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Public Health and Preventive Medicine
Vol. 1, No. 1, 2015, pp. 28-32
http://www.publicscienceframework.org/journal/phpm

Prevalence of Anaemia and Associated Factors Among Preschool Children (6-59 Months) in Western Province, Kenya

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Abstract

Background: Anaemia is the most prevalent nutritional deficiency globally and of major public health concern in preschool children and pregnant women in developing world. In Kenya current anaemia rates are about 69 % among preschool aged children. Anaemia has adverse health consequences in the children. Objectives: To evaluated the prevalence, severity and risk factors of anaemia in preschool children in an area with intense malaria transmission. Design: Cross-sectional study. Setting: Clusters in an area with intense malaria transmission in western Kenya. Subjects: A total of 125 preschoolers were enrolled aged between 6-59 months. Results: The prevalence of anaemia (Hb<11.0 g/dl) was 25%. It was further divided into moderate (14.2%) and mild (10.8%).Higher risk of presenting anaemia was documented for boys, lower household socioeconomic status, malaria infection and anthropometric deficits. Conclusion: The findings show occurrence of anaemia among preschool children. In addition to malaria, low socioeconomic status, anthropometric deficits, sex are important contributors to the pathogenesis of anaemia in Western province. Improving the case management of malaria is likely to reduce the burden of anaemia. Also to implement effective public health interventions to prevent anaemia in this group, an integrated approach that addresses poverty, nutrition and malaria infection is a must.

Keywords

Anaemia, Preschool Children, Malaria, Nutritional Status

Received: March 16, 2015 / Accepted: April 1, 2015 / Published online: April 2, 2015

1. Introduction

Anaemia is considered the most prevalent nutritional deficiency globally [1]. In preschool children, anaemia has adverse negative health consequences that include altered cognitive development, poor school performance, impaired physical growth, and poor immunity [2,3]. Approximately 1.6 billion people are anaemic worldwide, and approximately two-thirds of preschool children in Africa and Southeast Asia are anaemic [4]. In Kenya, previous studies have found approximately 66% of preschool children were anaemic [5].

Anaemia is preventable, yet it remains the most widespread nutritional deficiency in the world. Countries, which realized significant progresses in the control of the problem have identified contextual risk factors and implement context relevant programs. In sub-Saharan African, conditions which increase the risk for anaemia in children are complex and multidimensional. A first step for evidence-based interventions and policies towards the control and elimination of iron deficiency anaemia is a better understanding of these risk factors.

The complex aetiology of anaemia involves the interaction between multiple factors including nutritional deficiencies, genetic red blood cell disorders, and infectious diseases, particularly malaria and hookworm infections.

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Anaemia as an of both poor nutrition and poor health is a common and sometimes as a serious complication of *P. falciparum* infection [6]. Various plasmodium species cause malaria yet *p.falciparum* is the most critical for anaemia in children. Contrary to iron deficiency anaemia that develops slowly, p.falciparum causes severe and profound anaemia within 48 hours of the onset of the fever. Anaemia occurs in this case when red cells are destroyed more rapidly than they can be replaced or when red cells production falls below the minimal level required to maintain steady state [7].

The aim of this study was to describe the prevalence of anaemia in preschool children in Western province, an area with intense malaria transmission. In addition, describe the risk factors: nutritional status, *plasmodium falciparum* malaria infection, age, sex, and socio-economic status.

2. Methods

2.1. Study Site

The study was carried out in Western Province of Kenya outside Nairobi, West of the Eastern Rift Valley and is inhabited mainly by the Luhya people. It harbours 3,358,776 inhabitants within an area of 8,361 km². The main economic activity is farming with maize as the staple food and some animal husbandry (a few heads of cattle and goats or chicken). Other activity include quarrying for construction materials.

2.2. Study Population

The study population consisted of preschool children aged between 6-59 months. The inclusion of the study subjects was based on consenting parents/ guardians of children aged 6-59 months and without physical disability that would affect height measurement. Those who had physical disability were excluded from the study.

