

Prevalence of Rickets for children aged less than Five years admitted in Murang'a County Hospital in The Year 2014/2015

Victoria Wanjiku Ngugi¹, Ronald Omenge Obwoye², Justus Maingi Simba³, Joseph Kweri⁴, Sylvia Wairimu Ngugi⁵, Atanus Malik Nyabola⁶-

1. Department of clinical medicine, Faculty of health sciences, Kabarak University, Kenya.

2. Department of Community Health, Faculty of Health Sciences, Egerton University, Kenya

3. Department of pediatrics and child health, Faculty of health sciences, Jomo Kenyatta University of Agriculture and Technology.

4. Department of human anatomy, Faculty of health sciences, Jomo Kenyatta University of Agriculture and Technology, Kenya.

5. Department of nursing Kenya Medical Training College, Muranga, Kenya

6. Department of human anatomy, Faculty of health sciences, Jomo Kenyatta University of Agriculture and Technology, Kenya.

Corresponding Author: Victoria Wanjiku Ngugi

Abstract: Increased cases of nutritional rickets continue to be recorded murang'a County Hospital daily records indicated that rickets is commonly encountered among patients aged below 5 years who consult in the hospital. Nevertheless, studies estimating its prevalence and associated risks in the County are limited. The reappearance of rickets in Kenya means that there could be increased dependency resulting from disabilities associated with rickets. Establishing the prevalence of rickets for children age less than five years admitted in Murang'a County Hospital in the year 2014/2015. The study employed a retrospective survey design. General pediatrics ward Murang'a county and referral hospital. Subject: A total of 61 children age less than five years who had been admitted in the ward in the year 2014/2015 were enrolled in the study in the month of January 2016. Males were more affected (57.4%), most population came from Kiharu Sub County (42.6%), pneumonia was the most comorbid condition (30.2%) and most children had deranged biochemical ranges, low calcium (26.1%), high alkaline phosphatase levels (82.6%). Rickets mostly affected infants, children admitted with rickets suffered from pneumonia as a comorbid condition. Study therefore recommended that routine screening should be done to enhance early intervention.

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I. Introduction

Rickets is a disease that affects children and adolescents during times of rapid growth. Vitamin D deficiency and/or nutritional rickets remain prevalent in developing regions of the world and rank among the 5 most common diseases in children. Overreliance on fortified foods, changing lifestyles where children spend most of their time indoors on various forms of technology and globalization which has resulted in immigration of different peoples to different geographic locations.

Rickets resulting from different causes continue to be a major pediatric concern in many developing countries (Bell, 2011). It is considered as the most common non-communicable disease in children in the world (Prentice, 2013). Developed countries have not been exempted from this disease and it is an emergent problem in United States of America (USA) (Prentice, 2013). A hospital based study in Bangladesh found that rickets was the second common micronutrient deficiency condition in children (36%) and affected both sexes equally (Ejaz & Latif, 2010). Its occurrence is probably highest in many tropical and subtropical countries, despite the abundant sunlight. Social and cultural customs including the adherence to a special often vegetarian diet, avoidance of sunlight by continuous wrapping of children and keeping them indoors, together with increasing urbanization, malnutrition, and reduced breast feeding period are some of the associated risk factors for the disease subtropical and tropical countries (Bell, 2011).

The frequency of rickets in industrial countries is low, where vitamin D supplementation of infants' formula is obligatory and systematic (Yassin & Lubbad, 2010). On the other hand, rickets has been shown to be

prevalent in developing countries. Generally, in Africa and Kenya, there is limited data on risk factors associated with rickets. Protein-energy-malnutrition is widespread in developing countries and is strongly associated with vitamin D deficiency rickets. There is no amount of vitamin D that would promote normal bone development unless mineral elements necessary for building bones are provided in the diet in adequate quantities and in available form (Aggarwal et al., 2013). Calcium is a major mineral in bones and its low intake by children in developed countries often results from low intake of dairy products (Oramasionwu, Thacher, Pam, Pettifor, & Abrams, 2008). Markedly, deficiency or reduced availability of dietary calcium and vitamin D has been found to predispose children to nutritional rickets. Formation of strong bones in children requires combination of nutrients including Vitamin D and calcium, in appropriate amounts (Yassin & Lubbad, 2010).

