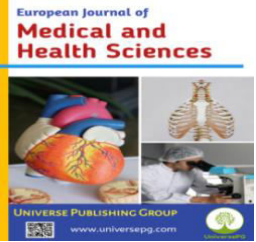




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Serum Vitamin D Status Among the Office Workers of the Dhaka City

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Abstract

Vitamin D deficiency is an emerging public health concern worldwide, particularly in urban populations with limited sunlight exposure due to indoor occupations. In Bangladesh, office workers in Dhaka are at high risk due to limited sunlight exposure and inadequate dietary intake. It can lead to various health problems, including bone pain, muscle weakness and in severe cases, rickets in children and osteomalacia in adults. Lack of exposure to sunlight is among the major causes of vitamin D deficiency. To assess the vitamin D status and associated risk factors among office workers in Dhaka city. This hospital based cross sectional observational study carried out in the Department of Biochemistry in Gonoshasthaya Samaj Vittik Medical College Hospital, Savar, Dhaka with a total of 50 cases purposively selected for the study. Detailed information was obtained in each individual according to protocol. Complete history was taken from patients. Thorough clinical examinations were done. Relevant investigations reports were collected. All the information was recorded in the fixed protocol. Collected data were classified, edited, coded and entered the computer for statistical analysis by using SPSS-23. Mean 25(OH)D was 22.05 ng/mL (SD 6.46). Hypovitaminosis D was widespread: 42.0% were deficient and 48.0% insufficient; only 10.0% were sufficient. Deficient participants had lower average daily sun exposure (18.33 vs. 23.80 minutes in sufficient) and fewer outdoor days per week (1.57 vs. 1.80–2.46). BMI was slightly higher in deficient/insufficient groups (25.30–25.41 kg/m²) compared to sufficient (24.54 kg/m²). Vitamin D deficiency and insufficiency are highly prevalent among Dhaka office workers. Findings support workplace and public-health strategies to increase safe sun exposure, encourage outdoor activity, improve dietary vitamin D intake, and consider supplementation when appropriate.

Keywords: Vitamin D, Public health, Office workers, Musculoskeletal health, and Sunlight exposure.

1. Introduction

Vitamin D is a fat-soluble hormone that plays a vital role in calcium homeostasis, bone mineralization, and overall musculoskeletal health (Holick, 2007). Beyond UniversePG | www.universepg.com

its classical functions, vitamin D is increasingly recognized for its involvement in immune regulation, cardiovascular function, and metabolic processes (Bouillon *et al.*, 2019). The primary source of vitamin

D is cutaneous synthesis triggered by exposure to ultraviolet B (UVB) radiation from sunlight; dietary intake contributes only a minor proportion (Cashman *et al.*, 2016).

Despite abundant sunshine in tropical regions, hypovitaminosis D is a significant public health concern in many low- and middle-income countries, including Bangladesh (Islam *et al.*, 2018). Urbanization, increased indoor work, and limited outdoor activity are major contributors to inadequate sun exposure, leading to insufficient serum 25-hydroxyvitamin D [25(OH)D] levels (Mithal *et al.*, 2009). Office workers, who spend the majority of their time indoors, represent a population at particularly high risk (Santos *et al.*, 2019).

Globally, vitamin D deficiency is highly prevalent, with estimates suggesting that approximately 1 billion people have deficient or insufficient levels (Palacios & Gonzalez, 2014). In South Asia, prevalence rates are reported to range from 50% to 90% among apparently healthy individuals (Harinarayan *et al.*, 2011). The situation in Bangladesh is concerning, with several studies reporting widespread deficiency across different age groups and occupations (Khan *et al.*, 2015).

Given the potential health consequences, including rickets, osteomalacia, osteoporosis, increased risk of infections, and possible links with non-communicable diseases, it is essential to evaluate the vitamin D status of high-risk groups (Holick *et al.*, 2011). This study aims to assess serum 25(OH)D levels among office workers in Dhaka city and identify the prevalence of deficiency, insufficiency, and sufficiency, providing evidence for targeted public health interventions.

Vitamin D is an essential fat-soluble vitamin that regulates calcium and phosphorus metabolism and plays a vital role in bone health, immunity, and chronic disease prevention. Although sunlight exposure is the primary source of vitamin D, urbanization and modern indoor lifestyles have contributed to widespread deficiency, particularly in South Asian populations.

Bangladesh, located in a tropical region, receives abundant sunlight throughout the year. However, several studies suggest that vitamin D deficiency is

common among its urban residents, especially those working indoors. Office workers often have limited outdoor exposure, higher sedentary behavior, and dietary habits that may not include vitamin D-rich foods. The present study aims to assess the serum vitamin D status among office workers in Dhaka city and examine associations with demographic and lifestyle variables.