2.3. Study Design and Sampling Procedure

This was a cross-sectional that used a two-stage stratified cluster sample where households were clustered using National Sample Survey & Evaluation Programme (NASSEP IV). The province was stratified into rural and urban EAs (enumeration areas). The first stage involved selection of Primary Sampling Units (PSUs) which were the EAs using probability proportional to measure of size (PPMOS) method. The second stage involved the selection of households and EAs were selected with a basis of one measure of size (MOS) defined as the ultimate cluster with an average of 100 households and constituted of one (or more) EAs. The household and structure were listed through a quick count, amalgamation /segmentation of EAs to form clusters, physical numbering of the structure of the dwelling unit.

The sample consisted of 37 clusters, 18 in the urban and 19 in the rural areas. For each cluster a total of 10 households were selected using systematic simple random sampling.

2.4. Data Collection

A structured and pretested questionnaire was used to record data. It captured demographic, socioeconomic and anthropometric measurements on children aged 6-59 months.

Anthropometric measurements were recorded*:* Height and weight were measured among children who were in light clothing to determine their nutritional status. The weight measurement was taken using a Seca scale (Hanson mode) to the nearest 0.1 kg and height/ length portable wooden constructed scale calibrated for height measurement to the nearest 0.1 cm. Height for age (stunting), weight for age (underweight) and weight for height were calculated using ≤ 2D NCHS (National Center for Health Statistics) reference data. The height for age Z-score (HAZ) of <-2 was classified as stunted and Z-score cut off point of <-2SD was used to classify low weight for age, low height for age and low weight for height.

Malaria rapid diagnostic kits (RDKs) were used at the household to test for malaria using blood collected in EDTA tubes. The RDKs used were *P. falciparum* only (HRP2) to capture *P. falciparum* malaria. Thick blood smears was prepared, stained with Giemsa stain and allowed to dry and observed under a microscope using oil immersion objectives (×100). The presence or absence of malaria was reported as any parasitaemic detected in blood smear.

Haemoglobin was determined from venous blood sample in EDTA tube using "Hemocue globinometer (Hemocue HB-301). Anaemia was defined as Hb below 11.0g/dl and further categorized as severe (Hb <7.0g/dl), moderate (Hb between 7 & 10g/dl) & mild (Hb between10 & 11g/dl) anaemia.

2.5. Statistical Analysis

Data was double entered, validated and analysis done using SPSS version 20. Data was summarized and percentages were used in the evaluation of the descriptive statistics. Chi square ($\chi 2$) test was used to compare relationship between anaemia and other risk factors. All results were considered to be statistically significant at 95% probability level ($P < 0.05$).

2.6. Ethical Clearance

Ethical clearance was sought from scientific steering committee (SSC) and ethical review committee (ERC) of Kenya Medical Research Institute (KEMRI) for approval. Prior consent was sought from parents/guardians of the preschoolers who participated in the study. During the interview privacy and confidentiality was observed.

3. Results

3.1. Characteristics of the Study Participants

A total of 125 preschoolers aged 6-59 months were enrolled in the study and consisted of males 72 (57.6%) and 53 (42.4%) females with a mean age of 35± (10 SD) ranging between 6-59 months. A high proportion (29.6%) was aged between 24-35 months. The majority (65.6%) of the participants resided in rural areas and a substantive proportion (34.4%) in urban areas. The wealth was defined by the type of house, roofing material and number of sleeping rooms as revealed. The study findings indicated that the main material of the (inside) walls of the house was mud (69.6%) and main house roofing materials was corrugated iron (88.8%). The commonly used source of energy for cooking was wood as reported by 72.8% of the participants. The other sources of energy for cooking were LPG/natural gas (4%), charcoal (22.4%) and others (0.8%). The prevalence of malaria among the preschool children was 6.7%. The economic status for each household was determined by means of a wealth index, which was a generic of all the social economic characteristics. Going by the wealth index scale, the bulk of the population (45.6%) were in the second quintile. The minority of the population were in the fifth quintile (4%) as shown in Table 1.

Table 1. Characteristics of study participants.

