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Original Research Article

Assessments of Vit D Levels among Children in Rural Maharashtra

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Abstract

Aim: To assess the prevalence and risk factors of vitamin D deficiency among preschool children in family health facilities in rural population of Dhule district.

Background: Vitamin D deficiency in childhood may play an important function in pathophysiology not only of rickets but also of non-skeletal diseases that have an immune system‑mediated pathogenesis.

Patients and Methods: An analytical cross‑sectional study was conducted on 96 preschool children who attended the OPD of ACPM Medical College, Dhule district during the period of data collection (3 months). This study started on the1st of February 2023 and lasted till April 2023. History, clinical examination, and serum vitamin D level measurement were conducted.

Results: The prevalence of vitamin D deficiency among preschool children was 63.5%, and 20.83% of them had mild deficiency, 31.25% moderate deficiency and, 11.46% had severe deficiency. Vitamin D deficiency was more among male children (54.10%) than female (45.90%). Fatigue, bone fracture, and delayed teething were significantly higher in vitamin D‑deficient children than normal children. There was a statistically significant difference between vitamin D‑deficient children and normal children regarding sex, education and work of mother, socioeconomic state, and sun exposure.

Conclusion: From the current study, we can conclude that vitamin D deficiency among preschool children was 63.5%. Risk factors for vitamin D deficiency were male children who had basically educated and working mothers and moderate socioeconomic status. Vitamin D deficiency was more among obese, exclusively breastfed children and who ate fish and egg and drank milk once daily and who did not have enough sun exposure. Fatigue and bone fracture were significantly higher in vitamin D‑deficient children than normal children.

Keywords: Family Health Facilities, Preschool Children, Vitamin D Deficiency.

Introduction

Vitamin D is a group of fat‑soluble secosteroids; the two major physiologically relevant forms of which are vitamin D2 (ergocalciferol) and vitamin D3 (cholecalciferol). Vitamin D3 is produced in the skin after exposure to ultraviolet B

light from the sun or artificial sources and occurs naturally in a small range of foods [1]. Vitamin D is a prohormone that plays an essential role in the mineralization of bones. There are two ways for humans to meet requirement for vitamin D: the major amount produced in the skin after exposure to the sunlight and the restis being fulfilled from dietary sources. There are few foods that are naturally rich with vitamin D, although there are some fortified products available for consumption [2]. It is essential for promoting calcium absorption from the gut and maintaining adequate serum calcium and phosphate concentrations to enable normal mineralization of bones. It is also needed for bone growth and bone remodeling by osteoblasts and osteoclasts. Vit D has 2 forms: vitamin D2 (ergocalciferol) is generated from ergosterol in plants and vitamin D3 (cholecalciferol)is produced in the skin of humans as well as by some animals from 7 dihydroxycholecalciferol, both reactions being prompted by exposure to sunlight [4]. The prevalence of vitamin D deficiency is greater in certain clinical subpopulations, and the presence of associated characteristics should raise the index of suspicion for the practicing clinicians regarding conditions associated with vitamin D deficiency, such as osteoporosis and osteomalacia. Further research investigating the pathophysiology of hypovitaminosis D and its clinical consequences can help better understand and prevent the development of associated comorbidities. There is emerging evidence that suggests vitamin D deficiency in childhood may play an important function in pathophysiology not only of rickets but also of non-skeletal diseases that have an immune system‐mediated pathogenesis, for example, allergic diseases such as asthma and eczema [5].

Recent studies have suggested that vitamin D deficiency in children is widespread. However, the vitamin D status among Egyptian preschool children is seldom investigated, so the aim of this study was to assess the prevalence and risk factors of vitamin D deficiency among preschool children in Dhule district to identify need for continuing vitamin D supplementation after 2 years of age.

Methodology

An analytical cross‐sectional study was conducted on 96 preschool children who attended the OPD of ACPM Medical College during the period of data collection (3 months).

Inclusion Criteria:

All apparently healthy preschool children and their mothers who attended the OPD of ACPM Medical College were included in the study.

Exclusion Criteria:

Chronic illnesses, for example, renal and hepatic; malabsorption syndromes, for example, celiac and cystic fibrosis; refusal to participate; and intake of vitamin D supplement were the exclusion criteria.

