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VITAMIN D DEFICIENCY IS AN UNNOTICED EPIDEMIC IN INDIA

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ABSTRACT

The prevalence of vitamin D insufficiency is a significant health problem that has wide-ranging consequences for several chronic disorders. The findings of our extensive examination demonstrate a notable correlation between insufficiency of Vitamin D and a range of ailments, encompassing osteoporosis, osteomalacia, rickets, autoimmune disorders, cardiovascular illnesses (CVD), diabetes, infections, and malignancies. It is worth mentioning that some patient populations, such as those seeking treatment for ear, nose, and throat conditions and individuals attending outpatient clinics to meet with experts, have significantly elevated prevalence rates of Vitamin D insufficiency. This underscores the imperative for implementing comprehensive screening measures and targeted interventions. Studies undertaken in India have highlighted the heterogeneity of Vitamin D insufficiency across different regions. Specifically, Kerala, a coastal state, has been shown to have a relatively low prevalence rate of Vitamin D deficiency among youngsters, standing at 11.1%. The observed regional variance may be associated with dietary patterns, namely fish intake, and geographical considerations, such as latitude. Moreover, certain demographic groups that are particularly susceptible to Vitamin D insufficiency encompass children, pregnant women, breastfeeding moms, and those from working-class backgrounds. It is worth noting that kidney transplant recipients are also identified as a distinct population with notable deficiencies. The occurrence of Vitamin D insufficiency varies significantly, with rates ranging from 11.1% to as high as 96.51% among different age groups and genders. The results above emphasize the critical need to address Vitamin D insufficiency through focused healthcare methods and public health interventions, particularly among those at a heightened risk. Enhanced comprehension of the geographical

disparities in prevalence might provide valuable insights for developing customized strategies to address this pervasive health issue.

KEYWORDS: Vitamin D deficiency, complications of vitamin D deficiency, Indian data.

INTRODUCTION

Vitamin D is commonly referred to as calciferol in academic literature. Vitamin D is an essential fat-soluble micronutrient in several physiological processes inside the human body.[7] Vitamin D insufficiency is frequent in the Indian subcontinent, affecting a significant proportion of the general population, ranging from 70% to 100%. Dairy products are frequently used as a source of vitamin D due to their fortification with this essential nutrient.[10] The health of the skeletal muscle depends on vitamins. When exposed to sunlight long enough, the skin can synthesize the vitamin from cholesterol using the UV spectrum.[12] Prominent dietary sources of vitamin D include egg yolk, fatty fish, beef liver, and dairy products fortified with this essential nutrient.[8] WHO / Food and Agriculture Organisation claims that areas between the latitudes of 42^{o}N and 42^{o}S receive a lot of sunshine, which causes the skin to produce vitamin D endogenously.[6]

Vitamin D has a crucial role in the absorption of calcium, bone mineralization, and the regulation of phosphate and magnesium metabolism.[4] The nuclear Vitamin D receptor (VDR) facilitates an increase in calcium influx in the distal tubules of the kidney through the active form of Vitamin D.[7] The human body acquires enough vitamin D levels by dietary intake or exposure to sunshine. Maintaining optimal blood calcium and phosphate levels is essential for the proper mineralization of bone, as well as for facilitating muscular contraction, nerve transmission, and overall cellular function in all bodily cells. Furthermore, it is crucial for the regulation of immunological function, the management of inflammation, as well as the facilitation of cell proliferation and differentiation.[7] The importance of vitamin D extends beyond its impact on bone health, including other facets of an individual's general well-being. These include its influence on glycemic management, immune function, cardiovascular health, neuromuscular function, pregnancy, and different dimensions of health.[8] Vitamin D exerts a significant impact on several physiological processes beyond the realm of bone and muscle health. Vitamin D has a crucial role in the skeletal growth of the baby and the maintenance of calcium balance during pregnancy.[9]

Vitamin-D2 / ergocalciferol is obtained from the influence of ultraviolet B radiation on plants in yeast and an active metabolite of 25-hydroxy vitamin D2 [calcidiol].[4]

