

# Retrospective analysis of prevalence of rickets and associated factors among children admitted to pediatric ward in jimma university specialized hospital

## Abstract

**Background:** Rickets is the disease of growing bone that is unique to children and adolescents. It is caused by a failure of osteoid to calcify in growing person. It commonly occurs due to inadequate sunshine exposure, vitamin D deficiency, dietary deficiency of calcium and phosphorus. It is highly prevalent in Ethiopia in about 41% of children with five years and below with frequent combination with protein energy malnutrition and infectious diseases.

**Objective:** to assess the prevalence of rickets and associated factors among children admitted to pediatric ward of Jimma University specialized hospital from May 1, 2010 to April 30, 2013.

**Methods and materials:** A facility based cross sectional retrospective analysis of patients' record with rickets admitted to pediatric ward of Jimma University Specialized Hospital from May 1, 2010 to April 30 2013 was conducted and data were collected using structured questionnaire by trained five data collectors and analyzed using SPSS version 16, chi-square test was used to test association between variables with confidence interval of 95% and the association accepted as significant if p-value is <0.05. Data were presented by using texts, tables and figure.

**Results:** A total of 170 rachitic children were studied from total of 1620 admitted children revealing 10.5% of rickets prevalence rate. Type of breast feeding ( $X^2 = 24.99$ ,  $P < 0.001$ ), duration of breast feeding ( $X^2 = 6.19$ ,  $P = 0.013$ ), time of complementary food introduction ( $X^2 = 24.99$ ,  $P < 0.001$ ) and in adequate sunshine exposure ( $X^2 = 82.4$ ,  $P < 0.001$ ) were factors that are associated with Rickets.

**Conclusion and Recommendation:** The prevalence of rickets was high and associated with type and duration of breast feeding, time of complementary food introduction and in adequate sunshine exposure indicating the need for Health education on sunshine exposure and breastfeeding issues.

**Keywords:** rickets, prevalence, associated factors, children

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## Introduction

Rickets is a disease of growing bone that is unique to children and adolescents. It is caused by failure of osteoid to calcify in a growing person. Failure of osteoid to calcify in adult is called osteomalacia.<sup>1</sup> Vitamin D deficiency rickets occur when the metabolites of vitamin D are deficient. Less commonly, dietary deficiency of calcium and phosphorus may also results in rickets. Vitamin D<sub>3</sub> (cholecalciferol) is formed in the skin from derivative of cholesterol under the stimulus of ultraviolet B light. Ultraviolet B light or cod liver oil was the significant sources of vitamin D until early in the 20<sup>th</sup> century when ergosterol (vitamin D<sub>2</sub>) was synthesized from irradiated plant steroids. During the industrial revolution, rickets appeared in epidemic form in temperate zone where the pollution from factories blocked the sun's ultraviolet rays. Thus rickets was probably the first childhood disease caused by environmental pollution.

Natural nutritional source of vitamin D are limited primary to fatty ocean going fish, dairy milk fortified with vitamin D (400IU/L) human milk contains little vitamin D generally less than 20-40IU/L. Therefore, infant who are breast fed are at risk for rickets, especially those who have darkly pigmented skin, which blocks penetration of ultra-

violet light.<sup>2</sup> Rickets usually manifested by frontal bossing, cranio-tabes, delayed closure of fontanelles, knobby deformities, bowlegs, knocked knee, Harrison's groove, rachitic rosary and others.<sup>3</sup> Usually rickets is difficult to reverse once it occur but we can avoid further complication by vitamin D (600,000IU stat) supplementation and prevent by early exposure to sunshine and giving vitamin D rich diet for breast feeding child and pregnant ladies if possible all reproductive age group women.<sup>4</sup>

In Britain 30% of immigrants from Indian subcontinent and the West Indies were found to have rickets and the figure rise to 74% when biochemical findings were included in the study.<sup>5</sup> Rickets is quite prevalent in Ethiopia and 41% of children age five year and less than their age and is commonly associated with protein energy malnutrition, infectious diseases of various cause including respiratory tract, anemia, congestive heart failure and gastrointestinal tract risk recurrent diarrhea and mal absorption.<sup>6</sup>

## Aim

The aim of this study is to determine the prevalence of rickets and associated factors in children admitted to Jimma University specialized hospital from May 1, 2010 to April 30, 2013.

