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Assessment of the factors and treatment outcomes of rickets among under five children in Tikur Anbesa Specialized Hospital, pediatric attendants.

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Abbreviations:
MAM- moderate acute malnutrition
SAM- severe acute malnutrition
SD- standard deviation
SPSS-Statistical Package for the Social Sciences

Operational definition:

- **Appropriate sunshine exposure**- exposure for 10-20minutes, mid-mornign, with no ointment and dressing.
- **Clinical features of Rickets-**An infant or child with Rachitic rosary, double maleoli, wrist joint widening, Craniotabes, Harrison's groove etc (two or more clinical features with or without radiological or biochemical evidences)
- **Severe (florid) rickets**-A child with clinical features of rickets with severe chest deformity or one or more of the complications of rickets
- **Mild-Moderate rickets**- More than three clinical features of rickets with atleast one biochemical evidences

Abstract
Background *- The increased metabolic demands together with dark skin pigmentation, low vitamin-D intake, and lack of sunlight exposure may predispose children to rickets. Lack of adequate information for the predisposing factors and treatment response appears to have negatively influenced the impact of prevention and treatment programs. Precise diagnosis, a sound understanding of the therapeutic options, and a multidisciplinary approach are essential for successful management and prevention of this metabolic problem.*
Methods*: A facility based prospective descriptive study was conducted to assess the risk factors of rickets and their responses to treatment,numbers of children presenting with clinical, biochemical and radiological features of Rickets were screened. The diagnosis of rickets was made based on a combination of clinical, radiological, and biochemical criteria, and followed for the responses to treatment. Children with rickets were treated by a single large intramuscular dose of vitamin D (600 000 IU) along with oral calcium and vitamin D containing supplements as well as advice on diet and sunlight exposure.*
Results*: In this prospective descriptive study, there were a total of 104 casesamong which 48 (46.2%) were males and the rest 56 (53.8% were females) with mean age of 13.02±10.2 months. The most commonly affected age groups accounting 31.7% of all Rickets cases is between 12-18months and great majority of the cases(75%) are from Rural areas and as family size increases, the risk of Rickets increases. Almost all (97.1%) of the children were given megadose of vitamin D, Most of the cases (77%) showed radiological improvement at 6months after treatment.*
Conclusion*: In this prospective descriptive study, 73% of children were exposed to sunlight for less than 10minutes with 76% of them were completely covered or dressed having ointments on their body, strikingly indicating that lack of exposure to sunshine due to traditional beliefs is the main cause of nutritional Rickets alerting that health education should be implemented at large in the community. The most common signs found were Rachitic rosary (83.7%), other skeletal deformities (71.2), and most associated complications being pneumonia (14.4%), Ricketic dwarfisms and pathological fractures(16.1%) and 93 children have osteopenia.*
Key words: - Causes, factors and treatment Reponses of Rickets.

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I. Introduction

Nutritional rickets contribute to the high burden of illness and death among Ethiopian children under 5 years of age. The major cause of nutritional rickets in Ethiopian children is lack of exposure to sunshine and/or inadequate intake of vitamin D. Lack of awareness and traditional beliefs are major causes for not exposing infants to sunshine. The disease is associated with poor socioeconomic status, low birth weight, malnutrition and common childhood infections. Severe form of rickets is commonly seen at about 18 months of age (1).

Clinical vitamin D deficiency, manifested as rickets, is a major public health problem. Action is urgently needed to reduce the risk of clinical vitamin D deficiency worldwide among infants, young children, pregnant mothers, and other vulnerable groups. Effective ways to do the following need to be found and implemented at the population level: 1) promote safe skin exposure to UV sunlight; 2) improve dietary intake of vitamin D; and 3) increase awareness among policy makers, health professionals, and the general public about the importance of vitamin D and prophylactic practices.

Rickets in Ethiopian perspective

Acase control study in Jimma Specialised Hospital outpatient, department showed that there was no statistically significant difference between the two groups in the mean level of calcium intake. Generally, in both cases and controls the majority of the study participants were taking calcium below the recommended daily calcium requirement of 800 mg for age group according to Food and Nutrition Board of the National Research Council(4).