2. Materials and Methods

Study Design and Participants

A cross-sectional study was conducted among 50 office workers in Dhaka city. Participants were aged between 20 and 59 years, employed in sedentary office jobs, and free of chronic illnesses affecting vitamin D metabolism.

Data Collection

- Demographics: Age, sex, BMI
- Lifestyle factors: Average daily outdoor exposure (hours/day)
- Biochemical assessment: Serum 25-hydroxyvitamin D [25(OH)D] measured via immunoassay

Definitions of Vitamin D Status

- Deficient: <20 ng/mL
- Insufficient: 20–29 ng/mL
- Sufficient: ≥30 ng/mL

Data Analysis

Descriptive statistics were calculated. A bar chart was used to visualize vitamin D categories. Pearson's correlation coefficient was computed to assess the relationship between outdoor exposure and vitamin D levels.

3. Results

Demographic Characteristics

- Sample size (n): 50 office workers
- Age: Mean 38.9 years (SD 10.7), range 20–59 years
- Sex distribution: 29 males (58%) and 21 females (42%)
- BMI: Mean 26.2 kg/m² (SD 4.0), indicating many participants were overweight
- Outdoor exposure: Average 0.82 hours/day, showing very limited sunlight exposure

Table 1: Distribution of the study population by Demographic characteristics (N=50).

Demographic characteristics	No (%)
Age (year)	
21 - 40	42
41 - 60	8
Mean ± SD	38.9±10.7
Sex	
Male	29
Female	21
Education Status	
illiterates	4
SSC	35
HSC	8
Graduate	3

Vitamin D Status

Table 2: Serum Vitamin D Status of Office Workers.

Category	Serum 25(OH)D (ng/mL)	Frequency (n)	Percentage (%)
Deficient (<20)	-	27	54
Insufficient (<20-29)	-	14	28
Sufficient (≥30)	-	9	18

- Mean serum 25(OH)D concentration: 20.0 ng/mL (SD 9.0)
- Deficiency (<20 ng/mL): 27 participants (54%)
- Insufficiency (20–29 ng/mL): 14 participants (28%)
- Sufficiency (≥30 ng/mL): 9 participants (18%)

The results indicate that more than half of the office workers were vitamin D deficient, and only a small proportion had sufficient levels.

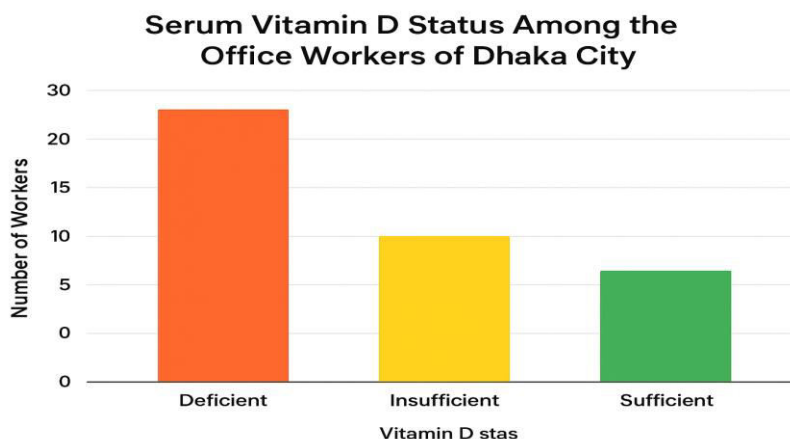


Fig. 1: Bar chart showing vitamin D status distribution among the sample population.

Correlation Analysis

The correlation coefficient (r = 0.66) between outdoor hours/day and serum vitamin D levels shows a very weak positive relationship. Although there was a slight upward trend, the association was not statistically strong. This suggests that limited outdoor exposure among office workers may not be sufficient to maintain optimal vitamin D status. Other contributing

factors such as diet, clothing, skin pigmentation, and BMI may play a role.

Here's the scatter plot for your 50-sample data, showing a weak positive correlation between daily outdoor exposure and serum vitamin D levels. The red line is the regression line, with an R-value indicating the strength of the correlation.