## Methods and materials

### Study Setting and Participants

The study was conducted in JUSH pediatric ward which is located in Jimma town, 352 km southwest of Addis Ababa, the capital city, from April 1 to 30, 2014. Retrospective analysis of the patient records was conducted by revising the clinical charts of patients admitted to pediatrics department of JUSH with rickets from May 1, 2010 to April 30, 2013. The source populations are all pediatric patients admitted to JUSH during May 1, 2010 to April 30, 2013 and study populations are all patients diagnosed to have rickets and admitted to the pediatrics department of JUSH during the abovementioned period.

### Data collection process

Chart of patients admitted with rickets at pediatric ward of JUSH from May 1, 2008 to April 30, 2013 were revised to extract relevant data using structured data collection format. Data was collected by trained nurses. The questionnaires contain socio demographic characteristics of the mothers/ care givers and children, dietary habit and clinical factors. The dependent variable was prevalence of Rickets while the independent variables included socio demographic, dietary related and clinical variables.

### Data analysis

Data were analyzed using SPSS version 16 statistical software. Chi-square test were used to test the association at 95% confidence interval and P- value of <0.05 was considered as a cut-off point for statistical significance and presented using tables, graph and descriptions.

### Ethical consideration

Ethical Clearance was obtained from Ethical Review Committee of Jimma University and Jimma University Specialized Hospital and the confidentiality of the information was kept.

## Results

### Distribution of rickets among children by socio demographic characteristics

170 rachitic children who were admitted to pediatric ward of JUSH from May 1, 2010 to April 30, 2013 were studied for prevalence of rickets over a period of three years from 1620 children admitted to pediatric ward revealing about 10.5% prevalence rate. There was no significant sex difference with females 49.4% and males 50.4%. Out of them, 97.6% were within the age range from 3-24 months, while the remaining 2.4% of them were in the age range from 25-59 months of age. No cases were observed in infants under 3 months of age and above 59 months of age. Majority of children were ordered as 4<sup>th</sup> and 5<sup>th</sup> birth order 41.8% followed by 2<sup>nd</sup> and 3<sup>rd</sup> 33.9% as indicated in Table 1. No rachitic children labeled as the first birth order. The children who were exposed to sunlight were 66(38.8%) and majority of children were exposed sunlight on weekly basis 38(57.6%) followed by 2-3 days/week, 27(40.9%) (Table1).

### Dietary factors

A total of 91(58%) were breastfed for one year or less and 66(42%) were breastfed for more than one year. Rickets was also found to be higher among children even with longer duration of breast feeding with  $X^2=6.19$  and  $P=0.013$ . The majority received their complementary feeding after six months 99(58.2%) and the rest 71(41.8%) re-

ceived before six months of age. Significant association was found between prevalence of rickets and time of starting complementary feeding with  $X^2=24.99$  and  $P=0.000$  indicating that early introduction of complementary food has a protective effect against rickets. Significant association was observed between rickets and sun shine exposure status with  $X^2=82.4$  and  $p=0.000$  indicating rickets is more likely to occur in children with no sun shine exposure. Significant association was observed with  $X^2=17.01$  and  $p=0.000$  indicating rickets prevalence increases among children as frequency of sunlight exposure decreases (Table 2).

