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ORIGINAL ARTICLE

Frequency of vitamin D deficiency in admitted children 6 -36 months of age at Sahiwal Teaching Hospital Sahiwal, Punjab, Pakistan.

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ABSTRACT… Objective: To find out the frequency of vitamin D deficiency (VDD) in healthy children. **Study Design:** Cross-sectional study. **Setting:** Department of Pediatric Medicine, Sahiwal Teaching Hospital, Sahiwal. **Period:** July 2022 to December 2022. **Material & Methods:** A total of 80 healthy children of either gender aged 6 to 36 months visiting outpatients department of pediatrics during the study period adopting convenient sampling technique were included. At the time of enrollment, demographic information was recorded and blood sample was obtained and sent for vitamin D analysis. The frequency of VDD was noted. **Results:** In a total of 80 children, 48 (60.0%) were boys and 32 (40.0%) girls. The mean age was of 14.4±6.2 months. Residential status of 47 (58.3%) children was rural. Evaluation of vitamin D status revealed that 16 (20.0%) children had sufficient levels while deficiency and severe deficiency were noted in 44 (55.0%) and 20 (25.0%) children respectively. Younger age group was having significant linkage with VDD (p=0.0135). **Conclusion:** The frequency of vitamin D deficiency was very high among healthy children visiting a tertiary care health facility of Punjab, Pakistan. Younger age groups had significant association with the occurrence of vitamin D deficiency.

Key words: Hypocalcemia, Hyperphospatemia, Outpatient, Pakistan, Vitamin D Deficiency.

INTRODUCTION

Vitamin D is introduced to hydroxyl to give active form 1,25-dihydroxyvitamin D (1,25(OH)2D) by liver and kidneys and ultimately resealed into the circulation.[1] In the recent past, the role of vitamin D has been studied extensively and important developments have been shared all over the world.[2] Vitamin D is not only an essential element for the growth and maintenance of the skeleton, but according to the increasing data, it is also beneficial for extra skeletal tissues and in contrast to previous conception, perhaps higher quantity of vitamin D is needed for an ideal health status.[3] The literature highlights that the people having inadequate vitamin D levels are higher in proportion.[4] Vitamin D deficiency (VDD) is generally described as the level of "25-hydroxyvitamin D (25(OH) D)" < 20 ng/ml.[5]

Inherited and non-inherited diseases, and reduction of vitamin D synthesis through skin are some of the reasons behind development of VDD.[6] There are numerous conditions like rickets, osteoporosis, dental cavities, and hypoplasia of dental enamel, which might develop with VDD.[7] Due to certain mechanisms, fracture rates might also rise with the rise in VDD.[8] Recent literature highlights that VDD is alarmingly high even in healthy children.[9] A study performed by Voortman et al found that 29% healthy children had VDD.[10] In a country like Pakistan where overall health status of children is not up to the mark, it is important to measure the proportions of VDD among healthy children of our area so the present study was planned. The objective of this study was to determine the frequency of VDD in healthy children aged 6 month to 36 month among local population of Punjab, Pakistan.

MATERIAL & METHODS

This cross-sectional study was done at The Department of Pediatric Medicine, Sahiwal

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Teaching Hospital, Sahiwal from July 2022 to December 2022. Sample size of 80 children was calculated considering anticipated prevalence of VDD among healthy children as 29%[10] with 95% confidence level and 10% margin of error.

During the study period, a total of 80 healthy children of either gender aged 6 to 36 months visiting outpatient department of pediatric medicine were included. Healthy children were labeled as those children accompanying sick children with their parents in pediatric outpatient department. These healthy children did not visit outpatient department for any medical reasons. All children having any kinds of acute or chronic ailment were excluded from this study. Children who used medication effecting vitamin D metabolism during last three month were not selected. Children who could not undergo vitamin D testing were excluded. Convenient sampling technique was adopted. Approval from "Institutional Review Board" was obtained (S.No. 50/IRB/SLMC/SWL). Written and informed consents were acquired form parents.

At the time of enrollment, physical and clinical examinations were performed, and demographic characteristics were noted. Three ml of blood was collected from each child and sent to institutional laboratory. Vitamin D sufficiency was labeled as 25(OH)D ≥ 20 ng/ml, deficiency, < 20 ng/ml or severe deficiency < 5 ng/ml. Hypocalcaemia was labeled as total serum calcium concentration below 8.5 mg/dl. Hyperphosphatemia was termed if plasma phosphate level was above 4.5 mg/dl. Raised alkaline phosphatase was labeled if above 147 IU/L. Socio-economic status was named as poor if monthly family income < PKR. 30,000, middle between PKR. 30,000 to 60,000 and upper if above PKR. 60,000.

Statistical analysis was performed employing "Statistical Package for Social Sciences (SPSS)", version 26.0. Frequency and proportions were shown for qualitative data. Mean and standard deviation (SD) were calculated for numeric data. Stratification of the study variables were done to compared between categories of vitamin D status applying chi-square test considering $p<0.05$ as significant.

RESULTS

In a total of 80 children, 48 (60.0%) were boys and 32 (40.0%) girls. The mean age was of 14.4±6.2 months (ranging 6-36 month) whereas 42 (52.5%) children were aged between 6-12 months. Socio-economic status of 57 (71.3%) children was middle. Residential status of 47 (58.3%) children was rural (Table-I).

Characteristics of Children		Frequency (%)
Gender	Boys	48 (60.0%)
	Girls	32 (40.0%)
Age (months)	6-12	42 (52.5%)
	13-24	20 (25.0%)
	25-36	18 (22.5%)
Socio-economic status	Poor	15 (18.8%)
	Middle	57 (71.3%)
	Upper	8 (10.0%)
Residential status	Rural	47 (58.8%)
	Urban	33 (41.3%)

Table-I. Characteristics of children (n=80)

Evaluation of vitamin D status revealed that 16 (20.0%) children had sufficient levels while deficiency and severe deficiency were noted in 44 (55.0%) and 20 (25.0%) children respectively (Figure-1).

