

## ORIGINAL ARTICLE

# RICKETS IN BREAST-FED INFANTS BELOW SIX MONTHS OF AGE WITHOUT VITAMIN D SUPPLEMENTATION IN TEHRAN

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### Abstract

**Background and Objectives**-Although breast-feeding is highly appraised and widely practiced in Iran, human milk supplies all necessary nutrients except a few including vitamin D. Despite abundance of sunshine, vitamin D deficiency rickets is not rare in Iran.

**Methods**-In a retrospective study, the medical records of all patients with rickets admitted to Bahrami Children's Hospital in a 16-year (March 1982-1998) period who were below 6 months of age and not receiving vitamin D supplementation, were reviewed.

**Result**-Forty-one cases of rickets less than 6 months of age without a history of vitamin D supplementation were detected. Convulsion was the most common presenting feature. Rachitic rosary and widening of the wrists were present in one-third of the cases while a quarter showed craniotabes. Ninety-five percent of the patients belonged to the lower socioeconomic class. Vaccination was not performed or was delayed and incomplete in 21 cases.

**Conclusion**-Early occurrence and presence of rickets in breast-fed infants below six months of age with no vitamin D supplementation is documented in Iran. Health professionals should be informed of this risk and should supervise the oral administration of vitamin D in breast-fed infants and other measures, including sunlight exposure and vitamin supplementation in lactating mothers, should be encouraged.

**Keywords** • Breast-feeding • rickets • vitamin D

### Introduction

Vitamin D deficiency rickets is preventable in children and has been almost eliminated among infants and children in the industrialized countries by prophylactic means.<sup>1</sup>

Although breast-feeding is a highly appraised practice and is widely promoted in Iran, human milk supplies all necessary nutrients except a few including vitamin D. Malnutrition in the mother and dark skin in the infant increase the risk of this disease.<sup>2</sup> The resurgence of nutritional rickets associated with unsupplemented breast-feeding has been reported and apparently this feeding practice

is no guarantee for rickets prevention.<sup>3</sup>

### Materials and Methods

In a retrospective study, the medical records of all children with rickets, aged less than six months and receiving no vitamin D supplementation, who were admitted to Bahrami Children's Hospital in a 16-year period (March 1982-1998) were reviewed.

The patients were provisionally admitted by medical house officers at the outpatient department and further investigations including laboratory enquiries were carried out under the supervision of a pediatric consultant, who made the diagnosis of vitamin D deficiency rickets.

Data pertinent to age, sex, nutritional status, consumption of vitamin supplements, season of

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referral, parental socioeconomic status, physical growth and developmental milestones, vaccination status, features of respiratory or intestinal tract infections, presenting symptoms and clinical signs of rickets (including craniotabes, rachitic rosary, thickening of the wrists and ankles, size of the anterior fontanel and caput quadratum), were collected.

Data on serum calcium, phosphorus, alkaline phosphatase, hemoglobin, sodium, potassium, blood urea and blood sugar were available in most infants; calcium, phosphorus and alkaline phosphatase were measured by calorimetric methods.

The diagnosis of rickets was confirmed by a trained pediatric radiologist based on the wrist radiograms considering the classical findings of rickets (widening, cupping, fraying and increase in the space between the distal ends of the ulna and radius and the metacarpal bones).

### Results

From a total of 140 cases of rickets admitted over a 16-year period, 41 cases were less than six months of age at the time of admission and had not received any kind of vitamin D supplementation. Their mean age was  $4.87 \pm 1.12$  months and the male to female ratio was 27:14. The mean  $\pm$  SD of their height, weight and head circumference was  $64.35 \pm 4.5$  cm,  $6.64 \pm 1.40$  kg and  $42.3 \pm 1.87$  cm, respectively. Twenty-five cases (61%) had exclusive breast-feeding and in 16 cases (39%) breast-feeding was the predominant mode of nutrition. Vaccination was complete in 17 infants (44.7%) while incomplete and no history of immunization was obtained in 10 (26.3%) and 11 (28.9%) cases respectively. Most of the cases (32 cases or 78%) presented in winter and almost all were of a low or lower-middle socioeconomic status.

Some important clinical features in our patients are represented in Table 1. As shown in this table, rachitic rosary and widening of the wrists were the most frequent findings in the physical examination, convulsion was the most common presenting symptom (87.5%) and the mean  $\pm$  SD serum calcium concentration was  $6.39 \pm 0.9$  (Table 2).

