

Assessment of Nutritional Status for Identifying Nutritional Rickets in Children Less Than Five Years of Age

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ABSTRACT

Aim: To assess the nutritional status for identifying nutritional rickets in children less than five years of age.

Study design: Prospective study

Place and duration of study: Department of Medicine Paediatrics, Arif Memorial Teaching Hospital Lahore from 1st April 2021 30th September 2021.

Methodology: Sixty children suffering from rickets were enrolled. Blood sample 3cc was taken from each child and serum was separated by centrifugation. The serum was stored at -20°C until analysis. Biochemical tests including 25-OH vitamin D3, serum calcium and alanine phosphatase were done. The radiological imaging (X-ray) pictures completely demonstrated the rickets status. Demographical information, age, body mass index of each child was documented on a well-structured questionnaire. Food frequency charts related to vitamin D rich foods as well as calcium rich diet was used for assessing the nutritional status of children.

Results: The mean age of the children was 3.5±1.9 years. The clinical symptoms of the enrolled children showed that sweating was most common symptoms in all sixty children suffering from rickets. Forty-eight percent cases were under weight and stunting was presented in 73% while wasting was observed in 23% of the cases. The radiological x ray imaging showed Cupping of the bones was presented in 51% of the cases followed by wrist widening in 24%. The food frequency results also presented similar findings in which serum calcium was observed inadequate in 86.6% of cases while ALP and vitamin D3 was inadequate in 90% and 100% of cases respectively.

Conclusion: Vitamin D status of Pakistan children was very alarming as 100% of the cases was vitamin D deficient. Calcium deficiency was also significantly associated with nutritional rickets.

Keywords: Nutritional rickets, Vitamin D deficiency, Geological location, Bone deformities

INTRODUCTION

Rickets is a disease which results in insufficient bone mineralization effecting bone health and growth.¹ The bones of a rickets child are not able to grow properly due to lack of mineralization in them as a result they cannot be properly calcified and becomes twisted as they grow due to weight of the child.² Rickets is a global issue however its prevalence is much higher in developing and under developed countries where notational deficiencies are much higher. There are various types of rickets including vitamin D dependent rickets, vitamin D resistant rickets and nutritional rickets. The nutritional rickets is caused by the lack of vitamin D and calcium inside the growing body.³ Bone defects are common in rickets accompanied with severe pain in the bones, convulsions or delay in development of a child.

Countries which are far from the equator are also deficient in vitamin D due to lack of UV light which initiates vitamin D production in the skin. Therefore such countries have only source of gaining vitamin D from their nutrition. Places which are deficient in vitamin D and calcium nourishing food are hit at the highest with nutritional rickets^{4,5}. Children suffering from nutritional rickets required supplementation of vitamin D as well as calcium mineral for their health betterment and treatment. However, if the required supplementation is not provided then it can lead into permanent deformity of the bones⁶.

The list of the foods which provides rich amount of vitamin D in them is very limited. Fish, mushrooms have high dose of vitamin D in them while foods like eggs, milk, cheese, liver, meat has a comparatively reduced but required amount of vitamin D and calcium in them^{7,8}. Breast milk has also got low content of vitamin D present in it but as infant feeds on it for a longer period resulting in this to be an important source of vitamin D nutrition.

In Pakistan almost 2.25% children suffer from rickets. Areas of Pakistan which are at the northern side are poorer in vitamin D as there is less UV rays as well as lack of nutritional support. Mothers have also been reported to wrap children in a cocoon from

which results in lack of skin exposure towards UV rays significant for vitamin D production⁹⁻¹².

The present study was designed to assess and identify the nutritional status of children and its role on formation of nutritional rickets. The results of this study will provide significant findings in improving child health by identifying the main nutritional deficiency factors related to formation of nutritional rickets.

MATERIALS AND METHODS

This prospective study conducted in the Department of Medicine Paediatrics, Arif Memorial Teaching Hospital Lahore from 1st April 2021 30th September 2021 after IRB permission. A total of 60 children suffering from rickets were enrolled. The age of the children was below five years. They were enrolled after complete clinical and physical examination for confirmation of nutritional rickets. The clinical symptoms of nutritional rickets involved reoccurring lower respiratory-tract infections, convulsion, delay in development and growth, chronic condition of diarrhea, high bone fracture tendencies and poor weight-gain. Children having renal rickets, hypocalcemia were excluded from the study. This study was approved from ethical review committee before its initialization. The sample size was considered as 60 after considering 2.25% prevalence of nutritional rickets in Pakistan with a confidence interval of 95% and margin of error as 5%. Each child parent or guardian was asked to sign a written consent of participation before enrolment of the child as participant of the study. Blood sample 3cc was taken from each child and serum was separated by centrifugation. The serum was stored at -20°C until analysis. Biochemical tests including 25-OH vitamin D3, serum calcium and alanine phosphatase were done. The radiological imaging (X-ray) pictures completely demonstrated the rickets status. Demographical information, age, body mass index of each child was documented on a well-structured questionnaire. Food frequency charts related to vitamin D rich foods as well as calcium rich diet was used for assessing the nutritional status of

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children. The vitamin D intake was calculated in terms of international unit present in 1 gram of a food. The total amount of grams of specified food taken within seven days was then calculated. Data was entered in SPSS version 26.0 and was analyzed by frequencies and percentages and chi square test with 0.05 p value of significance.