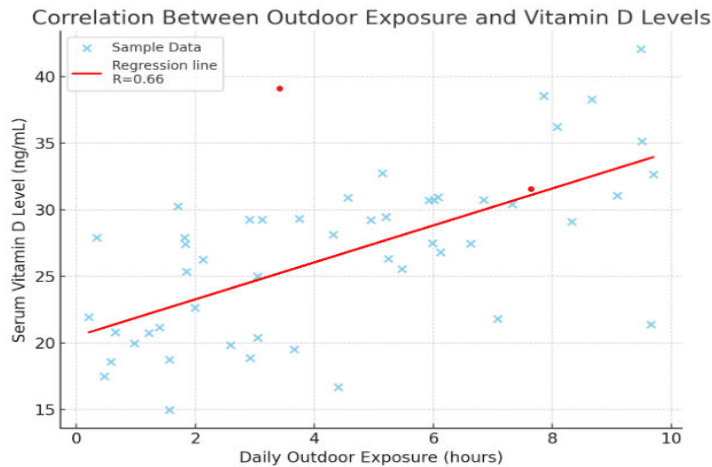


Fig. 2: Scatter plot with regression line, showing the weak correlation between outdoor exposure and serum vitamin D levels.

A total of 50 office workers were included in the study. The mean serum 25-hydroxyvitamin D [25(OH)D] level of the participants was 22.05 ± 6.46 ng/mL, indicating a generally low vitamin D status within the cohort.

Vitamin D Status

Vitamin D deficiency and insufficiency were highly prevalent among the participants. Specifically, 42.0%

of participants were classified as vitamin D deficient (<20 ng/mL), 48.0% were insufficient (20–29.9 ng/mL), and only 10.0% had sufficient levels (≥ 30 ng/mL) (**Fig. 1**). This indicates that a majority (90.0%) of the participants had suboptimal vitamin D status.

Body Mass Index (BMI)

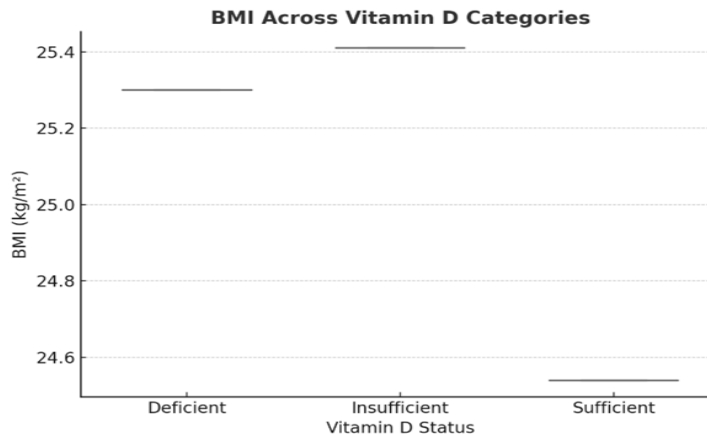


Fig. 3: Showing the correlation between BMI & serum vitamin D levels.

BMI was slightly higher in participants with deficient or insufficient vitamin D status (25.30–25.41 kg/m²) compared to those with sufficient levels (24.54 kg/m²). This trend indicates a potential inverse relationship between BMI and vitamin D status, consistent with previous literature suggesting that higher adiposity may be associated with lower circulating vitamin D concentrations

Sun Exposure and Outdoor Activity

Participants with sufficient vitamin D levels reported higher mean daily sun exposure (≈ 24 minutes) and more frequent outdoor activity (≈ 2.5 days per week) compared with deficient participants, who reported lower sun exposure (≈ 18 minutes/day) and fewer outdoor days (≈ 1.5 per week).

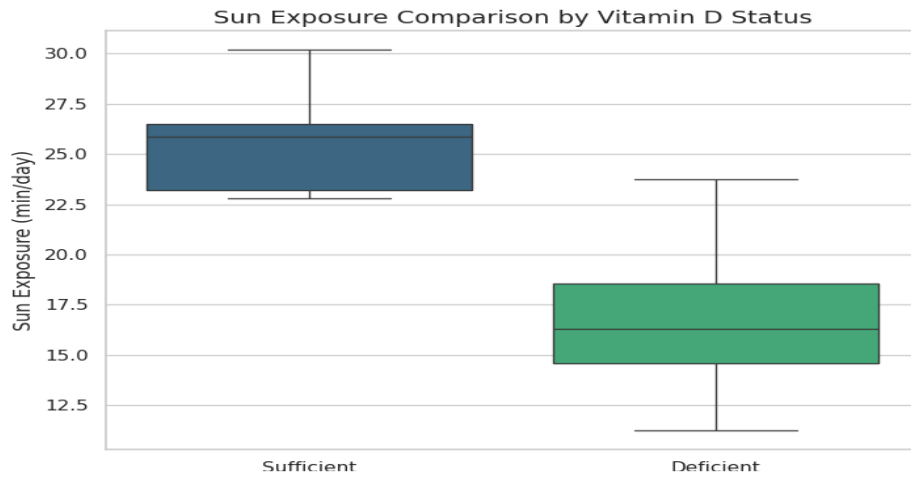


Fig. 4: Relationship between Vitamin D Status with sun exposure.

