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ASSESSMENT OF ANEMIA AND ITS ASSOCIATED RISK FACTORS AMONG CHILDREN UNDER 5 YEARS OLD ATTENDING RWANDA MILITARY HOSPITAL

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ABSTRACT

Anemia affects individuals of both gender and all ages. There is a need for localized and age- and context-specific studies to improve our knowledge of status of anemia and its associated risk factors in Rwandan population. The present study was done to assess anemia and its associated risk factors in children under five-year-old attending Rwanda Military Hospital. A cross-sectional study was carried out from August to September 2022 and for the diagnosis of anemia, WHO criteria for hemoglobin (Hb) threshold were used and children whose hemoglobin were less than 11.0g/dl were considered as anemic and those whose ferritin level were less than 7ng/dl were considered to have iron deficiency anemia. A total of 104 children were enrolled into the study of which 83.7% children were found to be anemic with a majority of less than 1year old children who were anemic at a level of 47% compared to those between 1 to 4years. 57.7% of children had low Iron that led to Iron deficiency anemia. Nutritional deficiency, particularly, Iron deficiency was the leading cause of anemia in the present study. In addition to nutritional deficiency, age also found to play an important role in development of anemia especially iron deficiency anemia since the body of children below 1 year old needs a lot of iron for development. Thus, interventions to minimize the high rate of anemia should be taken into consideration.

KEYWORDS: Nutrition, Haemoglobin, Anaemia.

1. INTRODUCTION

Anemia is defined by the World Health Organization (WHO) as "a condition in which the number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the body's physiologic need." Commonly, anemia is the final outcome of a nutritional deficiency of iron, folate, vitamin B12, and other nutrients. Anemia can also be defined as a reduction in hemoglobin (Hb) concentration, hematocrit, or a number of red blood cells per litter below the reference interval for healthy individuals of similar age, sex, and race, under similar environmental conditions (Lanzkowsky, 2015). According to the World Health Organization (WHO), for under-five children, the threshold Hb level for being anemic is less than 11.0 gm/dl (Benoist *et al*., 2008). Anemia is a global public health problem which affects 1.62 billion (24.8%) people worldwide. It occurs at all stages of the life cycle but is more prevalent in pre-school aged children (under five years). Globally, 293.1 million (47.4%) under five year's children are anemic and 67.6% of these children live in Africa (McLean *et al*., 2009). Several factors contribute to the occurrence of anemia and nearly half of (43%) the anemia cases in childhood are due to iron deficiency (Adish *et al*., 2010).

The deficiency may result from inadequate dietary intake of iron, mal absorption of iron, an increased iron demand during rapid growth in children and chronic blood loss. Other causes of anemia include folate and vitamin B12 and A deficiencies, Malaria, intestinal helminths, viral infections, chronic disease, hemoglobinopathies, hemolysis, and bone marrow disorders (Lopez *et al*., 2016). Different studies also claimed that factors such as age, sex, and residence, early initiation of complementary food, under-nutrition, maternal health status, maternal education, and poor socioeconomic status are significantly associated with anemia (Woldie *et al*., 2015). Anemia during childhood adversely affects mental, physical and social development of the children in short- and long-term outcome; it causes abnormalities of immune function, poor motor and cognitive development, poor school performance, and reduced work productivity in the life of the children, thereby decreasing earning potentials and negatively affect national economic growth (Grantham-McGregor *et al*., 2010). Anemia is also an important cause of morbidity and mortality in African children where resources to determine the underlying etiology remain poor (Brabin *et al*., 2001). Data on the magnitude of anemia and its risk factors in specific settings are scarce. Studying the specific etiology and prevalence of anemia in a given setting and population group is very important to prevent

or treat anemia (WHO, 2011). Rwanda, like other developing countries is challenged by anemia burden mostly in infant, and children below 5 years with an outcome of stunting. Globally, children with the age below 5 years have been mentioned to be at the high risk of having anemia mostly because of Iron deficiency which is considered as the leading cause of anemia globally (Breymann, 2015).

In general, anemia continues to be among health conditions with high burden. While understanding risk factors of anemia and potential mechanisms are crucial to the ability to intervene to reduce this burden, more information about risk factors is necessary in developing countries including Rwanda for innovative and evidence-based interventions. Therefore, this study is aimed to assess the prevalence of anemia and its associated factors among children under-five years of age attending Rwanda Military Hospital.