Trends in rickets have only been documented in a few African countries. Thus more current studies need to be conducted. Rickets still affects many children particularly in Sub Saharan Africa where tropical climate would be expected to be protective. Vitamin D deficiency is alleviated by intake of animal foods, dietary supplements and fortified foods such as milk and margarine (Whiting & Calvo, 2005). It is recommended that all infants and children should have a minimum daily intake of 400 International Units (IU) of vitamin D (C.L., F.R., Wagner, & Greer, 2008), (Calvo, Whiting, & Barton, 2005). On the other hand, in absence of sun exposure, 1000 IU of vitamin D is required daily for children to provide protective advantage against its deficiency (Holick, 2005).

Only scanty data in hospital records exist on the situation of nutritional rickets in Kenya. Previously, hospital records indicated that rickets was a persistent problem in Kenyan communities as children with delayed milestones are suspected to have rickets. This study therefore, determined prevalence and risk factors predisposing Kenyan children in Murang'a County to nutritional rickets so that health care providers in the study area may devise proper intervention strategies.

II. Materials And Methods

The study was undertaken in Muranga County and Referral Hospital, located within Muranga County. Has a bed capacity of two fifty and has various departments such as outpatient, inpatient, MCH/FP, Comprehensive care center for HIV (CCC) and ANC. The study was carried out at Muranga County Hospital pediatrics ward that has a bed capacity of 24.

Included children aged less than five years who were admitted during the time of study. A retrospective study design was used. Survey study was done; all patients admitted at Muranga County Hospital pediatrics ward in the year 2014/2015 who had rickets were included. Data abstraction sheet was used to all children aged less than 5 years and had rickets and were admitted at the Muranga County Hospital pediatrics ward in the year 2014 -2015. Information sought included; socio demographic data, biochemical data and comorbidity.

The information collected from the data abstraction sheet was entered into a computer coded and analyzed then presented in pie charts, tables and bar graphs.

The findings were disseminated through medical superintendent Muranga County Hospital

III. Results

In the year 2014/2015 rickets had a prevalence of 2% in the year 2014, and 1.45% in the year 2015.

Table 1: Table On Prevalence of Rickets of Children Age Less Than 5 Years In The Year 2014 /2015

YEAR	2014	2015
Total Admissions	1692	1925
No. Of Rickets	33	28
% Of Prevalence	2%	1.45%

Distribution of Rickets Per Age in Months.

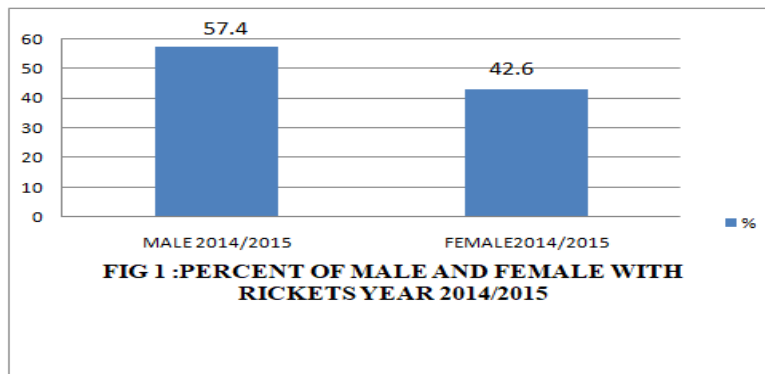
Most of the children suffering from rickets were in the age of 0-12 months which was 65.57% of the total sample, 13-24 months had 26.23%, 25-36 months had 6.55%, 37-48 months had 1.64% and no child was found to have rickets between the ages of 49-60 months.

Table 2: Frequency Distribution Table of Rickets Per Age in Months in The Year 2014\2015.