The major cause of nutritional rickets in Ethiopian children is lack of exposure to sunshine and/or inadequate intake of vitamin D. Lack of awareness and traditional beliefs are major causes for not exposing infants to sunshine. The disease is associated with poor socioeconomic status, low birth weight, malnutrition and common childhood infections. Severe form of rickets is commonly seen at about 18 months of age. Rickets predisposes Ethiopian children to pneumonia. Diagnostic criteria used in most studies include two or more clinical signs and a characteristic radiological or biochemical abnormality. There are critical gaps in our knowledge about the epidemiology, ecology, and potentially effective interventions to prevent and treat rickets in Ethiopian children (6).

Most of the studies on nutritional rickets in Ethiopia have been conducted in hospital settings. There is a need for well designed epidemiological and ecological studies. The biologic basis for the striking association between malnutrition and active rickets seen in Ethiopia needs to be determined The role of calcium deficiency, the part played by genetic factors, the nature of the association between the duration of breastfeeding and rickets, and the role of complimentary feeds in Ethiopian children need to be explored. Studies are required to determine the amount of sunshine required to prevent rickets in Ethiopian infants and to establish criteria for the diagnosis of clinical and sub clinical rickets, particularly in malnourished children. Prevention programs need to be pursued consistently and systematically and treatment options, including the single massive dose of vitamin D, need to be re-evaluated and optimal mode of treatment should be determined (5).

II. Materials and Methods

A facility based prospective descriptive study was conducted to assess the risk factors of rickets and their responses to treatment.Numbers of children presenting with clinical, biochemical and radiological features of Rickets were screened. Number and gender of children, maternal characteristics, nutritional status of the children and other associated factors were included. Radiographs of wrists and/or chest, as well as serum calcium, phosphate, and alkaline phosphatase levels were determined.

The diagnosis of rickets was made based on a combination of clinical, radiological, and biochemical criteria, and followed for the responses to treatment. Children with rickets were treated by a single large intramuscular dose of vitamin D (600 000 IU) along with oral calcium and vitamin D containing supplements as well as advice on diet and sunlight exposure.Data was collected by two trained nurses who were trained for two days on how to interveiw and register data . Every questionnaire was checked by the supervisor each day for clarity and completeness with strict follow up on the process. Serum levels of biochemical parameters were determined according to standard laboratory procedures and laboratory reagent with similar batch number was used. Radiological findings were interpreted by consultant radiologist at 4months and 6months after treatment. Finally, data wasentered to EPI-INFO VERSION (3.5.3) and analyzed using SPSS (version 23.)

Ethical clearance

Ethical clearance was obtained from department research ethical committee and Addis Ababa University medical faculty college of health sciences institutional review board (IRB).Informed consent was also obtained from the caretakers after they were told that there will not be any risks and incentives by being involved in this interview.