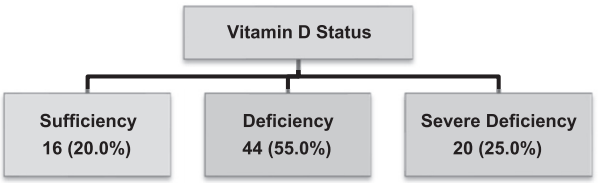

Figure-1. Vitamin D status in healthy children (n=80)

No significant difference was observed in terms of gender with the distribution of vitamin D status (p=0.3090). Younger age groups were found to have significant association with severe deficiency and deficiency of vitamin D (p=0.0135). No relationship of socio-economic status was found with vitamin D status distribution (p=0.3878). Residential status was not found to have any significant association with the distribution of vitamin D status (p=0.0583). The details of distribution of demographic characteristics with respect to vitamin D status are shown in Table-II.

Study Variable		Severe Deficiency (n=20)	Deficiency (n=44)	Sufficiency (n=16)	P-Value
Gender	Boys	10 (50.0%)	26 (59.1%)	12 (75.0%)	0.3090
	Girls	10 (50.0%)	18 (40.9%)	4 (25.0%)	
Age (months)	6-12	16 (80.0%)	18 (40.9%)	8 (50.0%)	0.0135
	13-24	4 (20.0%)	14 (31.8%)	2 (12.5%)	
	25-36	-	12 (27.3%)	6 (37.5%)	
Socio-economic status	Poor	6 (30.0%)	7 (15.9%)	2 (12.5%)	0.3878
	Middle	12 (60.0%)	34 (77.3%)	11 (68.8%)	
	Upper	2 (10.0%)	3 (6.8%)	3 (18.8%)	
Residential status	Rural	7 (35.0%)	29 (65.9%)	9 (56.3%)	0.0583
	Urban	13 (65.0%)	15 (34.1%)	5 (43.7%)	

Table-II. Distribution of socio-demographic characteristics with respect to Vitamin D status in healthy children (N=80)

Parameters		Severe Deficiency (n=20)	Deficiency (n=44)	Sufficiency (n=16)	P-Value
Hypocalcaemia	Yes	20 (100%)	38 (86.4%)	6 (37.5%)	<0.0001
	No	-	6 (13.6%)	10 (62.5%)	
Hyperphosphatemia and raised Alkaline Phosphatase	Yes	20 (100%)	44 (100%)	4 (25.0%)	<0.0001
	No	-	-	12 (75.0%)	

Table-III. Stratification of hypocalcaemia and hyperphosphatemia and raised alkaline phosphatase level in healthy children (n=80)

DISCUSSION

There are numerous factors linked with VDD such as improper exposure to sunlight, age-related compromised synthesis of coetaneous and consumption of foods which are poor in vitamin D.[11-14] The VDD has widely spread now, affecting children as well as adults all around the world.[15] Evidences confirm that VDD is linked with other likelihood morbidities including diabetes mellitus (both types 1 and 2), cardiovascular disease, and malignancy, involving intestine and prostate in particular.[16,17] Consumption of the supplements containing vitamin D helps to improve strength of the muscle and prevents falling, bringing its percentage down to 50%.[18]

In our study from Southern Punjab area of Pakistan, we came across a very high percentage of healthy children (80.0%) presenting VDD. These findings are very similar to a study conducted in Sri Lanka among apparently healthy children where the researchers found that 78% children had VDD.[19] A study done by Roh YE et al from Korea revealed that 59.1% children between 6-12 years of age had VDD.[20] A study done by Bustillo JM et al revealed that 66% of the children were found to have VDD.[21] A study by Shaka MF et al in apparently healthy children noted that 50.1% children had VDD.[22] All these studies show that VDD is quite high among pediatric population. More alarmingly, the present studies have shown that VDD affects vast majority of healthy children.

We did not find any significant linkage of gender with VDD but some researchers evaluating adult population in the past have shown male gender to have significant relationship with VDD.[23] Another study showed that female children are more prone to have VDD.[24] Notable inclination in the occurrence of VDD was observed in the younger age groups. Ziegler EE et al analyzing breastfed infants showed that infants were most affected with VDD.[25] Another study shared that 76% breastfeeding infants had VDD.[19] All these studies show that younger age groups among pediatric population might be exposed to more risk of VDD but the exact etiological mechanism is yet to be revealed.

A study done by Heaney RP et al[26] shared that there exists no relation between levels of 25 (OH) vitamin D and serum calcium levels but our findings revealed that hypocalcaemia was significantly more common among children who

had VDD. A study done by Mansour et al showed positive correlation between VDD and increased ALP levels which is quite consistent with our findings.[27]

Being a single center study on a limited number of children are some of the limitations of this study. Being a cross-sectional study, we could not follow up these children. Selection bias could be another limitation during sample selection as we did not clinical assessed and labeled study subjects as healthy.

CONCLUSION

The frequency of vitamin D deficiency was very high among healthy children visiting a tertiary care health facility of Punjab, Pakistan. Younger age groups had significant association with the occurrence of vitamin D deficiency.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Muhammad Faisal	Study concept, Study design, Discussion, Data analysis, Drafting.	
2	Sajid Mustafa	Methodology, Data Analysis, Discussion, Proof reading.	
3	Muhammad Yasin	Literature Review, Discussion, Data Analysis.	
4	Jovaria Saeed	Data collection, Data interpretation, Introduction, Literature review, Discussion.	