AGE	Frequency 2014	Frequency 2015	TOTAL Frequency	%
0-12	20	20	40	65.57%
13-24	11	5	16	26.23%
25-36	1	3	4	6.55%
37-48	1	0	1	1.64%
49-60	0	0	0	0%
TOTALS	33	28	61	100%

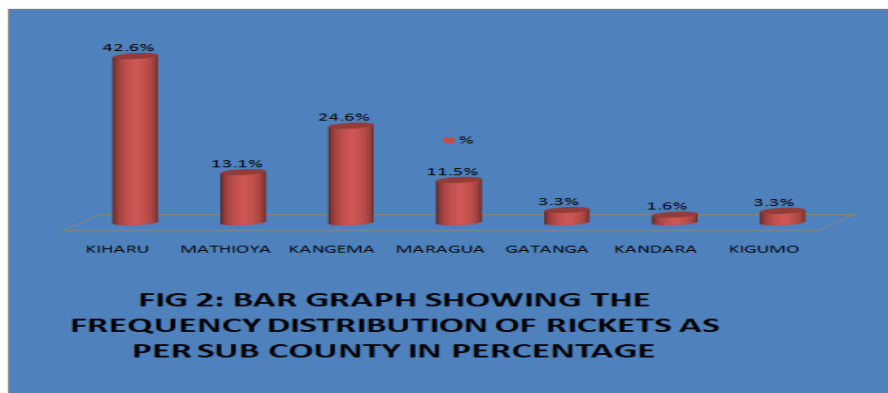
Prevalence of Rickets by Sex

From the study 61 children were sampled, 35(57.4%), children of the total sample were found to be males, 26 (42.7%) were found to be females.

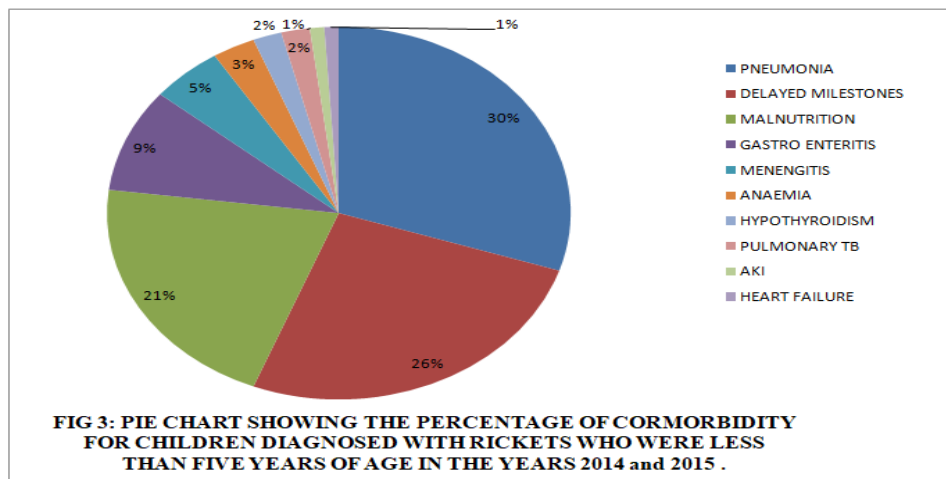


Prevalence of Rickets By Sub-county

Study done on prevalence of rickets in the year 2014/2015 sampled all the sub counties in Muranga County. Kiharu had a total of 26 cases (42.6%), Mathioya 8 (13.1%),Kangema 15 (24.6%),Maragua 7(11.5%),Gatanga 2(3.3%),Kandara 1(1.6%) and kigumo 2(3.3%). Muranga County Hospital is located in Kiharu Sub County.



Comorbidity And Rickets Most children were found to suffer from pneumonia 30%, 26% had delayed milestones, and 21% had malnutrition.



Outcome of Children Admitted with Rickets

In the year 2014 ,33 were admitted in the ward with rickets ,31 (93.1%)were treated and discharged home,2(6.9%) died, and none was referred. The year 2015 ,28 patients were admitted with rickets ,25(89.3%) were treated and discharged ,3 (10.7%) had complications and were referred, none died.