2. MATERIALS AND METHODS

2.1. Study area

This research was conducted at Rwanda Military Hospital which is located in Kigali City, Kicukiro district.

2.2. Study design and period

This was a cross-sectional study performed from August to September 2022. The caregivers of the children who were attending Rwanda Military hospital were approached and requested to give a voluntary consent form to register their children in the study.

2.3. Study population and Sample size

The study population included children less than 5 years old attended Rwanda military hospital during the study period. A group of 104 children were included upon inclusion criteria.

2.4. Inclusion and exclusion criteria

Children less than 5 years old suspected to have anemia within study period were included while subjects who had any sign of chronic diseases, had a surgery or blood loss from an accident, and who took iron tablets within 3 months preceding the data collection were excluded from the study.

2.5. Ethical consideration

Before conducting the research, a clearance from the Rwanda military hospital ethic committee was obtained and data set and results were reviewed and approved by the hospital. In addition to that, the information generated from the study population was kept confidential for their own protection and security.

2.6. Sample collection and analysis

After enrolment, samples were collected in EDTA and Red tubes and sent in hematology and biochemistry laboratory respectively for analysis. Full blood count and Ferritin test were performed for all collected samples. The form was verified if all criteria were followed and the questionnaire was also distributed to caregiver to get the information that was targeted.

2.7. Statistical analysis

After collecting the related information, the data were analyzed using Microsoft excel and SPSS program. The data was entered in the excel sheet and was analyzed using descriptive statistics. Chi-square test was used for study variables and the p-value <0.05 was considered as statistically significant.

3. RESULTS

3.1. Status of anemia among children under five years old

A total of 104 children who were under five years old participated in the study. The mean age of participating children was 1.5 year; table 1 shows that about 83.6% (n=7) had anemia (Hb <11 g/dL) with 6.7% of children who had severe anemia; 19.2% who had moderate anemia and 57.7% of those who had mild anemia.

Table 1: Status of anemia among children under-five years old.

Variables	Frequency(n=104)	Percent (%)
Child's Hemoglobin level		
Severe anemia	7	6.7%
Mild anemia	20	19.2%
Moderate anemia	60	57.7%
Normal	17	16.3%
Child's ferritin result		
Abnormal	60	57.7%
Normal	44	42.3%
Child's birth weight		
Underweight	67	64.4%
Normal weight	37	35.6%

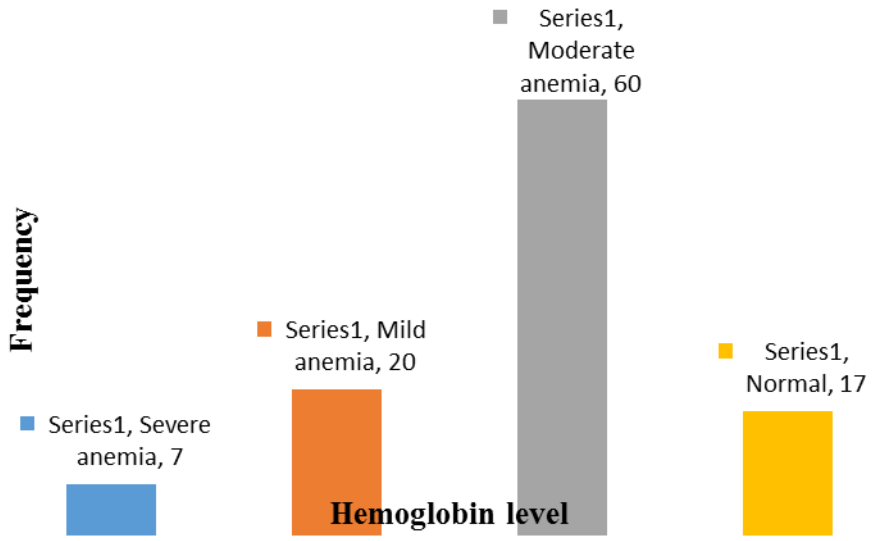

Figure 1: Distribution of anemia by severity among the children under five years old attending RMH.