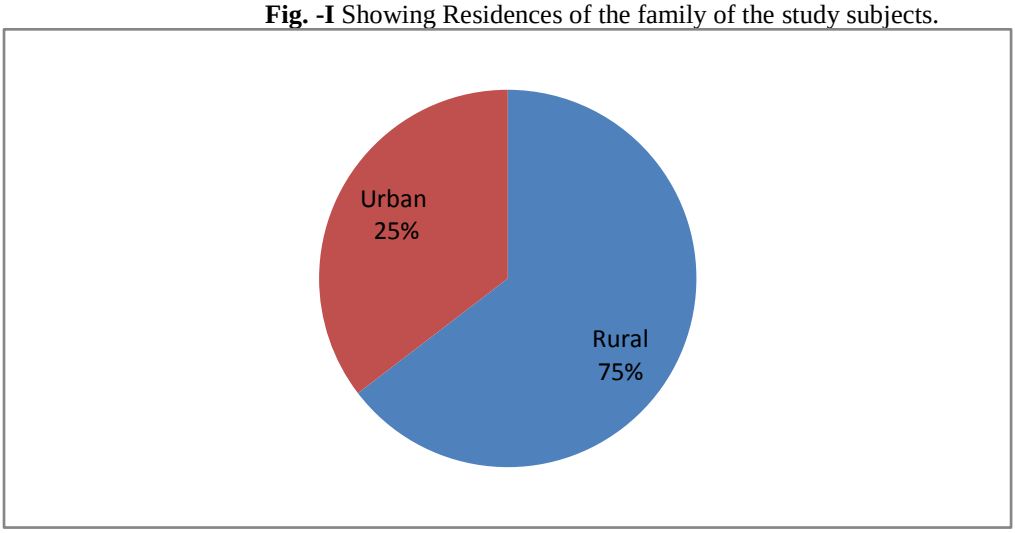
III. Results

In this prospective descriptive study, there were a total of 104 casesamong which 48 (46.2%) were males and the rest 56 (53.8% were females) with mean age of 13.02±10.2 months.
The mean height and weight of study subjects were 72.1c m(18.5SD)& 9.65 kgs (2.2SD)respectively.
The most commonly affected age groups accounting 31.7% of all Rickets cases is between 12-18months (**Table -I**), Great majority of the cases(75%) were from Rural areas and as family size increases, the risk of Rickets increases.

Table-I Showing Age and family size of the study subjects and the family.

Age in Months	Frequency	Percent
< 6	14	13.5
6-12	22	21.2
12-18	33	31.7
18-24	17	16.3
24-30	12	11.5
>30	6	5.8
Total	104	100
Family size		
< or = 3	23	22.1
4-5	60	57.7
>5	21	20.2
Total	104	100

Fig. -I Showing Residences of the family of the study subjects.



Regarding educational status and occupation of the fathers and mothers of the study subjects, most fathers (44.2%) are Diploma and above, but great majority (33.7%) of mothers can only read and write. More than half of the fathers (61.5%) are government employees, and 41.3% of mothers are housewives.
Large number of children (23.1%) and (21.2%) have SAM (severe acute malnutrition) <-3SD (Z-score) and MAM (moderate acute malnutrition) between -2 to – 3SD respectively. Rachitic rosary (83.7%) and other skeletal deformities (71.2%) are most clinical features (**Table-II**). Regarding complications, pneumonia (14.4%) and skeletal deformities (16.4%) are leading problems (**Table-II.)**

Table-II showing Clinical features and complications

Clinical symptoms		
Variables	Frequency	Percent
Rachitic rosary	87	83.7
Skeletal deformity	74	71.2
Delayed tooth eruption	17	16.3
Delayed motor development	14	13.5
Umbilical hernia	11	10.6
Enlarged head	9	8.7
Delayed anterior fontal closure	7	6.7
Complications		
Variables	Frequency	Percent
Pneumonia	15	14.4
Dwarfism or other bone deformity	17	16.3

Gastroenteritis	3	2.9
Pathological fracture	3	2.9
No complication	69	66.4

Great majority of the mothers (59.6%) were having children between one - two, and very few of them (4.5%) were having greater than five children. But, none of the mothers were supplemented with calcium or vitamin D during pregnancy. Regarding sunlight exposure time, dressing habits during sunlight exposure and feeding practices for the first 6 months, most of the children (73%) were exposed for less than 10 minutes and very few (5.8%) were getting appropriate exposure (for 10-20 minutes with no applications of ointments.) 76.9% were completely dressed (covered) and only 25.9% were on exclusive breast feeding for the first 6 months with the rest on mixed feeding patterns.

