ISSN No:-2456-2165

The Silent Anaemia Epidemic in Children

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Abstract:- Anaemia (haemoglobin level < 11 g/dl) is a silent epidemic that affects about 293.1 million children aged <5 years worldwide with 28.5% of those located in sub-Sahara Africa. Child hood Anaemia is associated with poor cognition, reduced growth, problems with immune function and ultimately decreased survival. Uganda's childhood Anaemia is insidious, multifactorial and undefined. The objectives of the study were to determine the prevalence, severity and leading cause of Anaemia amongst children ≤ 12 years attending Virika hospital. The cross-sectional study employed both qualitative and semi-quantitative methods. Participants were sampled by convenience and simple random techniques. Parents were given short interviews to obtain participants demographic and necessary information. Blood, stool and anthropometric measurements were obtained from the participants and tested for complete blood count, malaria, HIV, sickle cell disease, helminthes and malnutrition respectively. Data was analyzed using Excel computer program.

Results show that Prevalence of Anaemia in children is high, presenting mostly in moderate form. Malnutrition plays a major role in the development of Anaemia. Nutritional support and awareness are key aspects in prevention of Anaemia development and progression. Other control interventions may include provision of improved diagnostic tests, optimizing compliance, appropriating referral practices, implementation of standard treatment guidelines and research.

Keywords:- *Anaemia, Prevalence, Severity and Etiology.*

I. INTRODUCTION

Anaemia (haemoglobin level < 11 g/dl) remains one of the most intractable public health problems affecting more than half of all pregnant women and children less than 5 years old (Demaeyer et al, 1995 & Cheesbrough, 2006). In 1993-2005, nearly 300 million children worldwide had Anaemia while in Sub Saharan Africa, two thirds (83.5 million children) were Anaemic (Soares, 2011). In West Africa, the numbers of childhood Anaemia cases were highest in Burkina Faso, followed by Ghana and Mali with malnutrition playing a central causative role in preschool children (Soares, 2011). In Tanzania, the prevalence of Anaemia amongst people aged 15-65 years was estimated at 43.4% (Tatala et al, 1998) while in Kenya the prevalence was at 22% amongst adolescents and adults aged 16years and over (Akwale et al, 2004). Presently, Global estimate of childhood Anaemia is at 293.1 million children aged <5 years with 28.5% of those located in Sub-Sahara Africa. Child hood Anaemia is associated with increased risk of death, impairment of the cognitive and motor development, growth, immune function and physical work capacity and ultimately decreased survival (Soares, 2011).

Anaemia is usually multifactorial in origin with malaria playing a key aetiologic role in endemic countries like tropical regions. Infants are vulnerable to malaria from the age of approximately three months, when the immunity acquired from the mothers starts to wear off. Hospital series show that in the areas of intense transmission, most cases of severe malarial Anaemia, blood transfusions, and deaths occur in infants and children less than five years old (Biemba et al, 2000). Malaria causes Anaemia through haemolysis and increased splenic clearance of red blood cells and cytokine- induced dyserythropoesis (Mendez, 2000, Nagel, 2002 & Ekvall, 2003). Severe malarial Anaemia is presumed to account for more than half of all childhood deaths in Africa with case fatality rates in hospitals ranging between 8% and 18% (Slutcher et al, 1994). Case fatality from severe Anaemia in the community is likely to be much higher, since the majority of the hospital cases will have received a lifesaving blood transfusion.

HIV/AIDS is another factor that has been linked to childhood Anaemia. HIV causes cytokine-mediated inflammation, resulting into iron sequestration in macrophages and decreased iron absorption in the small intestines. A number of studies carried out in high HIV prevalence areas concur that there is a strong association between HIV/AIDS and Anaemia (Mukaya (2009, Calis et al, 2008 & Lewis et al, 2005). School age children are fond of harboring the greatest number of worms, with children below 24 months having intestinal helminthes infection rate ranging from 2% to 80% (Montresor et al, 2000). This puts children at risk of Anaemia since worms are associated to iron deficiency (Tatale et al, 1998). Out of more than 10 million deaths that occur each year in children less than five years old in developing countries, malnutrition attributes half of the deaths directly or indirectly (Black et al, 2003). Poor nutrition and micronutrient deficiencies exacerbate severity of infectious diseases resulting into Anaemia. Many African children live in a state of