The following figure (fig.2) illustrates the level of Iron deficiency where children with abnormal ferritin level are 57.7% of the total children.

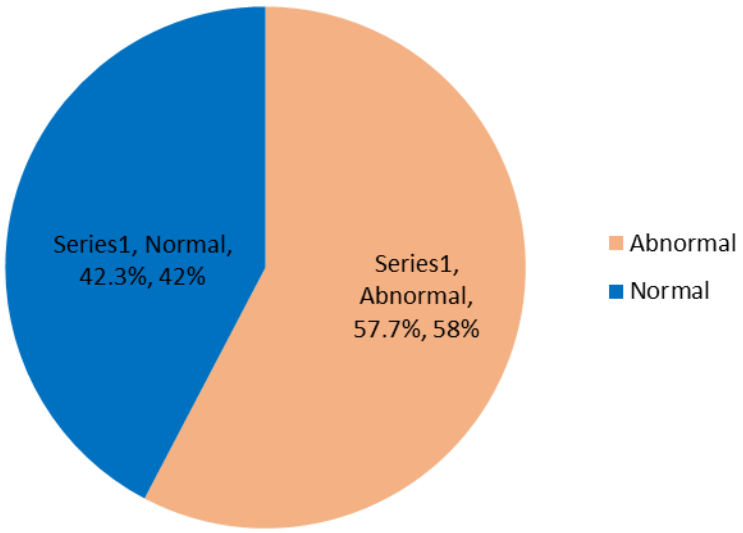

Figure 2: Status of Iron deficiency among children under five years old attending RMH.

3.2. Association of anemia and feeding practice

Table 2 shows the feeding habits that were associated with anemia. Among 104 children, only 26.9% (n=28) of the children consume meat, 32% (n=32) of them consume beans, 26.9% (n=28) of the children consume milk, among those children also 19.2% (n=20) consume vegetables and 30.7 (n=32) consume composite porridge while 26.9% (n=28)

consumed fruits. These numbers likely reflect a lack of nutrition knowledge on the part of the mothers.

Table 2: Association of anemia and feeding practice.

Variables	Child's Hemoglobin Level		Pearson Chi-square
	Anemic, n (%)	Normal, n (%)	p-value
Meat Consumption			
Consume	13(46.4)	15(53.6)	< **0.001**
Not consume	74(97.4)	2(2.6)	
Beans Consumption			
Consume	20(62.5)	12(37.5)	< **0.001**
Not consume	67(93.1)	5(6.9)	
Milk Consumption			
Consume	13(46.4)	15(53.6)	< **0.001**
Not consume	74(97.4)	2(2.6)	
Vegetables Consumption			
Consume	9(45.0)	11(55.0)	< **0.001**
Not consume	78(92.9)	6(7.1)	
Fruit Consumption			
Consume	13(46.4)	15(53.6)	< **0.001**
Not consume	74(97.4)	2(2.6)	
Composite Porridge Consumption			
Consume	20(62.5)	12(37.5)	< **0.001**
Not consume	67(93.1)	5(6.9)	

3.3. Anemia and other associated risk factors

Table 3 summarizes other factors associated with anemia. Three factors were significantly associated with anemia among the under-five children. These factors were: Age, mother's occupation and Child's ferritin level. According to Pearson chi-square the p-values of these 3 factors were less than 0.05 percent.

Table 3: Anemia and associated risk factors.

Variables	Child's Hemoglobin Level		Pearson Chi-square
	Anemic, n (%)	Normal, n (%)	p-value
Age(in years)			
<1 Year	47(94.0)	3(6.0)	**0.006**
1-5 Years	40(74.1)	14(25.9)	
Sex			
Male	60(81.1)	14(18.9)	0.265
Female	27(90.0)	3(10.0)	
Mother's place of residence			
Rural	48(81.4)	11(18.6)	0.468
Urban	39(86.7)	6(13.3)	
Mother's level of education			