Table 2 summarizes some important biochemical indices of rickets in our series at the time of admission and after treatment. Unfortunately, the alkaline phosphatase level was not recorded in all patients but was elevated in 31

**Table 1.** Important clinical features of rickets in this study.

Clinical feature	Frequency (%)
Weight below 5 <sup>th</sup> percentile	4/41 (9.75)
Fever	13/41 (31.7)
Rachitic rosary	30/41 (73.17)
Widening of the wrists	27/41 (65.85)
Craniotabes	24/41 (58.53)
Large anterior fontanel	15/39 (38.46)
Caput quadratum	4/41 (9.75)
Convulsion	36/41 (87.80)
URTI †	12/41 (29.26)
LRTI ‡	2/41 (4.87)
Gastroenteritis	5/41 (12.19)
Anemia	11/38 (28.94)

† Upper respiratory tract infection

‡ Lower respiratory tract infection

patients (75.5%).

### Discussion

In spite of the large amount of sunshine, rickets remains to be a common disease in children in Tehran. In a series of 82 wrist X-rays performed for children under 5 years of age admitted to a hospital in Tehran, signs of rickets were reported in 15% of the cases.<sup>4</sup> In another study, around 10% of the total 200 cases of rickets reported in 1975 in Tehran were under six months of age.<sup>3</sup> In our 140 cases of rickets, 29% were below this age. These figures are similar to other third world statistics. For instance, in Beijing, China, 11% of breast-fed infants have radiologically proven rickets and 20% may have a low vitamin D status.<sup>5</sup>

The true incidence and prevalence of rickets in the residents of Tehran is not known. Rickets develops particularly during the periods of rapid growth<sup>2</sup> and such growth may predispose the infant to vitamin deficiency. In our series only 4 infants weighed below the 5th percentile in comparison with NCHS standards (Table 1).

Milk provides as little as 10 IU of vitamin D/day in winter and 20 IU/day in the summer.<sup>3</sup> The lower amount of vitamin D content of breast milk during the winter and early spring seasons, and the lesser opportunity of infants to receive sunshine exposure, explains the occurrence of 32 cases of rickets in winter. In a report of 10 cases of rickets in breast-fed infants, 9 occurred in winter and early spring.<sup>3</sup> Specker<sup>6</sup> has documented seasonal variation in serum 25-hydroxy vitamin D in

**Table 2.** Biochemical indices of rickets in this series of our study.

Biochemical index	Value
Calcium (mg/dl) on admission	6.39±0.9 (n=41)
Calcium (mg/dl) after treatment	9.9±0.7 (n=37)
Phosphorus (mg/dl)	4.59±0.88 (n=37)

exclusively breast-fed infants younger than six months of age. These changes are directly related to ultraviolet light exposure.

Ninety-five percent of our patients belonged to the lower-middle socioeconomic class. Specker confirms the previous reports which indicate that the increased incidence of rickets among infants from the lower socioeconomic classes is probably due to the decreased amount of time spent outdoors.<sup>6</sup> The decreased exposure to ultraviolet radiation and the consumption of milk or other food containing inadequate amounts of vitamin D, may explain this increase in the lower socioeconomic groups.

In 21 cases, vaccination was not done or was delayed. Edidin reported 10 cases of rickets in unsupplemented breast-fed infants; in 8 cases vaccination was not performed.<sup>3</sup> A history of incomplete immunization, although not causally related, may offer a clue to low nutritional state and lack of proper infant care.

In a previous report from Iran, in a series of 200 children admitted to a children hospital with radiographically proven rickets, 43% had bronchopneumonia.<sup>4,7</sup> In our study, this figure was 31.7% (13 cases). Studies have shown that the hormonal form of 1.25 dihydroxyvitamin D3 modulates phagocytosis and the functions of the T and B lymphocytes.<sup>7</sup> These immunological and physiological changes may be responsible for the higher incidence of respiratory tract infections in these infants.<sup>7</sup>

In conclusion, pregnant and lactating women should receive vitamin D supplementation.<sup>2, 8</sup> and

rickets in breast-fed infants can be prevented by oral administration of vitamin D. Vitamin D supplementation (400 IU/day) of breast-fed infants is recommended by pediatric authorities.<sup>2</sup> In recent years, we have witnessed a major increase in the incidence and duration of breast-feeding. If breast-feeding is unsupplemented with adequate amounts of vitamin D, one may expect an increase in the incidence of rickets in such breast-fed infants.<sup>1,3</sup> Physicians and pediatricians should supervise the daily oral administration of vitamin D and sunlight exposure in breast-fed infants<sup>1,2,8</sup> as prophylactic measures.

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