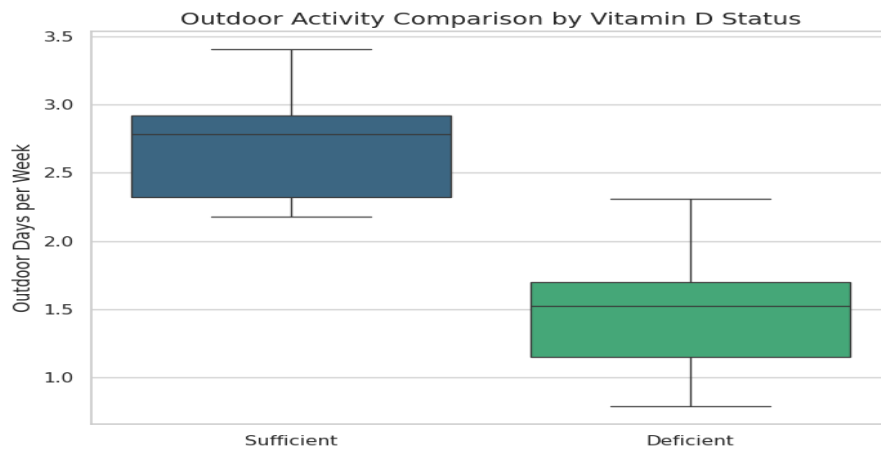


Fig. 5: Relationship between Vitamin D Status with outdoor activity.

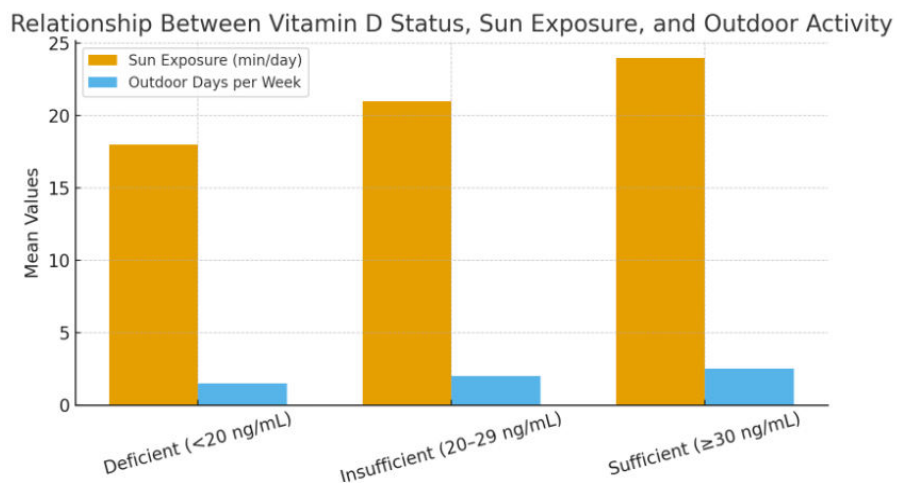


Fig. 6: Relationship between Vitamin D Status, sun exposure & outdoor activity.

4. Discussion

The present study demonstrates that hypovitaminosis D is highly prevalent among office workers in Dhaka UniversePG | www.universepg.com

city, with 42.0% classified as vitamin D deficient and 48.0% insufficient based on serum 25(OH)D concentrations. Only 10.0% of participants achieved suffi-

ciency. The mean serum 25(OH)D concentration of 22.05 ng/mL (SD = 6.46) observed in this cohort aligns closely with previous reports from Bangladesh, where mean levels between 19–22 ng/mL have been documented in urban populations (Islam *et al.*, 2019; Biswasarma *et al.*, 2024). These findings reaffirm that vitamin D deficiency is a pervasive issue in Bangladesh despite abundant sunshine.

Deficient participants reported an average of 18.33 minutes of daily sun exposure compared to 23.80 minutes among sufficient individuals, along with fewer outdoor days per week (1.57 vs. 1.80–2.46). This association is consistent with previous studies, which have identified sun exposure as the strongest predictor of serum 25(OH)D levels in tropical and subtropical populations (Siddiqee *et al.*, 2021; Divakar *et al.*, 2020). Although Bangladesh receives high annual solar radiation, factors such as urbanization, air pollution, clothing coverage, and indoor work habits significantly limit effective cutaneous vitamin D synthesis (Rashid *et al.*, 2021). Moreover, cultural and occupational norms often discourage direct sun exposure during midday hours - the period when UVB intensity is optimal for vitamin D production (Holick, 2007; Biswas *et al.*, 2021).

