VITAMIN D LEVELS AMONG CHILDREN WITH SEVERE ACUTE MALNUTRITION.

Dr. Sudhir Mehta*

MBBS, DCH, DNB (Pediatrics), Department of Pediatrics, Sri Aurobindo Medical College and PG Institute, Indore, Madhya Pradesh, India.

ABSTRACT

Background: Children with malnutrition may have co-existing vitamin D deficiency (VDD), which may be severe. The main objective of study was to evaluate vitamin D levels among children with severe acute malnutrition. Methods: Serum vitamin D levels were evaluated in 100 children with severe acute malnutrition of age between 6 months to 60 months. Results: VDD (vitamin D deficiency) was found in 32 of 100 children (32%). The mean vitamin D level was 68.8 nmol/l. Conclusion: The high prevalence of VDD in malnourished children underlines the need for active surveillance and aggressive management.

KEYWORDS: vitamin D deficiency, severe acute malnutrition, vitamin D levels.

INTRODUCTION

Vitamin D deficiency (VDD) is prevalent in children worldwide and is recognized to be a major public health problem.1 Studies on children and adolescents in low- and middle-income countries show VDD ranging from 28 to 62%.2,3 A study by Ejaz et al.4 in Pakistan found that 33.6% of the severely malnourished children had rickets. A survey of VDD among malnourished children in sub-Saharan Africa from 2012 to 2014 showed a prevalence of 28%.5, 6 A study done by Msomekela et al.7 in Tanzania concluded that metabolic bone disease is common in very-low-birth-weight (VLBW), exclu-sively breast-fed, preterm infants with a rate of 33% and this was identified radiographically. A prospective cohort study in HIV-infected and HIV-exposed children in Tanzania, revealed low level of vitamin D in both groups, an average of 18 ng/ml, indicating probable VDD in Tanzanian children.
which persisted in 34.6% of un-infected children at the age of 6 months.\textsuperscript{[8,9]} The specific objective of this study was to identify vitamin D levels among children with severe acute malnutrition.

**MATERIAL AND METHODS**

A cross-sectional descriptive study of children with severe acute malnutrition was conducted from 2014 to 2015. A total of 100 children of age between 6 months to 60 months whose weight for height/ length was $< -3$ SD using the Standard World Health Organization (WHO) growth charts\textsuperscript{[8,9]}, a mid-upper arm circumference (MUAC) $<115$ mm or had edema of bilateral feet were included in the study. Children with clinical signs of systemic illness were excluded.

The primary outcome was the serum level of vitamin D. This information was collected in a structured format. Detailed clinical examinations, anthropometric measurements and laboratory tests were recorded. All anthropometric measurements were done in a standard method as per the recommendations by WHO.\textsuperscript{[8,9]}

Serum vitamin D levels were determined using 25(OH) enzyme-linked immunoassay. Children with vitamin D levels of $<50$ nmol/l were categorized as vitamin D deficient. Data were analyzed using the SPSS version 20.0. Odds ratios (ORs) and confidence intervals (CIs) were used where appropriate. Sensitivity and specificity of wrist X-ray findings were determined using the receiver operating characteristic (ROC) curve.

**RESULTS**

A total of 100 children were recruited into the study. More than half (60%) of all malnourished children were males. The median interquartile range (IQR) of vitamin D level was found to be 68.8 nmol/l (40.9–100.7). Among 100 children, 32(32%) had VDD [Table 1]. About 20% (20 of 100) of the children had one or more X-ray features of VDD. In total, 18 of 100 (18%). 16 (16%) children had fraying and 12 (12%) children had splaying. These three features of wrist X-ray were significantly associated with VDD. A sensitivity of 72 and a high specificity of 95% for X-ray findings vs. vitamin D were found in this study.

The area under the ROC curve was 0.501 (p $\frac{1}{4} 0.882$, CI $\frac{1}{4} 0.287–0.514$). Cupping in the wrist X-ray were more likely to have VDD than those without cupping, and this was statistically significant (OR 10, 95% CI $\frac{1}{4} 2.13–47.63$, p < 0.01). Children who had fraying
were more likely to have VDD (OR 21, 95% CI ¼ 5.05–80.55, p < 0.01). Children with splaying were 11.7 times more likely to have VDD (OR 11.8, 95% CI ¼ 1.34–105.2, p < 0.02).

Table 1. Proportion of VDD among children with severe acute malnutrition

<table>
<thead>
<tr>
<th>VITAMIN D STATUS</th>
<th>NUMBER (N)</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No deficiency (&lt;50 nmol/l)</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td>Deficiency (&lt;50 nmol/l)</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

DISCUSSION

The prevalence of VDD among the 100 malnourished children was 32%. The median vitamin D level was found to be 68.8 nmol/l. These findings are similar to those seen in Pakistan (33.6%).[4] VDD in children from other countries shows variable prevalence, for instance the prevalence among 12–24-month-olds in China was 65.3%; non-malnourished children in Qatar was 68.8%, urban children aged 1–6 years in Saudi Arabia was 63%, in rural Ethiopia among school-aged children in the community was 49% and hospitalized malnourished children in Uganda was 43.6%.[10–14] Except for the similarity of the co-hort between Uganda and this study, all other studies had different groups of children. Nevertheless, these data indicate that VDD is prevalent. This could be related to decrease nutritional intake, poor sunlight exposure and possibly impaired absorption because of enteric dysfunction or a disease process.[8] A study on genetic predisposition and fish intake among indigenous population in Tanzania showed no significant deficiency in that population.[15]

A study in Qatar found higher rates in girls,[11], but in our study incidence in boys was more compared to girls (p ¼ 0.58). Raghuramulu et al.[16] from India found that most of the children with malnutrition had VDD. It is still not clear whether malnutrition and rickets co-exist because of poor economic status or whether malnutrition is causally related to rickets. Autier et al.[8] in their systematic review showed that VDD arises from diseases and not vice versa.

Those with radiological features of rickets had a sensitivity of 72% and a specificity of 95%, and this can arguably be used as a tool to aid measure VDD in resource-limited settings. Radiological evidence of rickets take time to develop and might not be present in many cases with low to moderate VDD.
The WHO guidelines for treatment of malnourished children in resource-poor settings only elude on potential VDD along with other vitamins and provide a recommended dose for supplementation, but do not emphasize the need to identify and treat severe VDD and rickets.\cite{11}

The limitations of this study are as follows: it was a hospital-based study, calcium, phosphate and alkaline phosphatase levels were not checked and detailed nutritional analysis was not performed.

**CONCLUSION**

The high prevalence of VDD in malnourished children underlines the need for active surveillance and aggressive management.

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**CONFLICT OF INTEREST:** None declared.

**REFERENCES**