RESULTS

The clinical symptoms of the enrolled children showed that sweating was most common symptoms in all sixty children suffering from rickets. This was followed by delay in teeth eruption in 25% of children and wide anterior fontanel opening as well as respiratory infections in 23.3% of the effected children (Table 1).

Forty eight percent cases were under weight and stunting was presented in 73% while wasting was observed in 23% of the cases. The mean age of the children was 3.5±1.9 years with majority of them between the age of 3-5 years. The distribution of gender showed that 39 cases such as 65% were boys while 21 cases were of girls with a 35% weightage. Rural area cases were higher in number than the urban areas cases (Fig. 1).

The radiological x ray imaging showed Cupping of the bones was presented in 51% of the cases followed by wrist widening in 24% of the enrolled nutritional rickety cases. Fraying was only observed in 8% of the enrolled cases (Fig. 2).

The biochemical variables as serum calcium, ALP and vitamin D results showed that mean calcium level was decreased in children and same was the case with the 25(OH) vitamin D3. The food frequency results also presented similar findings in which serum calcium was observed inadequate in 86.6% of cases while ALP and vitamin D3 was inadequate in 90% and 100% of cases respectively (Table 2).

The exposure to sunlight showed that rural children were more exposed to it than children living in urban regions with a significant variance between the two areas (Table 3).

Table 1: Clinical symptoms of nutritional rickets children (n=60)

Clinical Symptoms	No.	%age
Rachitic-rosary	8	13.3
Wide and opened anterior fontanel	14	23.3
Wide wrist	8	13.3
Legs bowing	8	13.3
Respiratory Infections	14	23.3
Diarrhea	6	10.0
Delay in teeth eruption	15	25.0
Thrive Failure	6	10.0
Seizures	3	5.0
Sweating	16	26.6
Petulance	10	16.6

Fig. 1: Distribution of rural and urban residents within gender and age



Table 2: Biochemical variables mean values and adequacy in children

Biochemical Variables	Blood Test	Food Frequency Assessment	
		Adequate	Inadequate
Serum Calcium (mg/dl)	8.07±0.55	8 (13.3%)	52 (86.6%)
Serum ALP (IU/L)	1219±566	6 (10%)	50 (90%)
25-OH Vitamin D3 (IU)	25.4±1.3	--	60 (100%)

Fig. 2: Radiological imaging of rickets in enrolled cases

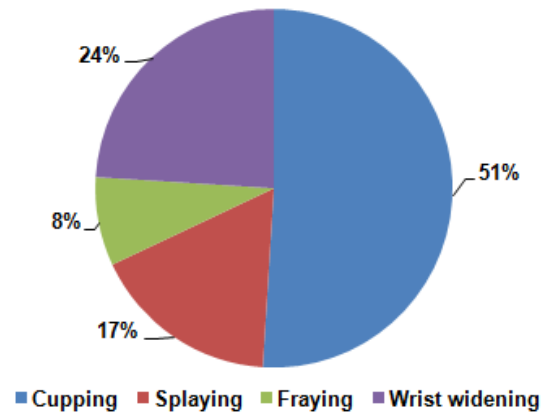


Table 3: Association of Sunlight exposure to rural and urban residence

Exposure to UV light	Urban	Rural	P value
Yes	8 (32%)	20 (57.1%)	0.03
No	17 (68%)	15(42.8%)	0.51
Total	25 (41.6%)	35 (58.3%)	0.04

DISCUSSION

Nutritional rickets appeared to be the common cause of rickets in growing children which lead to growth faltering and bone deformities. High prevalence of vitamin D and calcium has been observed in Pakistan due to various factors including geological location, lesser fortification, poor supplementation and lack of outdoor activities¹³⁻¹⁷. Pakistan is currently suffering from severe vitamin D deficiency which elevates the risk of various problems such as from mild (muscle weakness and fatigue) to even make person more prone towards cancer. Present study was designed to highlight the importance of nutritional requirements of children under the age of five.

Result of the present study highlights that, majority of the children was suffering from malnutrition. Additionally, cultural norms, lesser practice of breast feeding, inadequate awareness regarding sun exposure and lesser consumption of fortified food consumption are some of the main factors which directly or indirectly lead to nutritional rickets. Nutritional rickets most of the time leads to growth faltering and stunted growth in children. In this study, 48% of the children were underweight and stunted growth was observed in 73% of the children. This highlights the dire need of cost effective treatment plans and requirement of fortified food in developing regions of the world¹⁸⁻²¹.

Unhealthy and imbalanced diet could be the main contributing factor for nutritional rickets. Incidence of calcium deficiency was very high in present study. Almost 89% of the participants were not had satisfactory calcium level. On the other hand, biochemical analysis of vitamin D showed that not even a single child had normal vitamin D level. Result was extremely alarming and adequate measures should be taken timely to make out future generation nutritionally healthier and to prevent them from various diseases^{22,23}.

CONCLUSION

Vitamin D status of Pakistan children was very alarming as 100% of the cases was vitamin D deficient. Calcium deficiency was also significantly associated with nutritional rickets.

Conflict of interest: Nil

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