ISSN No:-2456-2165

precarious iron balance which affects their erythropoietic activities leading to Anaemia. Infants with a low total body index as a consequence of low birth weight or maternal iron deficiency are particularly prone to iron deficiency and Anaemia. Haemoglobinopathies are clinical syndromes resulting from disorders of haemoglobin (Cheesbrough, 2006). These abnormalities are categorized into cultural variants, failure to synthesize haemoglobin and failure to complete the normal neonatal switch from fetal to adult haemoglobin. The commonest of these disorders are sickle cell disease. The homozygous form of sickle cell disease is caused by substitution of valine instead of glutamic acid in position 6 of the B- globin chain. As a result of this, abnormal haemoglobin is formed which has poor solubility and deformability in the de-oxygenated state and can polymerize within the red blood cells. The red blood cells show a characteristic change due to polymer formation, they become distorted and rigid hence sickle cells. These rigid cells block blood capillaries resulting into haemolytic Anaemia (Cheesbrough, 2006). In light of the above, it is crystal clear that malaria, helminthes, malnutrition, heamoglobinopathies and HIV/AIDS play a big in the development of Anaemia. This study took the opportunity to assess presence of the above aetiological factors in children and determine the leading cause of Anaemia as one of the study objectives.

Anaemia most times is insidious. The moderate to mild Anaemia forms remain undetected by health workers and in the community resulting into silent morbidity and mortality. In management of Anaemia, blood transfusion is routinely used as supportive treatment for severe Anaemia based on patients' haemoglobin levels. However, most hospitals still use inaccurate haemoglobinometers that may produce imprecise results. This implies that there are higher chances that blood transfusion is prescribed on basis of inaccurate haemoglobin measurement which squarely exposes patients to HIV and other blood-borne pathogens. Additionally, Blood transfusion itself is a costly medical practice and that also requires trained personnel. Virika hospital blood transfusion (2011) report indicates that a good number of children below 12 years admitted at the hospital are associated with Anaemia and every four out of ten hospitalized children receive blood transfusion. Furthermore, a higher percentage of child death at the hospital has been also linked to Anaemia (HFVH, 2010), a hypothesis that needs to be verified.

The purpose of this study is to (1) determine the prevalence of Anaemia in children ≤12 years attending Virika hospital, (2) determine the severity of Anaemia amongst the children, and (3) examine the leading cause of Anaemia amongst the children.

II. MATERIALS AND METHODS

A. *Study design and population set up*

Across-sectional study was designed to determine the prevalence, severity and leading cause of Anaemia in children ≤12 years who were attending outpatient department Virika hospital. The study was conducted in a period of 50 days from May to July 2012 at Virika hospital, Kabarole district. A sample size of 230 children were enrolled following exclusion and inclusion criteria.

B. *Methods and laboratory analyses*

The study employed both qualitative and semi-quantitative methods which allowed the researcher to obtain demographic and numerical data from the participants. Demographic information, blood and stool samples were collected (MOH, 2008) from every child after consent was sought from the parent/guardian. Every participant underwent a blood tests for haemoglobin concentration, HIV, malaria, sickle cell disease, stool test for helminthes infection and assessment for nutritional status.

- **Haemoglobin measurement:** Venous blood was aseptically drawn from antecubital or great saphenous vein into an EDTA tube (Sarstedt AG & Co, Numbrecht, Germany) from the participant. The tube was gently inverted 8-10 times to enable thorough mixing. A complete blood count (CBC) was performed to estimate haemoglobin concentrations using Humacount haematology analyser.

- **Malaria microscopy:** A drop of capillary blood aseptically collected from the participant's finger/ heel was spread on the glass slide to make a thick smear (Cheesbrough, 2006). Following air-drying, the smear was stained by Field technique (Warhurst & Williams, 1996) and examined for presence of malaria parasites using Zeiss microscope.

- **HIV serology:** HIV antibody testing was carried out on the participants' EDTA venous blood using the National HIV testing algorithm comprised of Determine, Stat-pak and Unigold kits (supplied by Abbot Systems)

- **Sickle cell test:** The patient's EDTA blood sample was subjected to the standard heamoglobin solubility test followed by a variety of centrifugation and filtration procedures. The resultant haemoglobin was measured spectrophotometrically and categorized into phenotype AA, AS or SS (Randolph, 2012).

- **Stool analysis:** 2grams of stool was collected from each participant in a stool container upon instructions given to the guardian. The samples were processed by direct preparation and formal saline methods (Sartaj et. al., 1991) and the slides examined for parasites using Zeiss microscope.

- **Nutritional status assessment:** Anthropometric assessment of every participant's weight, age and height was done. Body mass index (BMI) was calculated and compared to with percentiles of age on Center for Disease Control/ National Center of Health Statistics BMI growth chart for children to obtain the participants nutritional status (Tamsin et, al., 2003)

C. Quality control

Every respondent was given a number and allowed to participate only once in the study to avoid repetition of test results. Both positive and negative controls were included in every days testing of participants samples. All laboratory analyses followed the standard operating procedures.

