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Status of Vitamin D Deficiency among Children: Observation at a Pediatric Consultation Center

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Abstract **Original Research Article**

Introduction: Vitamin D deficiency is a global health issue, with children being particularly vulnerable. This study aimed to assess the prevalence and risk factors of Vitamin D deficiency among children attending a pediatric consultation center in Mohammadpur, Dhaka, Bangladesh. ***Methods:*** This observational study was conducted at a Pediatric Consultation Center in Mohammadpur, Dhaka, Bangladesh, from March 2022 to February 2023. The study population consisted of a total of 100 children aged <18 years who visited the center during the study period. ***Result:*** The results indicated a substantial prevalence of Vitamin D deficiency (40%) and insufficiency (52%) among the participants. The deficiency was observed to escalate with age, with the highest prevalence (32.50%) in the 12-16 years age group. Dietary evaluation revealed that 72% of participants had a poor intake of Vitamin D. Limited sun exposure was reported by 51% of participants, while 35% led an indoor lifestyle. Socioeconomic analysis revealed that 28% of participants belonged to a low socioeconomic status, which was identified as a risk factor for Vitamin D deficiency. ***Conclusion:*** The findings underscore the urgent need for public health interventions to improve the Vitamin D status of children in this population. Such interventions should include promoting the consumption of Vitamin D-rich foods, encouraging outdoor activities, and providing Vitamin D supplements where necessary. Regular monitoring of Vitamin D levels, particularly in children from low socioeconomic backgrounds, is crucial.

Keywords: Vitamin-D, Sufficiency, Insufficiency, Deficiency, Prevalence.

INTRODUCTION

Vitamin D deficiency is a global health issue that has been linked to numerous health conditions, including rickets in children, osteoporosis in adults, and an increased risk of chronic diseases such as cardiovascular disease and certain cancers [1]. Despite the importance of Vitamin D in maintaining bone health and supporting the immune system, deficiency is becoming increasingly common worldwide [2]. Globally, it is estimated that about 1 billion people have vitamin D deficiency or insufficiency [3]. In the United States, a study conducted by Melamed and Kumar (2010) found that Vitamin D deficiency is becoming increasingly prevalent, with some evidence suggesting that it may lead to other diseases including diabetes mellitus, hypertension, infections, asthma, and dyslipidemia [4]. In Asia, the situation is no different. A study conducted in Thailand found that Vitamin D insufficiency and deficiency are more common and associated with the level of kidney function in the Thai Chronic Kidney Disease (CKD) population, especially in advanced stages of CKD [5]. This indicates that Vitamin D deficiency is not only prevalent but also has significant health implications in the Asian population. The situation in Bangladesh, a country in South Asia, mirrors the global and regional trends. However, there is a lack of comprehensive studies that focus on the prevalence of Vitamin D deficiency in the Bangladeshi population, particularly among children. Vitamin D deficiency in children is of particular concern due to its impact on growth and development. It is well established that Vitamin D is crucial for the absorption of calcium and phosphorus, essential elements for bone health [6]. Deficiency in children can lead to rickets, a disease characterized by bone deformity, growth retardation, and muscle weakness [7]. Several factors

contribute to Vitamin D deficiency. These include limited exposure to sunlight, which is the primary source of Vitamin D for most people; dietary factors, such as low consumption of Vitamin D-rich foods; and certain health conditions that affect the body's ability to absorb or convert Vitamin D into its active form [8–10]. In the context of Bangladesh, factors such as cultural practices that limit sun exposure, dietary habits, and socioeconomic factors may contribute to the high prevalence of Vitamin D deficiency. However, more research is needed to understand the extent of the problem and its implications for child health in the country. The proposed study aims to address this gap by investigating the status of Vitamin D deficiency among children attending a Pediatric Consultation Center in Mohammadpur, Dhaka, Bangladesh. The findings of this study will provide valuable insights into the prevalence of Vitamin D deficiency in this population and inform interventions to address this public health issue.