The sample size was 96 preschool children (all preschool children who fulfilled the eligibility criteria and attended the selected health facilities during the period of data collection; 3 months).

Data Collection:

A structured interviewing questionnaire for children and their parents was constructed to cover the following items:

The first part included data regarding the sociodemographic and socio-economic characteristics of the preschool children and their families such as age, sex, residence, parent education and occupation, socioeconomic state (low, medium, or high), crowding index (number of chambers in house/children number), and presence of waste and garbage. The socioeconomic level of the family was determined based on the scoring system of Fahmy et al. [6] (Social Class Classification Scale).

The second part included nutritional history of the children, which was composed of four questions such as normal breast feeding, added nutrition elements with breastfeeding, milk taking every day, and fish consumption.

The third part included four questions to identify sources of vitamin D among children such as sunexposure, taken food containing vitamin D, other vitamins or mineral supplement, and vitamins or mineral supplementation during lactation.

The fourth part included 19 questions to detect signs and symptoms of vitamin D deficiency among preschool children such as bone fracture, pain of bones or joints, fatigue, depressed mode, delayed teething, bowing of lower limb, delayed walking, delayed closure of fontanel, brooding of skull, rachitic rosary, and kyphosis.

Assessment of children's weight, height, and BMI wasdone.

Laboratory investigation

Assessment of serum level of vitamin D was done by 25‑OH vitamin D enzyme‑linked immunosorbent assay (ELISA) kit. This ELISA kit is designed, developed, and produced for the quantitative measurement of total 25‑OH vitamin D2/3 in serum utilizing the competitive immunoassay technique.

Statistical analysis

Results were tabulated and statistically analyzed by using a personal computer using Microsoft Excel 2016 and SPSS version 23 (SPSS Inc., Chicago, Illinois, USA). Statistical analysis was done using descriptive, for example, percentage, mean, and SD, and analytical, which includes χ^2 and Mann–Whitney test. A value of *P* less than 0.05 was considered statistically significant.

Results

Results showed that 36.46% (*n* = 35) of the studied children had normal level of vitamin D. On the contrary, 63.54% (*n* = 61) had vitamin D deficiency. Of the deficient children, 20.83% had mild deficiency,31.25% (*n* = 30) had moderate deficiency and, 11.46% (*n* = 11) had severe deficiency. The current study showed that there was no significantdifference between vitamin D‑deficient children and normal children regarding their age, education, and work of father, with *P* value more than 0.05. On the contrary, there were statistically significant differences between vitamin D‑deficient children and normal children regarding sex, education and work of mother,socioeconomic state, and presence of waste and garbage, with P value less than 0.05.

Approximately two‑thirds (65.57%) of vitamin D‑deficient children had been breastfeed. Approximately one‑third (32.79%) of vitamin D‑deficient children did not eat fish versus more than a third (34.30%) of normal children ate fish more than once per week. In addition, more than one‑third (37.70%) of vitamin D‑deficient children did not drink milk, whereas more than two‑thirds (68.60%) of normal children drank milk more than once per week. Furthermore, 31.15 and 49.18% of vitamin D‑deficient children did not eat egg and cheese versus 45.70 and 71.43% of normal children who ate fish and cheese more than once per week, respectively. In addition, there was a highly significant difference ($P < 0.001$) between vitamin D‑deficient children and normal children regarding sun exposure and BMI.

The current study showed that there were no significant differences between vitamin D‑deficient and normal children regarding presence of symptoms and signs of vitamin D deficiency except for fatigue, bone fracture, and delayed teething, which were significantly higher in vitamin D‑deficient children than normal children.

Discussion

The current study showed that approximately two‐thirds of the studied children had vitamin D deficiency (63.54%), and they were classified into: 20.83% had mild deficiency, 31.25% had moderate deficiency, and 11.46% had severe deficiency. This result agrees with Dooki *et al*. [7] who found that subnormal vitamin D levels were found in 68.9% of preschool children. This result is in agreement with a cross‐sectional study by Sharawat and Dawman [8], which included 96 apparently healthy school going children (50 male and 46 female) from age 5–10 years. They found that one‐third of the children had vitamin D levels (33.33%) less than 25 nmol/l and a third of them had between 25 and 50 nmol/l (33.33%).