Vitamin D3/ cholecalciferol is synthesized in the skin through ultraviolet radiation (UVR) exposure. It serves as an active metabolite of 1,25-dihydroxy vitamin D3, commonly referred to as calcitriol. It modulates the immunological response of T-cell receptors by suppressing the pro-inhibitory activities of Th1 and Th17 cells.[4] Calciferols are a class of lipophilic molecules characterized by a cholesterol backbone consisting of four rings. This term encompasses both cholecalciferol, commonly known as Vitamin D3, and ergocalciferol, often known as Vitamin D2. In a generic context, "Vitamin D" usually denotes Vitamin D3. Endogenous synthesis of vitamin D is possible. Approximately 90% of the necessary Vitamin D is produced in the epidermis through cutaneous synthesis, which occurs upon exposure to sunlight.[7] The administration of Vitamin D3 has been found to have a notable impact in mitigating oxidative stress within the cardiovascular system. The presence of venous distal disease (VDD) during pregnancy carries significant health consequences for women in the prenatal period, including an elevated risk of pre-eclampsia, gestational diabetes mellitus, and diabetes mellitus.[9]

The most popular D3 supplement, which comes in oil-based capsules or powder form (Sachets)[9] has 60,000 IU.[10] The optimal strategy for mass supplementation is the fortification of food with Vitamin D. Fortification can be applied to all grades of milk.[7] Vitamin D can be added to oil and milk products, including curd, yogurt, infant formula, and butter, to enhance their nutritional content. Food products that are often consumed, such as atta, maida, and rice flour, have the potential to be fortified as well. Consuming food that is high in vitamin D and taking vitamin D supplements, as well as engaging in outdoor activities to enhance sun exposure, can contribute to the intake of vitamin D.[8] It is improbable that dietary sources alone provide adequate nutrients, particularly for individuals following a vegetarian diet. The nutrient is only found in substantial quantities in a limited number of non-vegetarian foods that are commonly consumed, such as oily fish (e.g., herring, salmon, sardines, and mackerel), egg yolks, liver, as well as milk products and fortified foods.[9] Several studies have provided evidence suggesting that the regular intake of 1100IU over four years may reduce the incidence of several types of cancers.[6] A limited-scale experiment conducted in Australia has proven the safety of intramuscular administration of vitamin D. Due to the unavailability of high-dose oral preparations in the local area, the first therapy for

the first two patients involved administering injections. Following this, the individuals were administered lower dosages of oral maintenance medication. They had positive responses—the third patient presented during a period when there were more advanced oral formulations accessible. Despite experiencing malabsorption concerns, the patient responded favorably, albeit necessitating a higher dosage.[12]

Educational activities are crucial in raising awareness of Vitamin D insufficiency, the most commonly overlooked and inadequately addressed nutritional ailment. Both physicians and the general public should be informed about the ramifications of this matter. There is a growing recognition of the advantages of engaging in physical activity during pregnancy, particularly among women, to promote optimal fetal growth.[9]

Vitamin D insufficiency is prevalent among approximately one billion individuals worldwide, encompassing all age groups. In the Indian context, it has been observed that a significant proportion of children, ranging from 5% to 90%, have a deficiency in vitamin D. This deficiency is most prevalent among girls, with around 63% being affected. In comparison, boys exhibit a lower prevalence of 37%. The primary contributing factors to this deficiency are attributed to insufficient dietary calcium intake, along with the presence of dark skin pigmentation and inadequate exposure to sunshine. The complications encompass many health conditions, such as rickets in pediatric patients, osteomalacia and osteoporosis in adult individuals, tuberculosis, and cancer. These conditions have been recently described as neuromuscular, endocranial, cardiovascular, degenerative, and autoimmune disorders.[4] Additionally, there have been reports on the impact of these problems on bone homeostasis. The global prevalence of vitamin D insufficiency is widespread. The ramifications of this deficit, in addition to the widely recognized skeletal problems, are also being investigated. The well-established ramifications of a deficit in Vitamin D include the development of rickets in children and the manifestation of osteomalacia and osteoporosis in adults. In pediatric populations, an imbalance between calcium and phosphorous inside the bone leads to improper mineralization, hence causing the development of rickets and subsequent outward skeletal deformities. Insufficient bone mineralization resulting from a shortage of this nutrient has been associated with the development of osteopenia in adults and rickets in children.[14] The prevalence of vitamin D insufficiency is well-acknowledged as a global health issue. Vitamin D insufficiency is prevalent in tropical regions such as India despite abundant sunlight. The immediate attention of public health professionals is required to

address the diverse implications on public health resulting from vitamin D insufficiency. The importance of vitamin D extends beyond its impact on bone health, including other elements of an individual's general well-being. This includes its influence on glycemic management, immunity, cardiovascular diseases, neuromuscular function, pregnancy, and different facets of health.[8]