**Table 1** Distribution of rickets in children by social and demographic characteristics in Jimma University Specialized Hospital, Jimma, South West Ethiopia, April 2014

S. No	Variables	Prevalence of rickets		
		Frequency	Percentage	
1	Age of children	3-24 month	98	57.6
		25-59month	72	42.4
		total	170	100
		male	86	50.6
2	Sex	female	84	49.4
		total	170	100
		1st	21	12.3
		2nd and 3rd	58	33.9
3	Order of the child	4th -5th	71	41.8
		>6th	30	18
		total	170	100
		yes	66	38.8
4	Exposure to sun light	no	104	61.2
		total	170	100
		daily	1	1.5
		2-3 days/w	27	40.9
6	Exposure frequency	weekly	38	57.6
		total	66	100
		<1 hour	46	70
		>1 hour	20	30
7	Sunlight hours	total	66	100

### Distribution of rickets among children with clinical conditions

Concerning clinical condition widening of wrist was found in 69% of cases at all age groups and all cases that had craniotabes were under 6 months of age, while the frequencies of other physical signs were variable (Figure 1). As indicated in table below from the total of 170 studied rachitic children, 58% were also diagnosed to be under weight, while other 23% were marasmic, and other 12% were diagnosed to have kwashiorkor and 34.7% were anemic (Table 3).

## Discussion

Nutritional rickets remains a major health problem for children in many regions of country including Ethiopia. Its etiology and pathogenesis is thought to be multi factorial.<sup>1</sup> This study revealed that rickets is prevalent among studied children with prevalence rate of 10.5%. This is almost the same to the result obtained by a case control study conducted in Addis Ababa at Ethio-Swedish children's hospital.<sup>7</sup> This study found that there is significant association between rickets and sunshine exposure status ( $p=0.000$ ) indicating higher prevalence of rickets in children with no sun shine exposure which is comparable

with a case control study carried out in Kuwait. This is because vitamin D production in the skin is by product of sun shine exposure.<sup>8</sup>

This study also revealed that breast feeding (p=0.000) and duration of breast feeding (p=0.013) were associated with rickets indicating higher prevalence among children who breastfed exclusively and for longer duration. This finding is similar to the result of a study carried

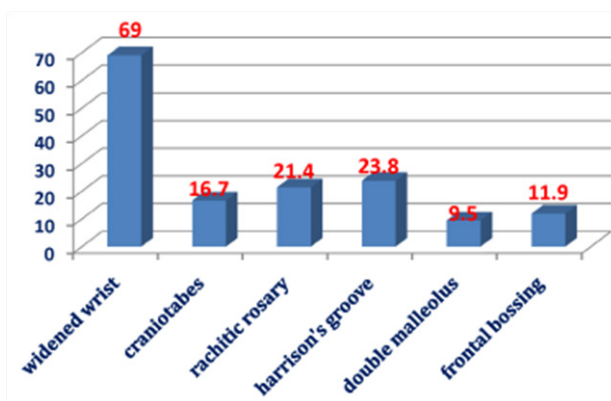
out in Vander-berg to assess prevalence of rickets in infant. This can be attributed to that exclusively breast fed children and children breast fed for longer duration are more likely to not feed other sources of Vitamin D like fishes, milk and eggs and also human milk contains a vitamin D concentration of <25IU/L making it a low source of vitamin D.<sup>9</sup>

**Table 2** Association between prevalence of rickets and different dietary and social factors of children in Jimma University Specialized Hospital, Jimma town, South West Ethiopia, June, 2014

S. No	Variables	Prevalence of Rickets		X2	p	
		Frequency	Percentage			
1	Type of breastfeeding	Exclusive	138	81.2	24.99	<0.001
		Nonexclusive	32	18.8		
		Total	170	100		
2	Duration of breast feeding	<12 months	76	42	6.19	0.013
		>12 months	91	58		
		Total	170	100		
3	Start of complementary	<6 months	71	41.8	24.99	<0.001
		>6months	99	58.2		
		Total	170	100		
4	Exposure to sunlight	Yes	66	38.8	82.4	<0.001
		No	104	61.2		
		Total	170	100		
5	Exposure frequency	Daily	1	1.5	17.01	<0.001
		2-3/week	27	40.9		
		Weekly	38	57.6		
	Total	66	100			