Moreover, 20.83% had levels between 50 and 75 nmol/l and 12.50% had more than 75 nmol/l. In contrast, Goswami *et al.* [9] found that most of the children had levels of 25(OH) D3 less than 50 nmol/l (91.1%). Moreover, Puri *et al.* [10] reported that most of children between 1 and 5 years of age had a 25(OH) D3 level less than 50 nmol/l (91.1%).

The present study showed that there was no relation between vitamin D status of children and their age. On the contrary, there was a statistically significant relation between vitamin D level among children and their sex. Vitamin D deficiency was more deficient among male children (54.10%) than female (45.90%). These results come in agreement with Khalessi et al. [11] who found that age was not significantly different in children who had higher vitamin D levels as compared with those who had vitamin D deficiency. In addition, Choi *et al.* [12] reported that age was not significantly different among the studied groups of children as stratified by vitamin D status. Our results disagree with Sahu *et al*. [13] who did not find a significant difference between vitamin D levels in boys and in girls.

The present study revealed that vitamin D deficiency was more among obese children (42.62%) than overweight (18.03%). These results are in agreement with Khalessi *et al.* [11] who found a significant difference in BMI of studied children as those who had higher BMI had vitamin D deficiency compared with others. In addition, Vandevijvere *et al.* [14] reported that the risk of vitamin D deficiency increased significantly with BMI of children. Moreover, Grineva *et al.* [15] confirmed a high prevalence of obesity among children who had vitamin D deficiency. Our results disagree with Gupta *et al.* [16] who concluded that there was no significant difference between vitamin D deficiency infants and normal children regarding birth weight. However, the follow‐up assessments by Maghbooli *et al.* [17] showed that there was no significant effect of maternal vitamin D deficiency on weight of children. This difference may be owing to larger number of cases and different conditions.

In this study, there was a statistically significant relationship between vitamin D status of the children and sun exposure. This comes in agreement with El Rifai et al. [18] who showed a significant correlation between vitamin D level and skin exposure. Moreover, a cross‐sectional study including 50 Pakistani children stated that vitamin D levels were significantly affected by sunlight exposure [19].

The current study indicated that there was a significant relation between vitamin D levels among children, as approximately a third of vitamin D‐deficient children did not eat fish (32.79%). More than a third of vitamin D‐deficient children did not drink milk (37.70%). Furthermore, approximately a third and approximately half of vitamin D‐deficient children did not eat egg (31.15%) and cheese (49.18%), respectively. More than 50% of vitamin D‐deficient children were consuming fish infrequently. Turner *et al.* [20,21] indicated

that vitamin D status could be affected in the children by compliance with the gluten‐free diet, poor absorption, and decreased intake.

The present study revealed that less than half of the studied children had bone pain (39.51%), more than one‐quarter experienced delayed walking (27.78%), and less than a tenth had depressed mood (7.41%). In addition, approximately one‐third of them had fatigue (30.86%), and approximately a tenth of children had bone fracture (9.26%). Moreover, less than a quarter of children experienced delayed teething (13.58%) and had bowing of lower limb (12.35%). Less than a quarter of them had boxing of their heads (15.43%) and delayed closure of fontanels (18.52%). In addition, 9.26% of children exhibited rachitic rosary and 3.09% of the studied children had kyphosis.

Conclusion

From the current study, we can conclude that vitamin D deficiency among preschool children was 63.5%. Risk factors for vitamin D deficiency were male children who had basically educated and working mothers and moderate socioeconomic status. Vitamin D deficiency was more among obese, exclusively breastfed children, and who ate fish and egg and drank milk once daily, and who did not have enough sun exposure. Fatigue and bone fracture were significantly higher in vitamin D‐deficient children than normal children.

Owing to high prevalence of subnormal vitamin D levels among preschool children in the current study, itis recommended that vitamin D deficiency prevention programs are continued in this age group. Moreover, proper maternal education should be conducted regarding calcium‐rich foods, adequate number of servings/day, and adequate sun exposure.

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