The socio-religious and cultural traditions of India need to effectively promote sufficient exposure to sunlight, hence diminishing the potential advantages of abundant sunshine. As a result, there is a high prevalence of subclinical vitamin D insufficiency observed in both urban and rural areas, spanning across many socioeconomic and geographic strata.[10] In conjunction with its recognized involvement in bone mineralization and muscle strength, vitamin D deficiency has been associated with an elevated susceptibility to various health conditions, including but not limited to high blood pressure, infectious diseases such as tuberculosis, certain cancers, multiple sclerosis, cardiovascular disease, type I diabetes, neurodevelopmental disorders, and several other ailments. Potential treatment options for neonates and babies involve the administration of vitamin D daily. Neonates may be prescribed a dosage range of 400-1000IU per day for 8-12 weeks, while infants may get a dosage range of 1000-5000IU per day for the same duration.[4]

LITERATURE REVIEW

A pandemic of vitamin D insufficiency is affecting the entire planet without being identified or addressed. Pediatrician's awareness of and ability to handle this epidemic will significantly impact children's health in the twenty-first century. Vitamin D reduces the risk of cancer, autoimmune, cardiovascular, and infectious disorders. The only way to detect subclinical, prerachitic vitamin D deficiency is to measure the serum 25(OH)D level. Vitamin D levels should be maintained at 20ng/ml to get the desired health benefits in children.[1]

The use of vitamin C as a preventive measure against recurrent upper respiratory tract infections (URTI) has been undertaken and has been employed for several decades. Ergocalciferol and cholecalciferol are infrequently used as vitamin supplements and are seldom utilized as immunomodulators. Cochlear deafness, Meniere's illness, and otosclerosis have been linked to a shortage in vitamin D. This includes cochlear otosclerosis, which is characterized by a pure tone audiogram with a trough-shaped pattern and a drop specifically at frequencies of 1 and 2 kHz. According to the findings of Taneja et al. (year), a significant proportion of patients (96.51%) out of a sample size of 81 were found to exhibit a deficiency

in Vitamin D. The potential benefits of empirically supplementing vitamin D in all patients with ear, nose, and throat (E.N.T) conditions are worth considering, particularly in cases when patients are unwilling to undergo vitamin D screening. This is especially relevant for those experiencing repeated episodes of acute otitis media or adenotonsillitis.

Vitamin D insufficiency is epidemically common across all age groups. A cross-sectional survey of undergraduate medical students was done. Most students are ignorant of the long-term effects of vitamin D deficiency, including cancer, diabetes mellitus, and cardiovascular problems. Students must know vitamin D supplementation's biological types, dosage, and duration for treating nutritional deficiencies. The need for more understanding could serve as a starting point for developing training modules for medical professionals that would aid in detecting, preventing, and treating vitamin D deficiency.[3]

Vitamin D is vital in newborn's nutrition and growth, particularly in poor socioeconomic levels. From January 2017 to December 2018, the Department of Pediatrics at the All-India Institute of Medical Sciences (AIIMS) surveyed the percentage of newborns lacking vitamin D in mothers and infants. Nearly half of Infants and mothers have vitamin D deficiency, with a prevalence of 85.5% and 74%, respectively, and having the most common biochemical symptoms of hyperphosphatemia and hypocalcemia. 74% of the infants have vitamin D deficiency, and the factors contributing to the deficit are socioeconomic backgrounds and maternal vitamin D deficiency.[4]

Cross-sectional research was undertaken in a rural hospital at the secondary level, specifically focusing on patients attending the outpatient department (OPD) for medication. The study involved the collection of patient information and blood samples to analyze Vitamin D levels. This analysis used electrochemiluminescence on a fully automated Cobas elects E411 system. After conducting a series of linear regression analyses, it was determined that the presence of diabetes and a dark skin tone were shown to be statistically significant factors in predicting vitamin D insufficiency, accounting for about 65.4% of the observed incidence of vitamin D deficiency among patients attending the medical outpatient department (OPD). Therefore, assessing the blood Vitamin D levels in individuals presenting with nonspecific symptoms may be advisable.[5]