Variables	n=125	%
Age in months		
6-11 months	5	4
12-23 months	18	14.4
24-35 months	37	29.6
36-47 months	36	28.8
48-59 months	29	23.2
Sex		
Male	72	57.6
Female	53	42.4
Residence		
Rural	82	65.6
Urban	43	34.4
Main Material of the floor of the house		
Earth/ sand	36	28.8
Dung	54	43.2
Cement	35	28
Main Material of the roof of the house		
Grass / thatch / makuti/ Dung / mud	12	9.6
Corrugated iron (mabati)	111	88.8
Asbestos sheet	2	1.6
Main material of the (inside) walls of the house		
Dirt/Mud/Dung	87	69.6
Bamboo with mud/ Stone with mud	4	3.2
Cement	30	24
Bricks	3	2.4
Cement blocks	1	0.8
Household ownership		
Clock/watch	36	28.8
Electricity	13	10.4
Radio	97	77.6
Television	30	24
Mobile Telephone	91	72.8
Fixed Telephone	2	1.6
Refrigerator	7	5.6
Solar Panel	4	3.2
Type of fuel used for cooking		
LPG/natural gas.	5	4
Charcoal	28	22.4
Wood	91	72.8
Other	1	0.8
Where cooking is usually done		
In the house	41	32.8
In a separate building.	78	62.4
Outdoors.	6	4.8
Number of rooms used for sleeping		
One	57	45.6
Two	47	37.6
Three	16	12.8
Four	5	4
Wealth index		
First quintile	17	13.6
Second quintile	57	45.6
Third quintile	31	24.8
Fourth quintile	15	12
Fifth quintile	5	4

Prevalence of anaemia was 25% and it was further divided into moderate (Hb between 7-10g/l) was 14.2% and mild (Hb between 10-11g/l) was 10.8%. There were no cases of severe anaemia (Hb<7.0g/l) as shown in Figure I.

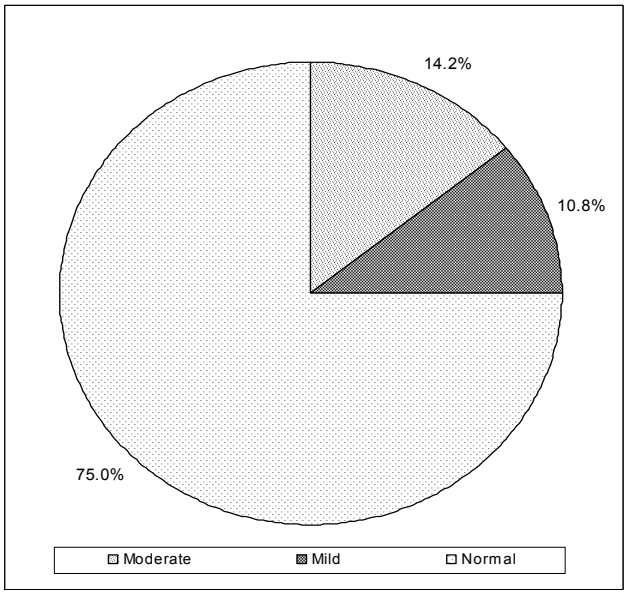

Figure I. Anaemia status of the children.

3.2. Bivariate Analysis

The demographic characteristics were age in months, sex and residence. Sex was significantly associated with anaemia (p=0.046). Using children of aged 48 to 59 months as the reference, males in all the age groups were at a higher risk of being anaemic than females (30.6%, OR=2.48, 95% CI: 1-6.11,

p=0.046). The risk of being anaemic decreased with age increase among the subjects, progressively lowering with each age group. Living either in a rural or urban set up had no effect with the children being anaemic as shown in Table 2.

Table 2. Anaemia in relation to demographic characteristics.

Variables	Deficient (n=26)		Normal (n=99)		OR	95% CI		p value
	n	%	n	%		Lower	Upper	
Age in months								
6-11 months	2	40.00%	3	60.00%	3.2	0.42	24.42	0.245
12-23 months	10	55.56%	10	44.44%	6	1.57	22.89	0.062
24-35 months	7	18.92%	30	81.08%	1.12	0.32	3.98	0.861
36-47 months	6	16.70%	30	83.30%	0.96	0.26	3.53	0.951
48-59 months	5	17.20%	24	82.80%	1			
Sex								
Male	22	30.6%	50	69.4%	2.48	1	6.11	0.046
Female	8	15.1%	45	84.5%	1			
Residence								
Rural	16	19.5%	66	80.5%	0.5	0.22	1.16	0.105
Urban	14	32.6%	29	67.4%	1			

There was an association between anaemia and malaria infection (OR=8.15, 95% CI: 1.48-44.85, p=0.006). Anaemia was also associated with being underweight (OR=11.13, 95% CI: 2.11-58.66, p=0.006) and stunting (OR=2.92, 95% CI: 1.23-6.94, p=0.014). Using fourth/fifth quintiles as the reference for the relationship between anaemia and socioeconomic characteristics, first quintile of the wealth index was significantly associated with anaemia (OR=4.29, 95% CI: 1.06-17.36, p=0.037) as shown in Table 3.