Table 3: Table On Outcome of Children Less Than Five Years Admitted with Rickets Year 2014/2015

Outcome After Admission	2014	%	2015	%
Discharge	31	93.1%	25	89.3%
Died	2	6.9%	0	0%
Referred	0	0%	3	10.7%
Total	33	100%	28	100%

Biochemical Data

Study sampled 61 children, only 46 (75.4%) had biochemical results ,15 (24.6%) had no results.70% of those with results had low calcium levels .26.1% had normal calcium levels ,4.3% had high calcium levels. 46 patients had phosphate levels done .91.3% had normal levels of phosphate ,8.7% had low levels of phosphate. Of the 46 patients that had been investigated ,82.6% had high levels of alkaline phosphatase (ALP),17.4% had normal ALP.

Table 4: Table On Biochemical Results.

	Calcium	Phosphate	ALP
Normal	12(26.1%)	42(91.3%)	8(17.4%)
Below normal	32 (69.6%)	4 (8.7%)	0(0%)
Above normal	2(4.3%)	0(0%)	38 (82.6%)

IV. Discussion

Rickets had a prevalence of 2% in the year 2014, and 1.45% in the year 2015. The study which was carried out at Muranga County Hospital pediatrics ward had 1692 total number of patients admitted in the year 2014, of which 33 (2%) had rickets, year 2015 had total admissions of 1925, of which 28 (1.45%) had rickets, (Table 1). Study done by Baser E et al 1994 showed that prevalence of rickets was 9.8%. The study found out that most of the children suffering from rickets were in the age of zero to twelve months which was 65.57% of the total sample, 13-24 months had 26.23%, 25-36 months had 6.55%, 37-48 months had 1.64% and no child was found to have rickets between the ages of 49-60 months (Table 2). This shows that rickets in this hospital was a case of infancy and early childhood. Findings agree with previous studies which found that rickets developed in the early months of life (Mølgaard & Michaelsen, 2003). Furthermore, severe rickets was commonly seen at around the age of 18 months according to previous studies (Ejaz & Latif, 2010); (Beck-Nielsen, 2012). Study carried out at Muranga County Hospital pediatrics ward on prevalence of rickets in the year 2014/2015 had 61 children sampled. 35 of the total sample were found to be male which was 57.4%, 26 were found to be female which was 42.6% (fig 1). From the study it was clear that male children were more affected than female. The findings concurred with the previous studies which concluded that, boys are generally more affected than girls by rickets (Al-Atawi, Al-Alwan, Al-Mutair, Tamim, & Al-Jurayyan, 2009). In addition, a hospital based study in Saudi Arabia showed that 67% of rachitic infants and children aged between 6 and 14 months were boys (Al-Atawi, Al-Alwan, Al-Mutair, Tamim, and Al-Jurayyan, 2009). Study done on prevalence of rickets in the years 2014/2015 sampled all the sub counties in Muranga County. Kiharu had a total of 26 cases (4%), Mathioya 8 (13%), Kangema 15 (25%), Maragua 7 (11%), Gatanga 2 (3%), Kandara 1 (2%) and Kigumo 2 (3%). Muranga County Hospital is located in Kiharu sub county (Fig 2). This could explain the high number of cases recorded in Kiharu Sub County. There are other hospitals in Muranga County apart from the Muranga hospital; hence patients could have sought health care in those hospitals reducing the number of cases recorded. From the study carried out at Muranga hospital pediatrics ward found out that all (100%) children admitted in the ward with rickets had a comorbid condition. Most were found to suffer from pneumonia 30%, 26% had delayed milestones, 21% had malnutrition and 23% had other comorbid conditions (Fig 3). This concurred with other studies that were carried out showing pneumonia as the leading comorbid condition for children suffering from rickets. This could be attributed to the weakening of respiratory cartilage and cilia by rickets. Children with rickets had a lowered body immunity. In Ethiopian study, presence of rickets was equally associated with childhood infections (Muhe, Lulseged, Mason, & Simoes, 1997). Additionally, in Bangladesh, a hospital based study found that 101 (74%) children with severe pneumonia were rachitic (Haider, Nagi, & Khan, 2010). Rachitic subjects frequently fell sick following their poor immunity and therefore expected to frequent the hospital more (Ladhani, Srinivasan, Buchanan, & Allgrove, 2004). It is clear that preventing upward trend on this preventable disease would most likely save time and money consequently improving livelihoods of Kenyans as most rachitic subjects were sick at the time of the survey. Studies have previously shown that rickets was more common in children with pneumonia (Muhe, Lulseged, Mason, and

