

## ORIGINAL ARTICLE

# Frequency of Nutritional Rickets in Children and Association with Iron Deficiency Anemia

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## ABSTRACT

**Background:** Nutritional rickets is a prevalent problem in developing countries. Despite extensive research the exact prevalence in Pakistan could not be found. Vitamin D deficiency is widespread throughout the world and is associated with rickets in children and iron deficiency anemia (IDA).

**Objectives:** Objectives of this study were to determine the frequency of nutritional rickets in children aged 6 months to 5 years and to determine the frequency of IDA in children with nutritional rickets.

**Materials and Methods:** This cross sectional study was conducted in the Children's Hospital, Lahore for 6 months. 300 children were included in the study through non probability purposive sampling technique. Informed consent and demographic information of child were taken from parents / guardian. Biochemical profile , x-ray wrist , hemoglobin, MCV and ferritin levels were done to assess rickets.

**Results:** Mean age was 25.16±17.84 months. There were 110 (36.7%) children of <1yr age, 123 (41.0%) had age between 1-3yrs and 67 (22.3%) had age between 3-5yrs. There were 145 (48.3%) male and 165 (51.7%) female children. The frequency of nutritional rickets in a sample size of 300 children was 44(14.7%). Out of 44 children with nutritional rickets, 21(47.7%) had concomitant IDA.

**Conclusion:** Nutritional rickets is a very common problem in our country and the cases that were found in this study represent a small percentage as a huge number of subclinical rickets is prevalent in our society and this number merely represents the tip of iceberg.

**Key words:** Nutritional Rickets, Iron deficiency anemia, vitamin D deficiency, bone disease.

## INTRODUCTION

Nutritional rickets is a disease that afflicts children and adolescents during times of rapid growth. It remains prevalent in developing regions of the world and rank among the most common diseases in children.<sup>(1, 2)</sup> Despite extensive research the exact prevalence in Pakistan could not be found, though in South East Asia it is about 15-18%.<sup>(2)</sup> Rickets is a disease of growing bone that is due to unmineralized matrix at the growth plate and occurs in children only before fusion of epiphysis. As the growth plate cartilage and osteoid continue to grow, it is poorly mineralized and soft which leads to thickening of growth plate.<sup>(3-6)</sup>

Vitamin D deficiency is widespread throughout the world.<sup>(7, 8)</sup> Vitamin D deficiency early in life is also classically associated with rickets and iron deficiency anemia (IDA).<sup>(9, 10)</sup>

IDA is prevalent nutritional problem globally (43%) and 65% of children aged 7m-5yrs are suffering from IDA according to Pakistan National Nutrition Survey.<sup>(11)</sup> We aim to measure the magnitude of nutritional rickets in healthy children from general population and the relationship with

iron deficiency anemia as no data is available in our country regarding frequency of these two nutritional problems together.

## OBJECTIVES

Objectives of this study are:

1. To determine the frequency of nutritional rickets in children aged 6 months-5yrs age group
2. To determine the frequency of iron deficiency anemia in children with nutritional rickets.

## MATERIALS AND METHODS

This cross sectional study was conducted in The Children's Hospital, Lahore for 6 months from 08-11-2012 to 08-05-2013 . Sample size of 300 cases was calculated with 95% confidence level, 3% margin of error and taking percentage of nutritional rickets i.e. 6.8% from a study conducted in Turkey.<sup>(12)</sup> Children were included in the study through non probability purposive sampling technique. Informed consent and relevant information was collected in a specially designed proforma from parents/guardians. Serum calcium, phosphate and Alkaline phosphatase were done in

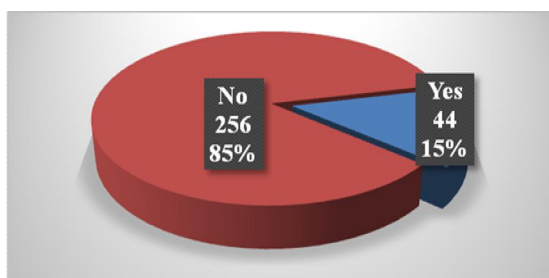
all patients and reports were reviewed by pathologist. The hemoglobin, MCV and ferritin levels were done in patients with nutritional rickets and reviewed by pathologist to diagnose IDA. Nutritional Rickets was defined as a disease of growing bone, occurring in children only before fusion of epiphysis and confirmed by low serum calcium (N:8.8-10.8mg/dl) and raised serum alkaline phosphatase levels(N:231-300U/l) and suggested x-ray findings.. Iron deficiency anemia was defined as Hb<11g/dl, MCV<70fl and serum ferritin <12µl .All data collected were entered and analyzed through SPSS version 20. Mean ±S.D was calculated for quantitative data like age, requery and percentages were calculated for gender, nutritional rickets and IDA.