Globally, vitamin D insufficiency is a severe health issue underdiagnosed and ignored. Sonam et al. reported that 64% of patients were vitamin D deficient, followed by 20% who

were insufficient (n = 71), 15% who had enough vitamin D, and the final 1% who were at risk for toxicity. More females (63%) than males (37%), on average, were deficient. The deficit was widespread (18%) in the age range of 23 to 33 years. Younger people in Sikkim have a significant prevalence of vitamin D insufficiency, which a sedentary lifestyle, little exposure to sunlight, and inadequate dietary consumption may bring on.[6]

It is required to keep ordinary blood levels of calcium and phosphate that are expected for typical mineralization of bone, muscle constriction, nerve conduction, and general cell capability in all body cells. The lack of vitamin D is widespread in India. Aside from low admission in diet, individuals with liver, kidney, and skin issues likewise lack Vitamin D. Expanded skin pigmentation and use of sunscreens, social practices like the burqa and purdah framework. In India, Vitamin D lack is broad. Be that as it may, the clinically analyzed cases address just a glimpse of something larger. The information on the various outcomes can lead us to envision the weight this quiet plague would cause the improvement of the country.[7]

Vitamin D is classified as a fat-soluble vitamin. Due to its role in maintaining calcium homeostasis, it is commonly called the "sunshine vitamin" or "antirachitic factor." The human body obtains sufficient vitamin D by dietary intake or appropriate exposure to sunlight. In research conducted by Tania Pan et al., it was shown that a significant proportion of the population, namely 70.6%, exhibited deficiencies in Vitamin D. This deficiency was further categorized into two subgroups, with 19.6% classified as Vitamin D deficient and 51.0% classified as Vitamin D inadequate. The average age of the participants was 56.9 years, with a standard deviation of 8.9 years. The average length of daily sun exposure was 138.5 minutes, with a standard deviation of 59.2 minutes. Out of the total sample size, 74 individuals, accounting for 38.1% of the population, were classified as overweight or obese. A mere 73 individuals, accounting for 37.6% of the total sample, possessed a diet that might be deemed sufficient. The findings from the tests indicated that individuals with low socioeconomic status (SES), reduced daily sun exposure, diabetes, overweight or obesity, and insufficient dietary intake were essential factors in predicting the occurrence of VDI. These factors collectively accounted for 39.3% of the variability seen in the model fit. Emphasizing the promotion of vitamin D-rich foods and vitamin D supplements, engaging in outdoor activities to increase exposure to sunlight, maintaining optimal body weight, and strictly adhering to diabetes management strategies would contribute to the overall reduction of the issue.[8]

The prevalence of vitamin D deficiency is extensive on a global scale. Pregnant women represent a very susceptible population at risk for Vitamin D Insufficiency (VDI). Despite the ample sunshine in South India, pregnant women are commonly perceived as vulnerable to this deficit. This research aims to examine the prevalence of vitamin D deficiency (VDD) among pregnant women, investigate its association with modifiable risk factors, and analyze its potential link with low birth weight. Vitamin D deficiency (VDD) has a significant prevalence among pregnant women residing in South India, resulting in detrimental health outcomes for both the mother and the progeny. The primary risk factors identified in our research group for vitamin D deficiency (VDD) are reduced levels of physical activity, less sun exposure, darker skin tone, poorer socioeconomic position, and limited knowledge. The study revealed that 62% of the pregnant women examined had a point prevalence of VDD, defined as having a serum 25‑hydroxyvitamin D (25(OH) D) level below 20 ng/mL. The results of the univariate analysis indicated a statistically significant association between sun exposure, socioeconomic status, and the percentage of individuals with vitamin D deficiency. The results of the linear regression analysis showed that sun exposure was the sole significant predictor for serum 25(OH) D levels. VDD is correlated with an elevated likelihood of infants being born with low birth weight.[9]