Table 3. Anaemia in relation to household economic characteristics, malaria status and nutritional status.

Variables	Anaemic (n=30)		Normal (n=95)		OR	95% CI		p value
	n	%	n	%		Lower	Upper	
Wealth index								
First quintile	10	58.8%	7	41.2%	4.29	1.06	17.36	0.037
Second quintile	8	16.3%	49	83.7%	0.49	0.14	1.72	0.260
Third quintile	7	22.6%	24	77.4%	0.88	0.23	3.26	0.842
Fourth/ Fifth quintile	5	25.0%	15	75.0%	1			
Malaria status								
Positive	5	71.4%	2	28.6%	8.15	1.48	44.85	0.006
Negative	23	23.5%	75	76.5%	1			
Not Tested	2		18					
Underweight								
Underweight	6	75.0%	2	25.0%	11.13	2.11	58.66	0.006
Not underweight	24	21.2%	89	78.8%	1			
Stunting								
Stunted	14	40.0%	21	60.0%	2.92	1.23	6.94	0.014
Not stunted	16	18.6%	70	81.4%	1			
Wasting								
Wasted	0	0.0%	2	100.0%	UD	UD	UD	1
Not wasted	30	25.2%	89	74.8%	1			

4. Discussion

The 25% prevalence of anaemia in this study is consistent with 28% reported by Ndyomugyenyi in Masindi Uganda [8]. Basing on WHO classification for persistent anaemia in a population (20-39%), our findings indicate that anaemia among preschoolers in the region was a moderate public health problem associated with several known risk factors. Malaria infection, low socio-economic status and anthropometric deficits (being underweight and stunting) were associated with anaemia. Non –modifiable characteristic i.e. sex was also associated with anaemia.

With regard to socioeconomic characteristics, the findings of the study indicate that poverty is linked to anaemia. As documented elsewhere, children living in low income household are at greater risk of anaemia compared to those in higher income. This is attributed to the care received by the children including nourishment and access to health services [9]. Moreover, the diet in poor families is usually monotonous even when there is enough food to eat as indicated in a study done by Ag Bendech et al [10].

Among the analyzed variables related to the children, underweight and stunting remained positively associated with anaemia. The association between these anthropometric indices and anaemia has been observed in several other

studies [11,12]. Nutritional status is affected by a common set of factors including socioeconomic status, sanitation, infections and parasitic diseases and diet.

There was no association between child's age and anaemia. This is in contrast with several other studies worldwide where an association was observed [13]. Children under 2 years of age experience high growth rate which also increases the demand for micronutrients such as iron, folate and vitamin B_{12}. However, relationship between child's sex and anaemia is less consistent with some studies indicating associations between these variables [14] and others not [15].

5. Conclusion

The findings show occurrence of anaemia among preschool children. In addition to malaria, low socioeconomic status, anthropometric deficits, sex are important contributors to the pathogenesis of anaemia in Western province. Improving the case management of malaria is likely to reduce the burden of anaemia. Also to implement effective public health interventions to prevent anaemia in this group, an integrated approach that addresses poverty, nutrition and malaria infection is a must.

Limitation

The cross-sectional nature of the research design does not allow for the establishment of causal relationships. Absence of data on feeding preludes analysis of dietary sources of bioavailable iron that provides epidemiological understanding of anaemia in the study population. Finally the effect of polyparasitic infections such as schistosomiasis and intestinal parasites could not be examined.

Authors' Contributions

IK: Primary author who was responsible for formulation of the research concept, designing the study, collection of data and analysis, interpretation of results and writing up the draft manuscript. CM: Conception, design and coordination of the project, data analysis and interpretation and writing and review of the draft manuscript. AM: Conception, design and coordination of the project, data interpretation and writing and review of the draft manuscript.

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