## RESULTS

The mean age of children included in this study was 25.16±17.8 months (about 2 years). There were 110 (36.7%) children of <1yr age, 123 (41.0%) had age between 1-3yrs and 67 (22.3%) had age between 3-5yrs. There were 145 (48.3%) male and 165 (51.7%) female children with the male-to-female ratio of 1:1.13. Nutritional rickets was observed in 44 (14.7%) neonates. Among all neonates, 21 (47.7%) were confirmed to have concomitant IDA. Nutritional rickets were more common in male neonates as compared to females.

**Table 1:** Demographic characteristics of children

Demographic Features	Mean±SD / n (%)
Age (months)	25.16±17.84
<1 year	110 (36.7%)
1-3 years	123 (41.0%)
>3 years	67 (22.3%)
Sex (male/female)	145 (48.3%) / 165 (51.7%)



**Figure 1:** Frequency distribution Nutritional Rickets

**Table 2:** Frequency distribution of IDA with and without rickets

		Nutritional Rickets		Total
		Yes	No	
IDA	Yes	21	0	21
	No	23	256	279
Total		44	256	300
p-value		0.000	Significant	

**Table 3:** Distribution of nutritional rickets and IDA in different age groups and genders

		Nutritional Rickets	IDA
Age groups	6m-1yr	20†	9†
	1yr-3yr	14	9
	3yr-5yr	10	3
Male		27†	16 □
Female		17	5

† = Insignificant (p-value>0.05) among different age groups

□ = significant (P-value<0.05) between both genders

## DISCUSSION

In our study a total of 300 children were included and the frequency of nutritional rickets was found to be 14.66%. The frequency of nutritional rickets was increased from 2.25%-74% from period of 2001 to 2010.<sup>(2, 13)</sup> Exact prevalence in Pakistan is not known but in South-East Asia it was found to be 15-18%.<sup>(14)</sup>

According to National Nutrition Survey published in 2011, 33.4% children were suffering from IDA.<sup>(11)</sup> In our study 47.7% of children with nutritional rickets were suffering from IDA. The association between iron deficiency and rickets was reported by Grindulis et al., in 1986 in Asian immigrants in England.<sup>(12)</sup>

In Sudan, 79% were anemic,<sup>(13)</sup> however, in contrast among immigrants in England<sup>(12)</sup> and findings in a previous study,<sup>(14)</sup> most of the rachitic infants were otherwise well nourished.

In humans, there is no known study regarding the long-term adverse effects of concurrent ID and VDD. As the final hydroxylation of vitamin D is dependent on iron, iron-deficient rats had lower concentrations of the active form of vitamin D. Diaz-Castro et al., also reported that bone

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metabolism was impaired despite normal 25(OH)D levels in iron-deficient rats.<sup>(15)</sup> A study of Asian infants aged  $\leq 2$  years showed a significant association between coexisting ID and VDD.<sup>(16)</sup> Similar findings were also observed in recent Korean studies revealing that a coexisting VDD frequently accompanies ID.<sup>(17)</sup> Therefore, VDD evaluation is needed for pediatric patients with ID and vice versa.

Vitamin D deficiency or nutritional rickets in children is almost eliminated in the industrialized countries by prophylactic means.<sup>(18)</sup> However, it remains major health problem in under developed countries of Asia.<sup>(19-21)</sup> Several studies have assessed vitamin D deficiency rickets in Pakistani children.<sup>(22-24)</sup> High incidence of sub-clinical rickets in immigrant's children have been reported in Denmark (46% in  $< 9$  years).<sup>(25)</sup> Nutritional rickets is also reported from Tehran and some other Arab countries.<sup>(26, 27)</sup> However, despite the availability of vitamin D and demonstration of its efficacy in preventing rickets, vitamin deficiency rickets still exists as a public health problem with significant morbidity. In many countries, there are reports of a high prevalence of subclinical vitamin D deficiency in children and adolescents and clinical rickets may merely represent the tip of the iceberg.<sup>(28)</sup>

### CONCLUSION

Nutritional rickets is a very common problem in our country. Children with nutritional rickets are more prone to have a concomitant IDA. These two nutritional disorders cause significant morbidity in children. Therefore, every child with nutritional rickets should be screened for IDA and educational efforts are needed for prevention strategies and increasing compliance regarding iron and vitamin D supplementation.

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