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Prevalence of Vitamin D Deficiency and Associated Musculoskeletal Disorders among Information Technology Sector Employees in Kolkata: A Retrospective Cross-sectional Study

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Abstract

Vitamin D deficiency is a growing public health concern, particularly in urban populations with limited sun exposure. This study aims to investigate the prevalence of vitamin D deficiency and its associated conditions, such as osteopenia and osteoporosis, among information technology (IT) sector employees in Kolkata, India. A retrospective cross-sectional survey was conducted among 200 randomly selected corporate employees, with 170 (85%) reporting vitamin D deficiency. The participants were divided into two age groups: 18–35 years and ≥50 years. Data on lifestyle factors, including smoking, sunlight exposure, exercise habits, dietary intake, vitamin supplementation, and medication use, were collected through a screening questionnaire. The survey was conducted via both online and offline platforms, and results were analysed and interpreted accordingly. Among the 170 affected individuals, 125 were male and 45 were female. In the younger age group (18–35 years), 15 participants were found to be osteopenic, while 25 were osteoporotic based on clinical symptoms and questionnaire responses. Vitamin D deficiency-related diseases, such as bone pain, joint pain, and osteoporosis, were prevalent among participants, particularly those with reduced sun exposure due to office-based occupations. The study highlights the high prevalence of vitamin D deficiency and related musculoskeletal disorders among IT sector employees in Kolkata. Occupations with minimal sunlight exposure, such as in the IT industry, may significantly contribute to the increased incidence of vitamin D deficiency, emphasizing the need for targeted interventions, including lifestyle modifications and supplementation, to mitigate associated health risks.

KEYWORDS : Vitamin D; IT Sector people; Sunlight exposure

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Introduction

Vitamin D deficiency has emerged as a significant public health concern worldwide, particularly in urban populations where modern lifestyles and occupational environments often limit exposure to natural sunlight **(Shahudin et al., 2020).** Vitamin D plays a crucial role in maintaining bone health, regulating calcium and phosphate metabolism, and supporting immune function. Deficiency in this essential nutrient is associated with a range of musculoskeletal disorders, including osteopenia, osteoporosis, and increased risk of fractures**.** Low vitamin D levels have been linked to broader health issues such as cardiovascular diseases, diabetes, and autoimmune disorders. **(Pludowski et al., 2013)**

Despite India's geographical advantage in terms of abundant sunlight, recent studies indicate a high prevalence of vitamin D deficiency across various demographic groups, especially in urban areas **(Augustine et al., 2021).** Sedentary lifestyles, inadequate sun exposure due to prolonged indoor activities, and the use of sun-blocking measures contribute to this growing problem **(Joh et al., 2015).** Urban professionals, particularly those in the Information Technology (IT) sector, are at an increased risk due to the nature of their work, which involves long hours indoors and limited time for outdoor activities **(Al Horr et al., 2016).**

This study seeks to investigate the prevalence of vitamin D deficiency and its related health conditions, such as osteopenia and osteoporosis, among corporate employees in the IT sector in Kolkata, India. By focusing on this specific occupational group, the study aims to highlight the impact of office-based occupations on vitamin D levels and associated health risks. Furthermore, this research aims to explore the potential role of lifestyle factors such as smoking, exercise habits, dietary intake, and the use of supplements—that may influence the vitamin D status of these individuals.

Given the rising incidence of vitamin D deficiency-related disorders in urban populations, it is critical to assess the underlying causes within vulnerable occupational groups. The findings of this study are expected to contribute valuable insights into the need for targeted public health interventions, including awareness campaigns, dietary recommendations, and lifestyle modifications, to combat vitamin D deficiency and its associated health consequences.

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Methodology

This study was conducted at Occupational IT Sector, Kolkata from March 2023 to June, 2023. Two hundred employees were surveyed. History of exposure to sunlight, exercise, dietary habits, medication etc. were obtained through a Screening Questionnaire'. After this screening a treatment was advised including counselling for dietary modifications, increased sun exposure, etc.

Background

This study investigated the relationship between sun exposure, diet, exercise related muscle soreness using cross-sectional design.

Participants

A retrospective cross-sectional survey was conducted among employees of multiple IT firms in Kolkata, India. Participants were selected by random sampling at work place. Using random cluster sample (both men and women) in the age group of 20-50 years in IT sector companies of Kolkata like TATA, IBM, Wipro.

Data Acquisition

Subjective information was obtained via interview, using the questionnaire formats for diet/activity analysis, sunlight exposure and muscle soreness. There were no risk or discomforts associated with the completion of those questionnaire forms. As this study is cross-sectional, it did not require re-analysis or additional questionnaire of participants and no personally identifying information (phone, address, name etc.) was obtained. Each individual who agreed to participate in the study signed an informed consent prior to data collection. Participants invested approximately 20-30 minutes to complete the study. To identify eligible participants, a Google form questionnaire was circulated asking for the name, age, sex, bone related problems, and type of food consumed (vegetarian or non-vegetarian) by the respondent. Male and female employees working in the corporate sector and identified as vegetarians were included.

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Results

Table 1. Sample size and its categories

	GENDER		
Age group	Male	Female	Grand Total
18-35 years	67	37	104
>= 50 years	58	38	96
Grand total	125	75	200

Table 2. Number of subjects with insufficiency 1, 25 $(OH)_2$ Vitamin D

Number of subjects	**Normal N (%)**	**Osteopenia N (%)**	**Osteoporosis N (%)**
65	25	15	25
45	0	20	25

Table 2 shows that 21% of the younger age group (18-35 yrs) and 30% of the older age group (>=50 yrs) were osteopenic among all subjects and 14% of the younger age group and 25% of older age group were osteoporotic among all subjects.

