Vitamin D Value Among Children In Nineveh Province

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Abstract

Objective: assess vitamin D level in healthy children in Nineveh Province -Iraq, and to study risk factors for it is deficiency. Design: A cross sectional study. Patients and method: study was conducted during summer on 160 healthy children. The children were in 3 age groups, below12 months, 12-72 months and >72 months. Blood was collected and serum 25-hydroxyvitamin D level was measured by ELISA. Vitamin D level below 12 ng/ml was defined as deficiency state, while 12-20 ng/ml was insufficient and that which was above 20 ng/ml as sufficient. Results: 53% of children had adequate vitamin D concentration, while 25% of them had insufficient vit D and 21.9% of children had deficient vitamin D. Female are more deficient in vitamin D than male, while male were more sufficient in vitamin D than female. Discussion: low prevalence of vitamin D may be due nutritional problems, pattern of clothing, and lack of sun exposure. Conclusion: In Nineveh city there is increased prevalence of vitamin D deficiency and insufficiency in child of 0 to 14 years old age. Only 53.1% of the study children had sufficient vitamin D while others were either deficient (21.9%) or insufficient (25%) in vitamin D.

Keywords: vitamin D, children, Nineveh

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Introduction

Recently, there was considerable attention on vitamin D relations to health and disease. Vitamin D receptors had been discovered in most tissues and cells of the body, which leads to the theories on the possible impacts of vitamin D on different health consequences (1). It was recognized that this vitamin enhances calcium and phosphate intestinal absorption and accelerate bone mineralization, hence supporting good skeletal development since the very early life stages (2). In 20th century vitamin D was identified as a nutrient, in addition to be synthesized in the skin through sunlight exposure. Calcium and phosphate metabolism regulation is the main function of vitamin D; therefore, it is necessary for the health of bone (2,3). Also vitamin D has another health effects including prevention of infectious diseases, immune-related diseases, and cardiovascular diseases (3). The main biological impact of Vitamin D is on the bone. Recently, the discovery of vitamin D receptors in the human body suggests multiple
biological roles of this vitamin in almost all tissues. Vitamin D could have a more specific essential role in the cell growth, proliferation, differentiation and apoptosis regulation, plus different immunological functions (4).

Deficiency or insufficiency of Vitamin D may be due to reduced intake and/or bioavailability, inadequate time of sunlight exposure or hepatic and renal diseases. The decreased calcium and phosphorus intestinal absorption may lead to depletion of the calcium in bones (4,5). The serum 25 hydroxyvitamin D level is a good dependable marker of whole vitamin D status because it gives an indication about total vitamin D from dietary intakes, and exposure to sunlight, in addition to its conversion from the liver (6,7). There were ongoing controversies about the definitions of vitamin D nutritional status (8). Threshold values of vitamin D need to be studied.

Prevalent studies on vitamin D levels (deficiency, insufficiency, and sufficiency) among Nineveh population, particularly among children and adolescent are relatively scarce. Vitamin D requirements are thought to vary with age, with a reported worldwide prevalence of deficiency in about 30-80% in children and adults, but there is little comparative evidence for this (9,10). Current studies have depended the value of less than 15 to 20 ng/ml as a cutoff for deficiency of vitamin D in child and adolescent. Although there are no established set levels of this vitamin among those age groups (11).

Seasonal variations in 25-OHD serum level have been described by other studies (12, 13). The effect of solar radiation is obviously observed from the correlations between the values of 25-OHD in those without regular vitamin D supplement intake and their exposure to sunshine (14). So, variations in circulating 25-OHD are usually attributed to seasonal changes in the ultraviolet energy of sunlight (15). Vitamin D requirements in Caucasian infants are maintained by exposure to sunlight for 30 minutes/week, for two hours/week fully clothed with no hat or with only diaper clothing. Both Asians and Africans have a protective skin pigmentation which need longer time of exposure to sunlight (16).

Residency in urban and rural communities is one of the key factors that positively correlated with serum 25(OH)D levels. Residence in suburban communities was considered as a protective factor for subjects of both sexes (17). The American Academy of Pediatrics recommendation of keeping infants away from direct sunlight, may increase children's risk of vitamin D deficiency (18).

The aim of this study is to assess vitamin D level in healthy children in Nineveh Province – Iraq, and to study risk factors for it is deficiency.

Patients and methods

A cross sectional study was performed between June and September 2018 (during summer months). One hundred sixty healthy child (male and female) with different ethnic groups who were attending the researcher pediatric clinic, their age ranged from one week to 14 years, all of them were lived in Nineveh province (including Mosul city and their villages). All children with chronic illnesses were excluded from the study. The approval of this study was
given by the scientific committee of the pediatric department, college of medicine, University of Mosul. All parents were informed about the nature of the study and a written consent was obtained from them.

The children were divided into 3 groups according to their ages. Group 1 includes infants below one-year age, group 2 includes children between 12 months and 72 months and group 3 includes children older than 72 months.