Simoes, 1997) and chest infections in 33% of patients studied in Saudi (Al-Atawi et al., 2009), (Hazzazi, Alzeer, Tamimi, Al Atawi, & Al Alwan, 2013). In Bangladesh children with rickets were significantly at a greater risk of pneumonia (Pettifor, 2005). Rachitic infants were commonly hospitalized due to lower respiratory tract infections (Najada, Habashneh, & Khader, 2004). In this study, the researcher observed that children were suffering from similar conditions. Probably, weak chest frame among the rachitic subjects increased their vulnerability to chest infections. Therefore, efforts to curb rickets will indirectly alleviate other health related burden within the health sector players. From the study done in the year 2014, 33 were admitted in the ward with rickets, 31 (93.1%) were treated and discharged home, 2 (6.9%) died and none was referred. The year 2015, 28 patients were admitted with rickets, 25 (89.3%) were treated and discharged, 3 (10.7%) had complications and were referred, none died (table 3). This showed that comorbidity of rickets can be fatal though most patients were treated and discharged. From the study conducted, out of the 61 sampled populations only 46 (75%). 69.6% of those with results had low calcium levels. This was corresponding to the findings from other studies. Serum calcium levels were low in patients with rickets (Pettifor, 2012). In this study 26.1% had normal calcium levels, 4.3% had high calcium levels (Table 4). Those with high calcium levels were noted to be on treatment, which could explain the unexpected findings. Table 4 shows the organic phosphate levels, which 46 patients had phosphate levels done. 91.3% had normal levels of phosphate, 8.7% had low levels of phosphate. Study done by (Tiosano & Hochberg, 2009) showed that hypophosphatemia was a constant finding in history; this was not corresponding with my findings. This could be because most patients were diagnosed early or the lab gave faulty result. Of the 46 patients that had been investigated, 82.6% had high levels of alkaline phosphatase (ALP), 17.4% had normal ALP (table 4). Serum alkaline phosphatase was above normal in majority of cases according to study done by (Clin-, 1999), which was corresponding with my findings.

V. Conclusion

Rickets was frequent among infants and children seeking health care services at Murang'a County Hospital and was a disease of infancy and early childhood associated with several factors. Any interventions to reduce its upward trend should be initiated early in life. Children with rickets are mostly admitted with pneumonia as a comorbid condition. Most people admitted at the hospital during the years of study were from Kiharu Sub-County.