METHODS

This observational study was conducted at a Pediatric Consultation Center in Mohammadpur, Dhaka, Bangladesh, from March 2022 to February 2023. The study population consisted of children aged <18 years who visited the center during the study period. The sample size was 100 participants. The selection criteria included children who were not taking any Vitamin D supplements or medications that could affect Vitamin D metabolism, and those who did not have any chronic diseases such as renal disease, liver disease, or malabsorption syndromes. The study was designed as a cross-sectional observational study. Upon arrival at the center, the parents or guardians of the children were informed about the study, and written informed consent was obtained. The children were then subjected to a thorough clinical examination, and their medical history was taken. Information on dietary habits, sun exposure, and socioeconomic status was collected through a structured questionnaire administered to the parents or guardians. The dietary assessment included questions on the frequency and quantity of consumption of Vitamin D-rich foods such as fish, milk, and eggs. Sun exposure was assessed by asking about the average time spent outdoors and the use of sun protection measures. Socioeconomic status was determined based on parental education and occupation. Blood samples were collected from the children for the measurement of serum 25-hydroxyvitamin D levels, which is the best indicator of Vitamin D status. The samples were analyzed using a high-performance liquid chromatography-tandem mass spectrometry (HPLC-MS/MS), which is considered the gold standard for Vitamin D testing. Vitamin D deficiency was defined as a serum 25-hydroxyvitamin D level of less than 20 ng/mL, and insufficiency as a level of 20-29 ng/mL. The data collected were analyzed using statistical software. Descriptive statistics were used to summarize the data, and inferential statistics were used to determine the association between Vitamin D status and various factors such as age, gender, dietary habits, sun exposure, and socioeconomic status. The level of significance was set at $p<0.05$. The study was carried out in accordance with the ethical standards of the Helsinki Declaration.

RESULTS

Table 1: Distribution of participants by sociodemographic characteristics (N=100)

Variables	Frequency	Percentage
Age in years		
<1 years	23	23.00%
2-5 Years	24	24.00%
6-11 Years	26	26.00%
12-16 Years	27	27.00%
Sex		
Male	48	48.00%
Female	52	52.00%
Socioeconomic Status		
Poor class	28	28.00%
Middle class	47	47.00%
Upper class	25	25.00%

The age distribution of the 100 participants was fairly even across the four age groups. The youngest group, those less than 1 year old, comprised 23% of the sample. The 2-5 years age group made up 24% of the sample, while the 6-11 years and 12-16 years age groups represented 26% and 27% of the sample, respectively. In terms of gender, the sample was almost equally divided, with males representing 48% and females making up 52% of the total participants. This slight female predominance reflects the gender distribution in the general pediatric population of the study area. The socioeconomic status of the participants was categorized into three groups: poor, middle, and upper class. The majority of the

participants (47%) belonged to the middle class, while 28% were classified as poor class. The remaining 25% of the participants were categorized as upper class. This distribution may reflect the socioeconomic stratification in the study area.

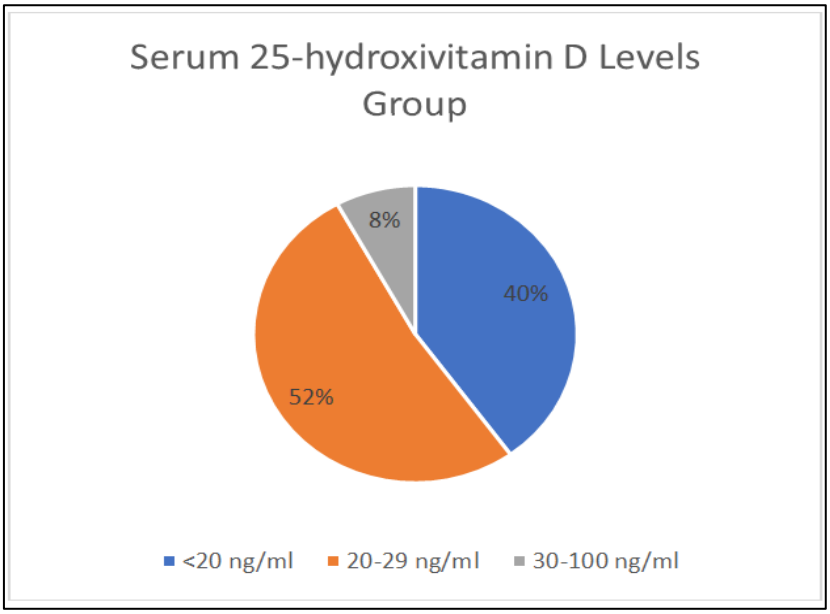

Figure 1: Distribution of participants by serum 25-hydroxivitamin D levels

The serum 25-hydroxyvitamin D levels were categorized into three groups. 40% of the participants had levels below 20 ng/ml, recognized as Vitamin D deficiency, 52% had levels between 20-29 ng/ml, recognized as vitamin D insufficiency, and 8% had levels between 30-100 ng/ml, and were recognized as normal vitamin D level.