None	9(100.0)	0(0.0)	0.320
Primary	25(89.3)	3(10.7)	
Secondary	36(80.0)	9(20.0)	
University	17(77.3)	5(22.7)	
Mother's Occupation			
Housewife	20(90.9)	2(9.1)	**0.047**
Farmer	34(77.3)	10(22.7)	
Small scale business	29(93.5)	2(6.5)	
Government employee	4(57.1)	3(42.9)	
Mother's marital Status			
Unmarried	44(89.8)	5(10.2)	0.377
Married	26(81.3)	6(18.8)	
Divorced	6(75.0)	2(25.0)	
Widow	11(73.3)	4(26.7)	
Child's ferritin result			
Abnormal	59(98.3)	1(1.7)	**< 0.001**
Normal	28(63.6)	16(36.4)	
Child's birth weight			
Underweight	59(88.1)	8(11.9)	0.102
Normal weight	28(75.7)	9(24.3)	

4. DISCUSSION

This was a cross-sectional study carried out in under-five year's children who attended Rwanda Military Hospital, Kicukiro District, Rwanda. It was revealed that the status of anemia was 83.6%, which was higher compared to the study done in Northern and Southern provinces of Rwanda where the prevalence of anemia was 30.9% (95% confidence interval [CI], 26.4-35.8) in children (Donahue *et al.*, 2017). The observed high prevalence could be due to deficiency in iron nutritive among under-five children associated with poor food availability and those include low consumption of meat, low consumption of beans and vegetables and even fruits included, there is also no availability of composite porridge like Sosoma. Age is also strongly associated with anemia in under-five year's children. The study revealed that children below 1 year were more likely to be anemic compared to the older children since they were 47% of the total children. This concurred with prior findings showing that at the younger age, there is high demand for nutrients to support the rapid body growth of children, which further increases their need for iron. Nutritional deficiency was the most important causative factor in the development of anemia in children under present study. At any point of time, higher number of individuals have iron-deficiency anemia than any other health problem-public health epidemic-worldwide. Iron deficiency anemia (IDA) is the commonest nutritional disorder in the world as it was also concluded by a nutrition landscaping tool that was carried out in Rwanda in 2016 which said that Prevalence rates of

indicators of malnutrition including stunting and anemia among children under five remain alarmingly high (Kompala *et al*., 2016).

Around 30% of the world's population is anemic, mainly due to iron deficiency. The effects of IDA on children are the most dangerous one because their bodies are still developing, including the brain, which is the fastest developing organ in infancy and early childhood. IDA impairs the cognitive development of children. A large portion of iron deficiency is preventable with appropriate and timely intervention. Children above 1 year are able to eat more variety of foods, which put them at less risk of being anemic. The World Health Organization reported that it is impossible to supply enough iron from unmodified plant-based complementary foods to meet the recommended daily intake of iron for under-five children without adding animal products such as liver, fish, beef, and eggs. Apart from other causes of anemia like blood loss, diseases, vitamin A, and folate deficiency, poor feeding practices especially no consumption of iron-rich foods (i.e., meat, vegetables, and fruits) were significantly associated with the presence of childhood anemia. Meat and/or meat-containing infant foods were rarely (26.9%) consumed by the study subjects. Further, almost 73.1% of study children did not eat fruits, which may have contributed to the higher prevalence rate of anemia. Vitamin C, which originates from fruits, potentiates absorption of nonheme iron that is found in legumes and other plant-based meals. According to the World Health Organization guidelines, MNP which is a single-dose packet of powder containing iron, vitamin A, zinc, and other vitamins and minerals, can be sprinkled onto any semisolid food at home or at any other point of use to increase the content of essential nutrients in the infant's diet during this period. This is done without changing the usual baby diet (Kejo *et al*., 2018).

5. CONCLUSION AND RECOMMENDATIONS

Anemia in children is a common preventable health issue in under-five-year-old children in Rwanda. This study has revealed that the prevalence of anemia in children less than five years is high and a severe public health problem in the study area. Age, nutritional status particularly, iron deficiency were the factors significantly associated with anemia that are leading cause of anemia in the present study. Therefore, the policymakers should make a strategy that can increase the awareness of women on breastfeeding, nutrition, and other associated factors to reduce anemia. It was recommended based on this study that community nutrition education, especially on exclusive breastfeeding and introduction of Iron rich complementary foods, should be improved. Additionally, it is strongly suggested that a

multisite, multiyear study must be conducted to allow a deeper understanding of the causes of anemia and factors most impacting on under-five year old children.

Data availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflict of interest

The authors declare that they have no conflicts of interest.

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