in Europe: pandemic? American Journal of Clinical Nutrition, 103(4), pp.1033–1044.
5. Nair, R. & Maseeh, A., 2012. Vitamin D: The "sunshine" vitamin. Journal of Pharmacology & Pharmacotherapeutics, 3(2), pp.118–126.
6. Marwaha, R.K., Tandon, N., Reddy, D.R., Aggarwal, R., Singh, R., Sawhney, R.C., Saluja, B., Ganie, M.A. & Singh, S., 2011. Vitamin D and bone mineral density status of healthy schoolchildren in northern India. American Journal of Clinical Nutrition, 94(2), pp.377–384.
7. Riaz, H., Finlayson, A.E., Bashir, S. & Hussain, S., 2016. Prevalence of vitamin D deficiency in Pakistan and implications for the future. Expert Review of Clinical Pharmacology, 9(2), pp.329–338.
8. Islam, M.Z., Shamim, A.A., Viljakainen, H.T., Akhtaruzzaman, M., Jehan, A.H., Khan, H.U., Lamberg-Allardt, C. & Hyppönen, E., 2018. Vitamin D deficiency and low bone status in adult female garment factory workers in Bangladesh. British Journal of Nutrition, 119(9), pp.1072–1079.
9. Khan, A.H., Jafri, L., Siddiqui, A.A., Naureen, G., Rizvi, S.M.A. & Habib, A., 2019. Prevalence of vitamin D deficiency in the healthy population in Pakistan. Pakistan Journal of Medical Sciences, 35(4), pp.1149–1154.
10. Chowdhury, R., Taneja, S., Bhandari, N., Strand, T.A. & Bhan, M.K., 2017. Vitamin D and tuberculosis: a review on current evidence. Expert Review of Respiratory Medicine, 11(10), pp.881–892.
11. Lips, P., Cashman, K.D., Lamberg-Allardt, C., Bischoff-Ferrari, H.A., Obermayer-Pietsch, B., Bianchi, M.L., Stepan, J., Fuleihan, G.E.H. & Bouillon, R., 2019. Current vitamin D status in European and Middle East countries and strategies to prevent deficiency. Endocrine, 61(1), pp.3–20.
12. Mithal, A., Wahl, D.A., Bonjour, J.P., Burckhardt, P., Dawson-Hughes, B., Eisman, J.A., El-Hajj Fuleihan, G., Josse, R.G., Lips, P., Morales-Torres, J. & IOF Committee of Scientific Advisors (CSA) Nutrition Working Group, 2009. Global vitamin D status and determinants of hypovitaminosis D. Osteoporosis International, 20(11), pp.1807–1820.

13. Hilger, J., Friedel, A., Herr, R., Rausch, T., Roos, F., Wahl, D.A., Pierroz, D.D., Weber, P. & Hoffmann, K., 2014. A systematic review of vitamin D status in populations worldwide. British Journal of Nutrition, 111(1), pp.23–45.
14. Palacios, C. and Gonzalez, L., 2014. Is vitamin D deficiency a major global public health problem? Journal of Steroid Biochemistry and Molecular Biology, 144, pp.138–145.
15. Shrestha, R., Shakya, P., Shrestha, A., Neupane, R., Aryal, M. & Pradhan, S., 2019. Prevalence and determinants of hypovitaminosis D among adults in urban Nepal. BMC Public Health, 19, p.88.
16. Anglin, R.E.S., Samaan, Z., Walter, S.D. & McDonald, S.D., 2013. Vitamin D deficiency and depression in adults: systematic review and meta-analysis. British Journal of Psychiatry, 202(2), pp.100–107.
17. Rosen, C.J., Adams, J.S., Bikle, D.D., Black, D.M., Demay, M.B., Manson, J.E., Murad, M.H. & Kovacs, C.S., 2012. The nonskeletal effects of vitamin D: an Endocrine Society scientific statement. Endocrine Reviews, 33(3), pp.456–492.
18. Roth, D.E., Abrams, S.A., Aloia, J., Bergeron, G., Bourassa, M.W., Brown, K.H., Calvo, M.S., Cashman, K.D., Combs, G., De-Regil, L.M. and Jefferds, M.E.D., 2018. Global prevalence and disease burden of vitamin D deficiency: a roadmap for action in low- and middle-income countries. Annals of the New York Academy of Sciences, 1430(1), pp.44–79.
19. Autier, P., Boniol, M., Pizot, C. and Mullie, P., 2014. Vitamin D status and ill health: a systematic review. The Lancet Diabetes & Endocrinology, 2(1), pp.76–89.
20. Bassil, D., Rahme, M., Hoteit, M. & Fuleihan, G.E.H., 2013. Hypovitaminosis D in the Middle East and North Africa: prevalence, risk factors and impact on outcomes. Dermato-Endocrinology, 5(2), pp.274–298.
21. Bilezikian, J.P., 2020. Vitamin D and bone health: the need for more randomized clinical trials. Journal of Bone and Mineral Research, 35(11), pp.2115–2119.
22. Rahman, M., Akhtaruzzaman, M. & Lamberg-Allardt, C., 2021. Vitamin D deficiency and its health implications in Bangladesh: a review. Public Health Nutrition, 24(7), pp.1733–1744.
23. Calvo, M.S. & Whiting, S.J., 2013. Survey of current vitamin D fortification practices in the United States and Canada. Journal of Steroid Biochemistry and Molecular Biology, 136, pp.211–213.