Five milliliters of venous blood were withdrawn from each child enrolled in the study. After centrifugation serum was separated and stored in freeze at (-20 c) till the time of measurement of vitamin D. Eight well microstrips of AlegriaOrgentic Diagnostic (GmbH, Germany) contains complete set of reagents. Each strip for one sample used for determination of 25-hydroxyvitamin D. This determination is based on Enzyme Linked Immune Sorbent Assay (ELISA). The test microstrip can be used by Algeria analyzer which is fully automated instrument that processed and evaluated the assay of 25-hydroxyvitamin D completely. Vitamin D level below 12 ng/ml was said as deficient, a level of 12-20 ng/ml, insufficient and a level above 20 ng/ml as sufficient. (20,21).

Results

It is clear from figure 3 that female (57%) are more than male (43%) in vitamin D deficiency group (<12 ng/ml), while male are equal to female with vitamin D insufficient group (12-20 ng/ml). In other hand 54.1% of male had sufficient amount of vitamin D (>20 ng/ml) comparing to 45.9% female.

Table 1 showed vitamin concentration according to age group. 43.7% of the population under study are infant (< 12 months) 32.8% of them were deficient of vitamin D (<12 ng/dl), 28.6% of them had insufficient vitamin D (12-20 ng/dl) and 38.6 % of them had adequate vitamin D (>20 ng/dl).

In other hand 34.4% of children are between 12-72 months age, 10.9 % of them were deficient of vitamin D (<12 ng/dl), 16.4 % of them had insufficient vitamin D (12-20ng/dl) and 72.7% had adequate vitamin D (>20ng/dl). Also 21.9% of children are older than 72 months’ age, 17.1% of them are deficient of vitamin D (<12ng/dl), 31.4% of them had insufficient vitamin D (12-20ng/dl) and about half of them (51.5%) had adequate vit D concentration.

Table 2 showed the effect of daily sun exposure for more than 20 min on vitamin D concentration. 35% of children under study were daily exposed to sun for 20 min or more while 65 % were not. 43.52 % of children with adequate vitamin D (>20 ng/dl) were exposed to sun and 56.4% were not but the result is statistically not significant P =0.233. In other hand 74 % of children with vitamin D deficiency (<12 ng/ml) and 75 % of children with vit D insufficiency (12-20 ng/ml) had insufficient daily exposure to vit D compared to only 25.7 % and 25 % with adequate vitamin D exposure and the results are highly significant p =0.004 and 0.002 respectively.

It is clear from table 3 that 80.6 % of children lived in urban area compared to 19.3 % lived in rural area. Most children with deficient and insufficient vitamin D live in urban area (91.45 %) and (87.5%) compared to (8.5%) and (12.5%) live in rural area respectively and the deference is highly significant p=0.0000. In other hand children with
adequate vit D concentration lived in urban area (80.6%) more than rural area (19.3%) and the deference is statistically significant p=0.0000.

Discussion

Vitamin D deficiency is a vital problem in both developed as well as developing countries (10). Significant controversy has been connected with determining standards of vitamin D sufficiency, insufficiency, and deficiency. Thresholds used to define these states are based upon associations of 25OHD levels with clinical indication of rickets and elevations in bone turnover markers. In this study we considered the following vitamin D levels as sufficiency, insufficiency and deficiency: (19,20)

- Vitamin D sufficiency: "20 to 100 ng/mL 50 to 250 nmol/L"
- Vitamin D insufficiency: "12 to 20 ng/mL 30 to 50 nmol/L"
- Vitamin D deficiency: "<12 ng/mL <30 nmol/L"

These standards are consistent with recommendations of the 2016 Global Consensus from the Pediatric Endocrine Society. They are depending on observations of radiologic changes of rickets and elevations of serum alkaline phosphatase at vitamin D level below 20ng/ml. (20).

Results of the current study showed that 53% of the studied children had adequate vitamin D levels, while 25% of them had insufficient vitamin D and 21.9% of children were deficient of it. The low prevalence rate of adequate vitamin D in our locality may be due nutritional problems, pattern of clothing, lack of vitamin D supplementation or lack of sun exposure due to indoor living. (21)

Vitamin D deficiency of the Western world had been suggested by many reports, combined with many health benefits for vitamin D supplementation. Deficiency of this vitamin occurs usually among European infants, children, and adolescents, including those who are at risk like breastfed infants (not receive the recommended supplement of vitamin D), dark skin children and adolescents living in northern nations, also obese children and adolescents and those with insufficient sun exposure (22). In Pakistan, 90.1 % of children are vitamin D deficient. Significant predictors of vitamin D levels are age, town of residence, and housing structure (23).