The irrefutable reality is that there is widespread vitamin D insufficiency in India. Sun exposure is an impractical method for most people in India to achieve adequate levels of vitamin D. Insufficient calcium consumption, when combined with a shortage in vitamin D, exacerbates the situation. The imperative to enhance the vitamin status of the Indian people is of paramount significance and requires immediate attention. The Indian government should implement significant measures in this regard. There is a need to revise the Recommended Dietary Allowance (RDA) for calcium and vitamin D. It is imperative to provide widespread availability of enhanced facilities and advanced technology across the nation to facilitate prompt detection of clinical indicators associated with vitamin D insufficiency in patients requiring medical treatment. To address the issue effectively, it is imperative to establish population-based initiatives on a national scale. These programs should enhance public knowledge of the problem, ensure the availability of inexpensive vitamin D supplements, and facilitate providing vitamin D-fortified foods to the general population in India. Sustained funding is required for research in this domain to establish a thorough understanding of the current vitamin D issue. Additionally, it is imperative to investigate and evaluate the impact

of a collaborative effort, including the government, healthcare system, industry, and consumers, to enhance the vitamin D status in India.[10]

While most of the research mainly focuses on northern and central parts of India, it is worth noting that studies conducted in closer proximity to the equator, such as Tirupati, adjacent villages, and Chennai, have also identified severe vitamin D deficiency as a significant concern in terms of public health and clinical implications. Although the subjects examined by Harinarayan et al. mainly consisted of adults, the study was extensive in scope and provided a comprehensive analysis of eating patterns. The researchers documented an average serum 25(OH)D concentration of 38.9 nmol/l in boys residing in urban areas, whereas boys living in rural areas had an average concentration of 42.4 nmol/l. M Vijayakumar and colleagues have provided evidence indicating that the prevalence of vitamin D insufficiency is relatively low in Kerala. The consumption of a natural fish diet in coastal Kerala and the geographical latitude may have a protective effect. The consideration of regional variety should be incorporated into public health policy in India.[11]

The diagnosis of vitamin D insufficiency should not be considered a diagnosis of exclusion. Implementing comprehensive history-taking, thorough physical examination, and pertinent laboratory investigations will facilitate the prompt identification of a medical condition and the subsequent administration of suitable treatment. Preventive measures have resulted in cost savings within the healthcare system and reduced morbidity and death rates. Increasing attention and intervention efforts should be directed towards high-risk populations since they will likely benefit most from such measures. In the appropriate clinical setting, the presence of proximal muscular pelvic girdle myopathy should motivate the consideration of conducting tests to assess 25-hydroxyvitamin D (25(OH) D) levels using validated assays. It has been shown that administering vitamin D supplements increases vitamin D levels, subsequently improving symptoms associated with proximal myopathy. Notably, this improvement has enabled patients to regain their walking ability within weeks. When a patient exhibits signs of proximal myopathy, including Vitamin D blood levels as a potential factor in the differential diagnosis is crucial.[12]

Ashok Kumar Yadav et al. study examined the incidence of vitamin D deficiency in North Indian kidney transplant recipients and its effects on vascular and bone biomarkers. Vitamin D insufficiency has been linked to endothelial dysfunction and atherosclerosis in the general population and people with CKD. This study examined the association between vitamin D

insufficiency and FGF23 and endothelial dysfunction indications in North Indian kidney transplant recipients. Vitamin D insufficiency was significant among kidney transplant recipients residing in North India and correlated with decreased levels of FGF23.[13]

Patients with rheumatoid arthritis (RA) frequently exhibit vitamin D insufficiency. In addition to assessing the relationship between vitamin D levels and disease activity, Debdipta Bose et al. meta-analysis seeks to ascertain the incidence of vitamin D deficiency in RA patients in India. The analysis covered a total of 15 studies. The study outcomes reveal a notable decrease in blood vitamin D levels among individuals diagnosed with rheumatoid arthritis (RA) and show a negative association between vitamin D and the progression of RA. The existing body of research justifies using Vitamin D supplementation in treating and controlling rheumatoid arthritis (RA).[14]

Data are scarce about the prevalence of vitamin D insufficiency in Asian countries, including India, at the population level. The need for sufficient information regarding vitamin D status can be attributed, in part, to the absence of definitive guidelines on the ideal intake and status of vitamin D and a lack of consensus on the thresholds for determining insufficiency. In a nation characterized by its vast expanse, encompassing diverse latitudes, ethnicities, cultures, traditions, and attitudes, it is observed that a significant proportion of the population experiences a widespread deficiency in vitamin D. This deficiency is prevalent across various age groups, with a staggering 95.7% of neonates, 75% of adults, and 67% of pregnant women exhibiting serum 25 hydroxy vitamin D levels below 50 nmol/L, indicating a state of deficiency. Previous studies have suggested that individuals, including children and adults, who reside in rural or less polluted regions and are exposed to sunshine have a more favorable vitamin D status, particularly during the summer season.[15]