Table 2: Distribution of participants with Serum 25-hydroxyvitamin D levels by age group

Age Groups	Vitamin D Deficiency (n=40)		Vitamin D Insufficiency (n=52)		Vitamin D Sufficiency (n=8)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
<1 years	7	17.50%	12	23.08%	4	50.00%
2-5 Years	9	22.50%	12	23.08%	3	37.50%
6-11 Years	11	27.50%	14	26.92%	1	12.50%
12-16 Years	13	32.50%	14	26.92%	0	0.00%

In the vitamin D deficiency category, 17.50% of participants under the age of 1 year had deficient levels, while 22.50% of those aged 2-5 years, 27.50% of those aged 6-11 years, and 32.50% of those aged 12-16 years were deficient. In the vitamin D insufficiency category, 23.08% of participants under the age of 1 year had insufficient levels, followed by 23.08% of those aged 2-5 years, 26.92% of those aged 6-11 years, and 26.92% of those aged 12-16 years. However, in the vitamin D sufficiency category, 50.00% of participants under the age of 1 year had sufficient levels, along with 37.50% of those aged 2-5 years, 12.50% of those aged 6-11 years, and none of those aged 12-16 years. These findings indicate variations in vitamin D status across different age groups, with a higher prevalence of deficiency observed in older age groups.

Table 3: Distribution of participants by dietary habits

Dietary Habits	Frequency	Percentage
Vitamin D rich food consumption (Fish, Milk, Eggs)		
Regular Consumption	19	19.00%
Irregular Consumption	57	57.00%
No Consumption	24	24.00%
Fortified Foods Consumption		
Regular Consumption	15	15.00%
Irregular Consumption	35	35.00%
No Consumption	50	50.00%

In terms of consuming vitamin D-rich foods such as fish, milk, and eggs, 19% reported regular consumption, 57% reported irregular consumption, and 24% reported no consumption of these foods. Regarding the consumption of fortified foods, 15% reported regular consumption, 35% reported irregular consumption, and 50% reported no consumption of fortified foods.

Table 4: Distribution of participants by observable risk factors

Risk Factors	Frequency	Percentage
Poor Dietary Intake of Vitamin D	72	72.00%
Limited Sun Exposure	51	51.00%
Indoor Lifestyle	35	35.00%
Dark Skin Pigmentation	32	32.00%
Low Socioeconomic Status	28	28.00%

The majority of participants, 72%, had a poor dietary intake of vitamin D. Approximately 51% reported limited sun exposure, while 35% had an indoor lifestyle. A significant percentage of participants, 32%, had dark skin pigmentation, which can affect the synthesis of vitamin D in the skin. Furthermore, 28% of participants were classified as having a low socioeconomic status as a risk factors.

DISCUSSION

The present study aimed to assess the status of Vitamin D deficiency among children attending a pediatric consultation center in Mohammadpur, Dhaka, Bangladesh. The results revealed a high prevalence of Vitamin D deficiency and insufficiency among the participants, with 40% and 52% of the children falling into these categories, respectively. The prevalence of Vitamin D deficiency was found to increase with age, with the highest prevalence observed in the 12-16 years age group. These findings are consistent with several studies conducted in different parts of the world. A study conducted in southern Iran reported a high prevalence of Vitamin D deficiency among children and adolescents, with advancing age being a significant risk factor [11]. Another study conducted in Saudi Arabia found that all participants were either Vitamin D deficient or insufficient, with girls being more deficient than boys [12]. This is in line with our findings where we observed a slightly higher prevalence of Vitamin D deficiency in girls. The dietary habits of the participants in our study were found to be a significant contributing factor to their Vitamin D status. Only 19% of the participants reported regular consumption of Vitamin D-rich foods, and 72% had a poor dietary intake of Vitamin D. This is consistent with the findings of a study conducted in China, which reported a high prevalence of Vitamin D deficiency among children and adolescents, with poor dietary intake of Vitamin D being a major contributing factor [13]. Limited sun exposure and an indoor lifestyle were reported by 51% and 35% of the participants, respectively. These findings are similar to those reported in a study conducted in Saudi Arabia, which found that limited sun exposure was a significant risk factor for Vitamin D deficiency among pregnant women [14]. This is of particular concern given that Bangladesh, like Saudi Arabia, is a country with abundant sunshine, suggesting that lifestyle factors play a significant role in Vitamin D deficiency. Our study also found that 28% of the participants were classified as having a low socioeconomic status, which was identified as a risk factor for Vitamin D deficiency. This is in line with the findings of a study conducted in Qatar, which reported a high prevalence of Vitamin D deficiency among breastfeeding mother-infant dyads, with low socioeconomic status being a significant risk factor [15]. A study conducted in Colombia also found that Vitamin D deficiency was positively related to indicators of higher socioeconomic status [16]. In conclusion, our study highlights the high prevalence of Vitamin D deficiency among children attending a pediatric consultation center in Bangladesh, with poor dietary habits, limited sun exposure, an indoor lifestyle, and low socioeconomic status being significant contributing factors. These findings underscore the need for public health interventions to improve the Vitamin D status of children in this population, including promoting the consumption of Vitamin D-rich foods, encouraging outdoor activities, and providing Vitamin D supplements.