References

- [1]. Aggarwal, V., Seth, A., Marwaha, R. K., Sharma, B., Sonkar, P., Singh, S., & Aneja, S. (2013). Management of nutritional rickets in Indian children: A randomized controlled trial. *Journal of Tropical Pediatrics*. <https://doi.org/10.1093/tropej/fms058>
- [2]. Al-Atawi, M. S., Al-Alwan, I. A., Al-Mutair, A. N., Tamim, H. M., & Al-Jurayyan, N. A. (2009). Epidemiology of nutritional rickets in children. *Saudi Journal of Kidney Diseases and Transplantation: An Official Publication of the Saudi Center for Organ Transplantation, Saudi Arabia*.
- [3]. Beck-Nielsen, S. S. (2012). Rickets in Denmark. *Danish Medical Journal*.
- [4]. Bell, D. S. H. (2011). Protean manifestations of vitamin D deficiency, part 1: The epidemic of deficiency. *Southern Medical Journal*. <https://doi.org/10.1097/SMJ.0b013e318213d0f9>
- [5]. C.L., W., F.R., G., Wagner, C. L., & Greer, F. R. (2008). Prevention of rickets and vitamin D deficiency in infants, children, and adolescents. *Pediatrics*. <https://doi.org/10.1542/peds.2008-1862>
- [6]. Calvo, M. S., Whiting, S. J., & Barton, C. N. (2005). Vitamin D intake: a global perspective of current status. *J Nutr*.
- [7]. Clin-, M. (1999). A COMPARISON OF CALCIUM, VITAMIN D, OR BOTH FOR NUTRITIONAL RICKETS IN NIGERIAN CHILDREN, 563-568.
- [8]. Ejaz, M. S., & Latif, N. (2010). Stunting and micronutrient deficiencies in malnourished children. *Journal of the Pakistan Medical Association*.
- [9]. Haider, N., Nagi, A. G., & Khan, K. M. A. (2010). Frequency of nutritional rickets in children admitted with severe pneumonia. *Journal of the Pakistan Medical Association*.
- [10]. Hazzazi, M., Alzeer, I., Tamimi, W., Al Atawi, M., & Al Alwan, I. (2013). Clinical presentation and etiology of osteomalacia/rickets in adolescents. *Saudi Journal of Kidney Diseases and Transplantation*. <https://doi.org/10.4103/1319-2442.118087>
- [11]. Holick, M. F. (2005). The Influence of Vitamin D on Bone Health Across the Life Cycle. *J. Nutr*.
- [12]. Ladhani, S., Srinivasan, L., Buchanan, C., & Allgrove, J. (2004). Presentation of vitamin D deficiency. *Archives of Disease in Childhood*. <https://doi.org/10.1136/adc.2003.031385>
- [13]. Mølgaard, C., & Michaelsen, K. F. (2003). Vitamin D and bone health in early life. *The Proceedings of the Nutrition Society*. <https://doi.org/10.1079/PNS2003298>
- [14]. Mughal, M. Z. (2011). Rickets. *Current Osteoporosis Reports*. <https://doi.org/10.1007/s11914-011-0081-0>
- [15]. Muhe, L., Lulseged, S., Mason, K. E., & Simoes, E. A. F. (1997). Case-control study of the role of nutritional rickets in the risk of developing pneumonia in Ethiopian children. *LANCET*. [https://doi.org/10.1016/S0140-6736\(96\)12098-5](https://doi.org/10.1016/S0140-6736(96)12098-5)
- [16]. Najada, A. S., Habashneh, M. S., & Khader, M. (2004). The frequency of nutritional rickets among hospitalized infants and its relation to respiratory diseases. *Journal of Tropical Pediatrics*. <https://doi.org/10.1093/tropej/50.6.364>
- [17]. Oramasionwu, G. E., Thacher, T. D., Pam, S. D., Pettifor, J. M., & Abrams, S. A. (2008). Adaptation of calcium absorption during treatment of nutritional rickets in Nigerian children. *British Journal of Nutrition*. <https://doi.org/10.1017/S0007114507901233>

- [18]. Pettifor, J. M. (2005). Rickets. In *The Bone and Mineral Manual*. <https://doi.org/10.1016/B978-012088569-5/50010-3>
- [19]. Pettifor, J. M. (2012). Nutritional Rickets. In *Pediatric Bone*. <https://doi.org/10.1016/B978-0-12-382040-2.10023-1>
- [20]. Prentice, A. (2013). Nutritional rickets around the world. *Journal of Steroid Biochemistry and Molecular Biology*. <https://doi.org/10.1016/j.jsbmb.2012.11.018>
- [21]. Tiosano, D., & Hochberg, Z. (2009). Hypophosphatemia: The common denominator of all rickets. *Journal of Bone and Mineral Metabolism*. <https://doi.org/10.1007/s00774-009-0079-1>
- [22]. Whiting, S. j. & Calvo, M. S. (2005). Dietary Recommendations for Vitamin D: a Critical Need for Functional End Points to Establish an Estimated Average Requirement. *The Journal of Nutrition*. <https://doi.org/135/2/304> [pii]
- [23]. Yassin, M. M., & Lubbad, A. M. H. (2010). (Peacock, 2010) rickets. *International Journal of Food, Nutrition and Public Health*, 3(1), 33–44.