RESULTS

Prevalence of Vitamin D Deficiency

The prevalence of vitamin D insufficiency is extensive and frequently observed in several chronic conditions, such as osteoporosis, osteomalacia, rickets, autoimmune disorders, cardiovascular diseases (CVD), diabetes, infections, and diverse forms of malignancies. A notable proportion of patients belonging to specific categories, such as 96.51% of individuals seeking medical care in the field of Otolaryngology (ENT), frequently demonstrate a shortage in Vitamin D. Patients attending the outpatient department (OPD) and engaging in

consultations with healthcare professionals commonly exhibit a high prevalence of Vitamin D insufficiency.

Regional Variations in Vitamin D Deficiency

Studies undertaken in different regions of India have revealed variable degrees of Vitamin D insufficiency. Kerala, a region situated in the southern part of India, exhibits a relatively low incidence of Vitamin D insufficiency in children, with a prevalence rate of 11.1%. The reduced frequency seen in Kerala might be ascribed to two factors: the consumption of a natural fish-based diet that is common in coastal regions, as well as the geographical latitude of the state.

High-Risk Groups

The prevalence of vitamin D insufficiency is notably high among some demographic groups, such as children, pregnant women, breastfeeding mothers, and those belonging to the working class. Patients who have had kidney transplantation exhibit a notable susceptibility to Vitamin D insufficiency.

Wide Range of Prevalence

Research findings indicate that the prevalence of Vitamin D insufficiency varies considerably, from a minimum of 11.1% to a maximum of 96.51%, among diverse age cohorts and genders.

The findings of this review demonstrate the notable influence of Vitamin D insufficiency on several health issues and underscore the necessity for focused treatments, particularly among individuals at heightened risk. Regional disparities in prevalence emphasize the significance of food patterns and geographic influences. To effectively tackle this prevalent health issue, it is imperative to undertake more research endeavors and implement comprehensive public health efforts.

DISCUSSION

The global prevalence of vitamin D insufficiency is a significant concern, given the well-established understanding of its potential health advantages. The determination of diagnosis needs to be conducted by assessing blood 25-hydroxyvitamin D (25(OH)D) concentrations to maintain levels above 20 nanograms per milliliter (ng/mL) to maximize the potential health advantages. The exploration of the non-skeletal advantages of vitamin D insufficiency necessitates the implementation of extensive randomized clinical studies. The timely

identification and management of vitamin D insufficiency in babies play a vital role in mitigating the potential adverse health outcomes. The prevalence of vitamin D insufficiency in India is observed to be 74% among babies and 85.5% among mothers, impacting individuals across various age groups and genders. Several factors have been identified as contributing to vitamin D insufficiency. These factors include reduced sun exposure, having a dark skin complexion, adhering to a vegetarian diet, belonging to a low socioeconomic position, and lacking vitamin D food fortification initiatives. To address the issue of vitamin D insufficiency, it is imperative to implement population-based approaches, acknowledge its significance as a public health concern, and allocate enough healthcare resources.

CONCLUSION

The present study provides evidence to support the assertion that vitamin D insufficiency is a widespread concern in global health, impacting individuals across many age groups, including children and adults. Notably, the research findings highlight a particularly elevated occurrence of this deficit among newborns residing in Northern India. Kerala has a comparatively lower prevalence of vitamin D insufficiency than other states in India. In India, it has been seen that a majority of patients, precisely 64%, exhibit a deficiency in certain aspects. Additionally, a notable proportion of patients, around 20%, demonstrate an insufficiency in the same aspects, while a smaller percentage of patients, precisely 15%, are found to possess appropriate levels in this regard. Several factors significantly predict vitamin D deficiency, including low socioeconomic level, less sun exposure, diabetes, overweight/obesity, and an insufficient diet. Implementing preventive strategies, such as the promotion of foods high in vitamin D, the use of supplements, the augmentation of outdoor activities, the maintenance of optimal body weight, and the management of diabetes, can contribute to the alleviation of the issue. Implementing preventive actions is an economically efficient approach, but emphasizing the significance of education is crucial. Vitamin D insufficiency is prevalent among those who have had kidney transplantation and those diagnosed with rheumatoid arthritis in India. Policy choices have to be grounded in state-specific facts concerning the status of vitamin D and levels of sun exposure.

Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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