**Table 3** Distribution of rachitic children by their clinical nutritional status in Jimma University Specialized Hospital, Jimma town, South West Ethiopia, June, 2014

S. No	Variables	Frequency	Percentage	
1	Nutritional status (Anthropometry)	Marasmus	39	23
		Kwashiorkor	21	12
		Marasmic kwashiorkor	13	7
		Under weight	97	58
		Total	170	100
2	Anemic	Yes	60	34.7
		No	110	65.3
		Total	170	100



**Figure 1** Clinical presentation of Rachitic children (n=170) in Jimma University Specialized Hospital, Jimma town, South West Ethiopia, June, 2014.

Initiation time of complementary feeding was found to be associated to rickets (P=0.000) indicating less prevalence among children who started complementary feeding early. This coincides with finding from a case control study carried out in Kuwait which reported

that early introduction of complementary food has a protective effect against rickets. This can be because of delayed complementary feeding/prolonged breastfeeding may lead to a breast milk dependent child who prefers milk over complementary food which may not be solely adequate as the age of the child increases more than six months. Nevertheless, the exact age at which to introduce complementary food, duration, appropriate frequency, content and factors affecting intake of complementary food are beyond the scope of the current study and requires further investigation.<sup>8</sup>

This study also identified that most of rachitic children were presented with widened wrist which is same finding to a systematic nutritional survey carried out in Ethiopia. It may be because of it is easy sign to pick out for it is at periphery although it needs further investigation.<sup>6</sup> Protein energy malnutrition and anemia were identified as common nutritional problems in studied rachitic children which is similar to a case control study conducted at Ethio-Swedish children's hospital in Addis Ababa that reported infectious diseases, PEM, anemia and congestive heart failure as common associated conditions. This may be due to most identified associated factors like low socio economic status/care taker is also associated with other poor nutritional status of children but its assessment is beyond scope of this study.<sup>7</sup>

## Conclusion

This study found that the prevalence of rickets is high. Prolonged exclusive breast feeding, inadequate or absence of sun shine exposure, delayed initiation of complementary food were associated with rickets. Most of the rachitic children studied were presented with widened wrist and frequency for other clinical findings varies. Protein Energy malnutrition and Anemia were some of the nutritional problems identified associated with rickets in studied children.

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## Conflicts of interests

The authors declare that they have no competing interests regarding the publication of this article.

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## References

1. Curran JS, Barness LA. Nutrition. In: Behrman R, Jenson B, Kleigman R (Eds.), Nelson text book of pediatrics, W.B. Saunders Company, Philadelphia, London. 2010;:84–187.
2. Tefera B. Vitamin D deficiency. In: B Tefera (Eds.), Lecture note on nutrition, Addis Ababa, Birhanu selam. 2007:132–169.
3. Bereket A. Rickets in developing countries. In: Hochberg Z (Ed.), Vitamin D and Rickets. Karger AG, Medical and Scientific Publishers Basel, Switzerland. 2003;6:220–232.
4. Lawrence M, Gartner MD, Greer FR. Prevention of rickets and vitamin D deficiency: In New guidelines for vitamin D intake. *Pediatrics*. 2003;111(4):908–910.
5. Jellite D. Rickets in childhood. In: J Stanfield (Ed.), Diseases of Children in Tropics and Subtropics. 1979.
6. Wondale Y, Shiferaw F, Lulseged S. A systematic review of nutritional rickets in Ethiopia: status and prospects. *Ethiop Med J*. 2005;43(3):203–210.
7. Lulseged S. Severe rickets in children's hospital Addis Ababa. *Ethiop Med J*. 1990;28(4):175–181.
8. Molla AM, Badawi MH, Al-Yaish S, et al. Risk factors for nutritional rickets among children in Kuwait. *Pediatr Int*. 2000;42(3):280–284.
9. Dagnelie PC, Vergote FJ, van Staveren WA, et al. High prevalence of rickets in infants on macrobiotic diet. *Am J Clin Nutr*. 1990;51(2):202–208.