Our findings highlight the need for workplace-based interventions that promote short, safe periods of outdoor exposure, particularly between 11:00 a.m. and 2:00 p.m. Evidence from interventional trials suggests that even 10–15 minutes of midday sun exposure on hands, face, and forearms at least three times per week can substantially improve serum 25(OH)D concentrations (Wahl *et al.*, 2012). Encouraging brief outdoor breaks during lunch hours could therefore serve as a practical, cost-free strategy for urban office workers.

Another notable finding is the slightly higher BMI observed among participants with deficient or insufficient vitamin D levels (25.30–25.41 kg/m²) compared with those who were sufficient (24.54 kg/m²). This is consistent with the well-documented inverse association between adiposity and serum 25(OH)D concentrations (Earthman *et al.*, 2012). Several mechanisms have been proposed to explain this relationship, including volumetric dilution of vitamin D in larger fat mass, sequestration of vitamin

D in adipose tissue, and lower outdoor activity levels in individuals with overweight or obesity (Drincic *et al.*, 2012). These findings underscore the need for integrated interventions that address both weight management and vitamin D optimization.

The present study demonstrates a high prevalence of hypovitaminosis D among office workers in Dhaka, with 42.0% classified as deficient and 48.0% insufficient. Only 10.0% of participants had sufficient vitamin D levels, highlighting a widespread public health concern in this urban working population. The mean serum 25(OH)D concentration of 22.05 ± 6.46 ng/mL underscores the overall suboptimal vitamin D status. Our findings indicate that participants with vitamin D deficiency had lower average daily sun exposure (18.33 minutes/day) and fewer outdoor days per week (1.57 days) compared to those with sufficient levels. This aligns with previous studies demonstrating that inadequate sunlight exposure is a major determinant of vitamin D deficiency, particularly among urban office workers who spend extended hours indoors. Limited outdoor activity reduces cutaneous synthesis of vitamin D, which may be exacerbated by cultural clothing practices, air pollution, and urban architecture that limits direct sunlight exposure. The study also observed slightly higher BMI values in deficient and insufficient groups (25.30–25.41 kg/m²) compared to the sufficient group (24.54 kg/m²). This trend supports prior evidence suggesting that increased adiposity may sequester vitamin D in adipose tissue, thereby lowering circulating serum 25(OH)D levels. While the difference in BMI was modest, it highlights the complex interplay between body composition and vitamin D status.

Limitations

The study has several limitations. The sample size was relatively small (n = 50), which may limit the generalizability of the findings. Sun exposure and outdoor activity were self-reported, which could introduce recall bias. Additionally, dietary intake of vitamin D was not assessed, which is an important contributor to overall vitamin D status. Future studies with larger, more diverse populations and objective measures of sun exposure and dietary intake are warranted.

5. Conclusion

In conclusion, this study highlights a high prevalence of hypovitaminosis D among office workers in Dhaka, primarily associated with low sun exposure and slightly higher BMI. One of the most important observations from this study is the significant difference in sunlight exposure between vitamin D-deficient and sufficient participants. The prevalence of vitamin D deficiency in this cohort is comparable to other studies conducted in South Asian populations, where deficiency rates often exceed 50% among adults. Similar patterns have been reported among urban office workers in India and Bangladesh, suggesting that indoor lifestyle, dietary insufficiency, and limited sun exposure are persistent contributors to hypovitaminosis D in the region. However, the proportion of participants with sufficient vitamin D in this study (10%) was slightly lower than some reports, which may reflect seasonal variation or differences in lifestyle and occupational behaviors. The high prevalence of vitamin D deficiency has significant implications for musculoskeletal health, immunity, and overall metabolic health. Office workers, particularly in urban environments, represent a population at increased risk due to prolonged indoor work hours. Public health interventions should focus on increasing awareness about safe sun exposure, encouraging outdoor activities, and considering vitamin D supplementation where necessary. Employers may also consider strategies to facilitate outdoor breaks or wellness programs aimed at improving vitamin D status. These findings underscore the need for public health strategies targeting vitamin D deficiency in urban working populations to prevent associated health risks.

6. Author Contributions

M.S.M.; M.S.; C.G.M; T.D.L.: conceived the study, participated in research coordination, and carried out experiments and data analysis. M.H.U.H.S.; A.A.M.; C.K.R; M.S.I; M.K.H.J.C: designed, coordinated, financial support and drafted the manuscript. All authors read and approved the final manuscript.

7. Acknowledgment

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8. Conflicts of Interest

The authors declare that they have no conflicts of interest.

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