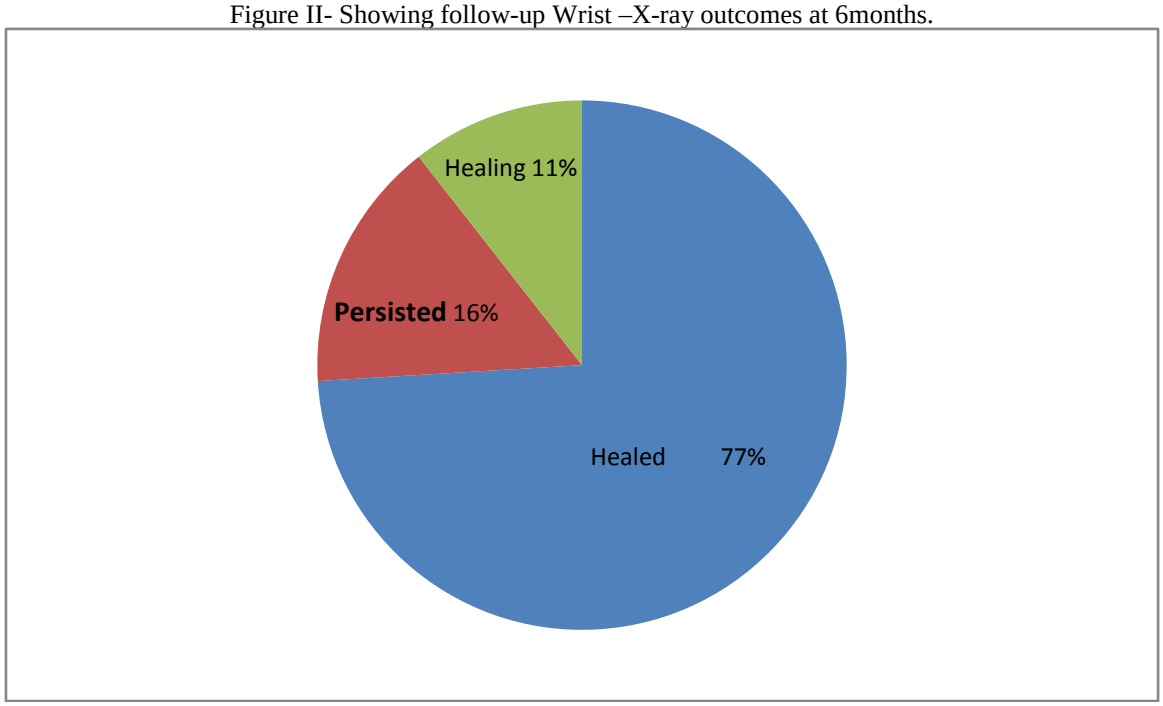
Based on treatment and treatment outcomes, almost all (97.1%) of the children were given megadose of vitamin D, and alkaline phosphatase and phosphorus were significantly raised during the initial phase (**Table-III.)**

Table-III Depicting biochemical evidences at different times and initial wrist X-ray findings.

Alkaline phosphatase			
Values	Initial (%)	at 4weeks (%)	at 6 months (%)
Elevated	98.1	98.1	96.1
Normal	1.9	1.9	3.8
Phosphorus			
Low	90.4	84.6	72.1
Normal	9.6	15.4	27.9
Calcium			
Low	27.9	22.1	72.1
Normal	72.1	79.8	22.9
Initial wrist X-ray findings			
Osteopenia	93		
Active Rickets	76		
Healing Rickets	24		
Healed Rickets	4		

Most of the cases (77%) showed radiological improvement at 6months after treatment (Fig.II)

Figure II- Showing follow-up Wrist –X-ray outcomes at 6months.



IV. Discussions and conclusions

- Nutritional rickets contribute to the high burden of illness and death among Ethiopian children under 5 years of age, the major causes being lack of exposure to sunshine and/orinadequate intake of vitamin D with lack of awareness and traditional beliefs are major obstacles for not exposing infants to sunshine. The disease is associated with poor socioeconomic status, low birth weight, malnutrition and common childhood infections.
- In this prospective descriptive study, 73% of children were exposed to sunlight for less than 10minutes with 76% of them were completely covered or dressed having ointments on their body, strikingly indicating that lack of exposure to sunshine due to traditional beliefs is the main cause of nutritional Rickets which is similar to the study done in Qatar (3) and a case control study done in Jimma specialized hospital (6) This alerts that health education should be implemented at large in the community.
- Rickets was higher among children of unemployed (41.3%) and low educational status (33.7%) of mothers with more than 75% of them coming from rural Ethiopia, which are similar to studies in Gaza strip (7) and Ethiopia, Addis Ababa university(5). None of the mothers reported that they were supplemented either with calcium or vitamin D during their pregnancy. Cognizant of this result, problem centered strategy and commitment to health education for health professionals and the community at large should be the targeted program. Calcium supplementation during pregnancy should be a routine practice and essential to make part of a curriculum. Taking more affected age groups and other risk factors in to account, prophylactic vitamin D supplementation should be integrated and started as a child hood routine activities.
- The most common signs found were Rachitic rosary (83.7%), other skeletal deformities (71.2), and most associated complications being pneumonia (14.4%), Ricketic dwarfisms and pathological fracture(16.1%) and 93 children have osteopenia. Those results are comparable with studies done in Saudi(8) and Gambia(10)
- Large number of children (23.1%) and 21.2% had associated SAM (severe acute malnutrition and MAM (moderate acute malnutrition.) Alkaline phosphatase was persistently elevated (98.1%-96.1) even after 6months of treatment with persistently low phosphorus and normal calcium values. Most of the participants (77%) had good radiological response (healed Rickets) after 6months of treatment. Those results are similar with studies done in Gambia(10), Boston Medical Center, USA(9) and Bangladish(2)Accordingly, treatment of Rickets should be more than a single dose of vitamin D(should be 2-4 doses) with calcium or calcium containing supplements for a brief period of time.