Results of this study showed that male had sufficient amount of vitamin D (>20 ng/ml) more than female. In the present study girls showing lower vitamin D status in comparison with boys. This was agreed by studies carried out with children and/or adolescents in USA, Australia, New Zealand, Greece and other countries (25-28). This may be due to the low physical activity recorded for girls, also clothing habits in girls in our locality and the time spent on outdoor activities. The higher dietary supplements of vitamin D reported for boys compared with girls in some countries could be a cause of the sex differences in vitamin D levels (10,28). As well as potential confounding factors, like socio-demographic characteristics, pubertal maturation, BMI and serum concentrations of parathyroid hormone (29).
In this study there were no significant differences between children with adequate vitamin D who were exposed to sun and those who were not exposed. This is in agreement with other results said that in spite of an equal degree of sun-exposure during summer months; there is no more increase in the 25-OHD levels. This might have related to some control mechanisms of the substrate activation in the skin "7-dehydrocholesterol", cholecalciferol release from the skin or a conversion to 25-OHD by hepatic regulation (14).

Results of the current study showing that most children with deficient and insufficient vitamin D live in urban areas with highly statistically significant differences compared to rural areas. The reasons for this difference are not clear, several risk factors, including an urban environment with high air pollutants, less sun exposure, and type of feeding may predispose such children to more deficient and insufficient status (30). Our study has some limitations in that it did not include seasons in this analysis, serum was taken at only one point in time. Moreover, the aim of the present analysis was to study the prevalence of certain level of 25(OH)D in children and to find out and discuss some possible causes of the observed levels. To our knowledge this is the first descriptive sample that provide examination of the prevalence of three levels of serum in that it investigates the prevalence of vitamin D value among children in Nineveh city. It could help pediatricians to recognize vitamin D supplement recommendation for and be able to educate and instruct parents about nutrition, breastfeeding, and sun exposure during childhood and adolescence.

**Conclusion**

It is concluded that in Nineveh city there is high prevalence of vitamin D deficiency and insufficiency in children aged 0 to 14 years old. Only 53.1% of the study population have sufficient vitamin D while others are either deficient (21.9%) or insufficient (25%) in vitamin D. An increase rate of vitamin D insufficiency is reported in children. It may result from inadequate sun exposure, skin pigmentation, skin covering, air pollution and low intake of vitamin D. This study recorded that vitamin D supplement should be given not only for infants, but also for all the children and adolescent.

**Acknowledgments**

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**References**


Figure 1: Gender distribution of the study sampled population according to vitamin D concentration.

Table 1: vitamin D concentration according to age

<table>
<thead>
<tr>
<th>Vit. D (ng/dl)</th>
<th>&lt;12 ng/dl(%)</th>
<th>12-20 ng/dl(%)</th>
<th>&gt;20 ng/dl(%)</th>
<th>Total No.(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12 months</td>
<td>23(32.8)</td>
<td>20(28.6)</td>
<td>27(38.6)</td>
<td>70(43.7)</td>
</tr>
<tr>
<td>12-72 months</td>
<td>6(10.9)</td>
<td>9(16.4)</td>
<td>40(72.7)</td>
<td>55(34.4)</td>
</tr>
<tr>
<td>&gt;72 months</td>
<td>6(17.1)</td>
<td>11(31.4)</td>
<td>18(54.5)</td>
<td>35(21.9)</td>
</tr>
</tbody>
</table>

Table 2: Effect of Sun exposure > 20 min/day on Vitamin D concentration.

<table>
<thead>
<tr>
<th>Vitamin D concentration</th>
<th>Sun exposure</th>
<th>Total</th>
<th>P*-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes No.(%)</td>
<td>No.(%)</td>
<td></td>
</tr>
<tr>
<td>&lt; 12 ng/dl</td>
<td>9 (25.71)</td>
<td>26 (74.28)</td>
<td>35</td>
</tr>
<tr>
<td>12-20 ng/dl</td>
<td>10 (25)</td>
<td>30 (75)</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 20 ng/dl</td>
<td>37 (43.52)</td>
<td>48 (56.47)</td>
<td>85</td>
</tr>
<tr>
<td>Total</td>
<td>56 (35)</td>
<td>104 (65)</td>
<td>160</td>
</tr>
</tbody>
</table>

* Z- test of one proportion was used.
Table 3: Effect of Residence on Vitamin D concentration.

<table>
<thead>
<tr>
<th>Vitamin D concentration</th>
<th>Residence</th>
<th>Total</th>
<th>P*-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rural No.(%)</td>
<td>Urban No.(%)</td>
<td></td>
</tr>
<tr>
<td>&lt; 12 ng/dl</td>
<td>3 (8.57)</td>
<td>32 (91.43)</td>
<td>35</td>
</tr>
<tr>
<td>12-20 ng/dl</td>
<td>5 (12.5)</td>
<td>35 (87.5)</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 20 ng/dl</td>
<td>23 (27.06)</td>
<td>62 (72.94)</td>
<td>85</td>
</tr>
<tr>
<td>Total</td>
<td>31 (19.36)</td>
<td>129 (80.63)</td>
<td>160</td>
</tr>
</tbody>
</table>

* Z-test of one proportion was used.