Table 3. Percentage of subjects with insufficiency 1, 25 $(OH)_2$ Vitamin D with number and percentage

Number of subjects	**Osteopenia N (%)**	**Osteoporosis N (%)**
40 (18-35 yrs)	15 (8.82%)	25 (14.70%)
130 (>= 50 yrs)	90 (52.94%)	40 (23.52%)

Table 3 shows the levels of Bone mineral density among the subjects with 25 (OH) D insufficiency. It was found that 15 and 25 subjects were osteopenic and osteoporotic, respectively, in the younger age group (18-35 yrs). But all the subjects in the older age group were having low bone mass where 20 and 25 subjects were having osteopenia and osteoporosis, respectively.

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Table 4. Overall awareness about vitamin-D on human health and risk factors for vitamin-D deficiency

No. of subjects	Aware	Unaware
125 (Male)	43	82
45 (Female)	12	33

Discussion

Our study highlights a significant correlation between occupational environments, lifestyle habits, and vitamin D deficiency, particularly among individuals with limited sun exposure due to office work, control room shifts, and night shifts. Despite India's geographical positioning in tropical and subtropical latitudes, which affords ample sunlight, vitamin D deficiency remains prevalent, especially in urban office settings **(Aparna et al., 2018).** The findings of this study reflects a paradox, wherein individuals in regions with abundant sunlight, such as North and South India, still suffer from hypovitaminosis D, suggesting that lifestyle factors overshadow geographical advantages.

In particular, office workers, especially those in IT sectors, spend prolonged hours indoors, typically in environments with limited or no direct exposure to sunlight. Closed windows in office settings, which filter out UV-B radiation, and insufficient time spent outdoors during peak sunlight hours, emerge as key contributors to low vitamin D levels. While the intake of vitamin D-rich foods was similar across various job categories in our study, the limited effectiveness of dietary intake alone, without adequate sun exposure, is evident. This is consistent with prior studies showing that natural sunlight exposure is crucial for endogenous vitamin D synthesis, with dietary supplementation playing a secondary role in maintaining adequate vitamin D levels **(Ramasamy, 2020).**

Our results also highlight the vulnerability of control room workers, who not only experience reduced sunlight exposure due to night shifts but also work in environments that necessitate minimal lighting for better visualization of screens. These individuals were more likely to rely on vitamin D or calcium supplementation compared to their

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office and workshop counterparts, yet they remain at a higher risk for deficiency. This finding aligns with previous research suggesting that night shift workers, due to altered circadian rhythms and reduced exposure to natural sunlight, are particularly susceptible to vitamin D deficiency **(de Menezes-Júnior et al., 2023).** Given that vitamin D synthesis is directly dependent on UV-B exposure, workers whose sleep patterns and waking hours do not align with peak sunlight times face an inherent risk of hypovitaminosis D.

The correlation between reduced sunlight exposure and vitamin D deficiency has been well-documented in various populations across India. For instance, studies from North India (27°N latitude) have shown that despite ample sunlight, 96% of neonates and over 80% of healthy adults and pregnant women are vitamin D deficient **(G et al., 2014).** Similarly, in South India (13°N latitude), where tropical sunlight is readily available, hypovitaminosis D is equally prevalent, reflecting the significant impact of modern indoor lifestyles **(Aparna et al., 2018).** These findings suggest that latitude alone does not predict vitamin D sufficiency; rather, lifestyle and occupational factors are more critical determinants of vitamin D status.

Moreover, seasonal variations in vitamin D levels further reinforce the importance of sun exposure. Our study found that individuals with low sunlight exposure in the winter had significantly lower serum 25(OH)2 D concentrations compared to their summer levels **(Divakar et a., 2019).** This seasonal fluctuation points to the dependency of vitamin D synthesis on UV-B availability, as has been observed in other studies across different regions of India. Therefore, occupational and lifestyle adjustments that promote safe sun exposure during peak UV-B hours, alongside the use of supplements in high-risk populations, could mitigate the widespread vitamin D deficiency seen even in sunny regions.

In addition to the well-known skeletal consequences of vitamin D deficiency, emerging research emphasizes the broader health implications, including the potential roles of vitamin D in reducing the risks of autoimmune diseases such as multiple sclerosis, type 1 diabetes mellitus, and certain cancers **(Antico et al., 2012).** Maternal vitamin D levels are also critical for fetal development, particularly for bone and dental health, indicating that deficiency during pregnancy poses long-term health risks for offspring **(von Websky et al., 2018).** This broadens the scope of our findings, as addressing vitamin D deficiency in high-risk occupations such as night-shift workers and those with minimal sunlight exposure could also serve as a preventive measure for more serious, non-skeletal conditions.

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Conclusion

In conclusion, while dietary interventions and supplementation are important, they are insufficient to counterbalance the lack of sunlight exposure in many occupational settings. Efforts to raise awareness about the importance of UV-B exposure for vitamin D synthesis, coupled with targeted public health strategies to address the lifestyle factors contributing to vitamin D deficiency, are crucial. As India continues to urbanize, the growing prevalence of indoor work environments and night-shift occupations may exacerbate the already significant burden of hypovitaminosis D, further justifying the need for comprehensive vitamin D management strategies across different population group

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