Limitations of the Study

The study was conducted in a single center with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study highlights a significant prevalence of Vitamin D deficiency among children attending a pediatric consultation center in Bangladesh. Factors such as poor dietary habits, limited sun exposure, indoor lifestyle, and low socioeconomic status contribute to this deficiency. The findings underscore the urgent need for public health interventions, including promoting Vitamin D-rich diets, encouraging outdoor activities, and considering Vitamin D supplementation. Regular monitoring of Vitamin D levels, particularly in children from low socioeconomic backgrounds, is crucial. The study emphasizes the need for a comprehensive approach to address this public

health issue, involving both medical interventions and broader lifestyle modifications.

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REFERENCES

1. Jain, A., Chaurasia, R., Sengar, N. S., Singh, M., Mahor, S., & Narain, S. (2020). Analysis of vitamin D level among asymptomatic and critically ill COVID-19 patients and its correlation with inflammatory markers. *Scientific reports*, *10*(1), 20191.
2. Mariani, J., Giménez, V. M. M., Bergam, I., Tajer, C., Antonietti, L., Inserra, F., ... & Manucha, W. (2021). Association between vitamin D deficiency and COVID-19 incidence, complications, and mortality in 46 countries: an ecological study. *Health security*, *19*(3), 302-308.
3. Holick, M.F. Vitamin D deficiency. N Engl J Med. 2007 Jul 19;357(3):266–81.
4. Melamed, M. L., & Kumar, J. (2010). Low levels of 25-hydroxyvitamin D in the pediatric populations: prevalence and clinical outcomes. *Pediatric health*, *4*(1), 89-97.
5. Satirapoj, B., Limwannata, P., Chaiprasert, A., Supasyndh, O., & Choovichian, P. (2013). Vitamin D insufficiency and deficiency with stages of chronic kidney disease in an Asian population. *BMC nephrology*, *14*(1), 1-5.
6. Laird E, Ward M, McSorley E, Strain JJ, Wallace J. Vitamin D and Bone Health; Potential Mechanisms. Nutrients [Internet]. 2010 Jul 5 [cited 2023 Jul 11];2(7):693–724. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3257679/
7. Thacher, T. D., & Clarke, B. L. (2011, January). Vitamin D insufficiency. In *Mayo Clinic Proceedings* (Vol. 86, No. 1, pp. 50-60). Elsevier.
8. Holick, M. F. (2004). Sunlight and vitamin D for bone health and prevention of autoimmune diseases, cancers, and cardiovascular disease. *The American journal of clinical nutrition*, *80*(6), 1678S-1688S.
9. Holick, M., & Chen, T. (2008). Deficiencia de vitamina D: un problema mundial con consecuencias para la salud. *La revista estadounidense de nutrición clínica*, *87*(4), 1080-1086.
10. Cashman, K. D. (2020). Vitamin D deficiency: defining, prevalence, causes, and strategies of addressing. *Calcified tissue international*, *106*(1), 14-29.
11. Saki, F., Dabbaghmanesh, M. H., Omrani, G. R., & Bakhshayeshkaram, M. (2017). Vitamin D deficiency and its associated risk factors in children and adolescents in southern Iran. *Public health nutrition*, *20*(10), 1851-1856.
12. Al-Saleh, Y., Al-Daghri, N. M., Khan, N., Alfawaz, H., Al-Othman, A. M., Alokail, M. S., & Chrousos, G. P. (2015). Vitamin D status in Saudi school children based on knowledge. *BMC pediatrics*, *15*(1), 1-6.
13. Hu, Y., Chen, J., Wang, R., Li, M., Yun, C., Li, W., ... & Yang, L. (2017). Vitamin D nutritional status and its related factors for Chinese children and adolescents in 2010–2012. *Nutrients*, *9*(9), 1024.
14. Al-Faris, N. A. (2016). High prevalence of vitamin D deficiency among pregnant Saudi women. *Nutrients*, *8*(2), 77.
15. Salameh, K., Al-Janahi, N. S. A., Reedy, A. M., & Dawodu, A. (2016). Prevalence and risk factors for low vitamin D status among breastfeeding mother–infant dyads in an environment with abundant sunshine. *International Journal of Women's Health*, 529-535.
16. Beer, R. J., Herrán, O. F., & Villamor, E. (2020). Prevalence and correlates of vitamin D deficiency in a tropical setting: results from a nationally representative survey. *The American Journal of Clinical Nutrition*, *112*(4), 1088-1098.