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Reference

[1]. Wondale Y, Shiferaw F, Lulseged S.A systematic review of nutritional rickets in Ethiopia: status and prospects. Ethiop Med J. 2005 Jul;43(3):203-10. Review

[2]. Thierry Craviari, John M. Pettifor, Tom D. Thacher, Craig Meisner, Josiane Arnaud, and Philip R. FischerRickets: An Overview and Future Directions, with Special Reference to Bangladesh. A Summary of the Rickets Convergence Group. J Health Popul Nutr. 2008 March; 26(1): 112–121. PMCID: PMC2740674.

[3]. Muhammad Javed, Mehnaz Munir Ahmed, Fatima Ghayas Siddiqi. The Emerging Burden of Rickets: Impact of High Rise Buildings in Karachi. The Punjab medical journal02/2009; 3.

[4]. T Belachew, H Nida, T Getaneh, D Woldemariam, W Getinet. Calcium deficiency and causation of rickets in Ethiopian children. *East African Medical Journal*; Vol 82, No 3 (2005)

[5]. Yimenu Wondale, Fetsum Shiferaw, Sileshi Lulseged. A systematic review of nutritional rickets in Ethiopia: status and prospects. Department of Pediatrics and Child Health, Tikur Anbessa Specialized Hospital, Faculty of Medicine, Addis Ababa University, Ethiopia. Ethiopian medical journal 08/2005; 43(3):203-10

[6]. Michael F Holick, Tai C ChenVitamin D deficiency: a worldwide problem with health consequences. Department of Medicine, Boston University School of Medicine, 715 Albany Street, M-1013, Boston, MA 02118, USA. American Journal of Clinical Nutrition (impact factor: 6.67). 04/2008; 87(4):1080S-6S.

[7]. Maged Mohamed Yassin and Abdel Monem H. Lubbad. Risk factors associated with nutritional rickets among children aged 2 to 36 months old in the Gaza Strip: a case control study. The Islamic University of Gaza, Palestine. *International Journal of Food, Nutrition and Public Health, Vol. 3, No. 1, 2010* 33.

[8]. *Zubaida Abdel Nabi Bakeit and Fadia Yousif Abdel Megeid.* Study of Risk Factors of Rickets in Children. Food Science and Nutrition Department, Women Students Medical Studies & Sciences Sections, Food Science and Nutrition Department, King Saud University, KSA. World Applied Sciences Journal 17 (11): 1386-1393, 2012

[9]. Hataikarn Nimitphong, Michael F Holick .Vitamin D, neurocognitive functioning and immunocompetence. Section of Endocrinology, Diabetes, Nutrition, Department of Medicine, Boston University Medical Center, Boston, Massachusetts, USA. Current opinion in clinical nutrition and metabolic care 01/2011; 14(1):7-14. DOI:10.1097/MCO.0b013e3283414c38

[10]. Ann Prentice, Mustapha Ceesay, ShailjaNigdikar, Stephen J. Allen, John M. Pettifor FGF23 is elevated in Gambian children with rickets. Department of Paediatrics, University of the Witwatersrand and Chris Hani Baragwanath Hospital, Johannesburg, South Africa. A. Prentice et al. / Bone 42 (2008) 788–797

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