D. Ethical consideration

Written ethical approval was obtained from the Faculty of Research and Ethics Committee (FREC) department of Mbarara University of Science and Technology. Permission was also sought from Virika hospital administration who allowed the study to take place. Informed consent was sought from all the subjects who participated in the study. All information obtained from the study was kept confidential.

E. Data analysis

Data was cleaned, entered into excel for analysis and presented in form of frequency tables and figures.

III. RESULTS

The study was hospital based, a reason that could explain the 100% response rate. Out of 230 children, 132 (57%) were females while 98 (43%) were males.

A. Prevalence of Anaemia

The number of children with Anaemia was 102 (44%) while those without Anaemia were 128 (56%). In the study, prevalence meant the percentage of children diagnosed with Anaemia, therefore prevalence was 44%.

Subject	Frequency	Percentage Distribution
Anaemia	102	44
No Anaemia	128	56

Table 1:- Shows frequency and percentage distribution of Anaemia amongst the subjects

B. Severity of Anaemia

Severity of Anaemia referred to as degree of its presentation. Out of 102 Anaemic clients, 20 (19.7%) had severe Anaemia, 42 (41.1%) had moderate Anaemia and 40 (39.2%) had mild Anaemia.

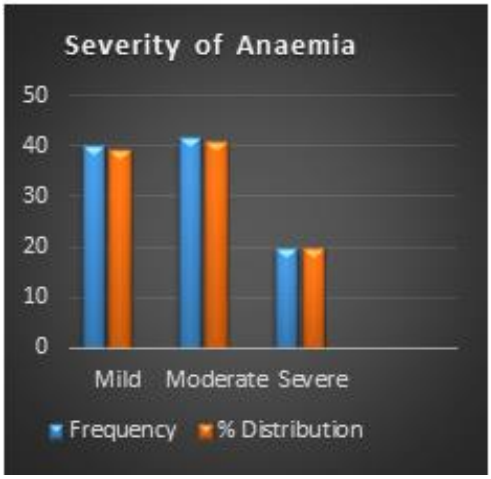

Fig 1:- Shows frequency and percentage distribution of mild, moderate and severe degrees of Anaemia amongst the subjects

C. Aetiology of Anaemia

Out of 102 Anaemic clients, 38 (37%) were associated with malnutrition, 35 (34.3%) had malaria, 9 (8.8%) had helminthes, 8 (7.8%) had sickle cell disorder, 2 (1.7%) had HIV/AIDS and 10 (10.4%) had unknown aetiology. Malnutrition contributed to highest number of anaemia cases

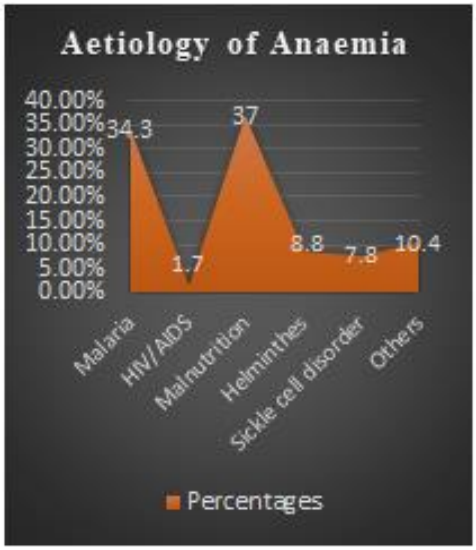

Fig 2:- Shows percentage causes of Anaemia

IV. DISCUSSION

The cross-sectional study was conducted at Virika hospital, where 230 children were recruited by convenience and simple random sampling. Social-demographic data and clinical details were collected. Blood samples were collected and analyzed for CBC, malaria, HIV, Sickle cell disorder and stool for presence of helminthes. The participants' nutritional status was done by anthropometrically assessing their weight, age and height. Results indicated that prevalence of Anaemia was 44% (102 patients). The high burden of Anaemia was attributed to its insidious nature that allows affected patients live in silence death without being diagnosed or treated. The

second reason was public unawareness of the silent epidemic given the fact that 89.9% of the study participants showed knowledge gap on interviews.

Mukaya (2009) conducted a similar cross- sectional descriptive study in the emergency Medical ward of Mulago hospital, where 395 patients were recruited by systematic random sampling. A complete blood count and peripheral film examination were done. Results indicated Anaemia prevalence of 64.6%, a high value that can be linked to chronic diseases common among patients attending Medical ward of Mulago hospital. Another similar study was carried out by Mbuya (2003) using cluster sampling to survey 2417 households at random in four contiguous districts in south- eastern United Republic of Tanzania in mid-1999. Overall, 58 %(1722) of participants had Hb <11g/dl, 39 % (775) had Hb <8g/dl and 3 %(65) had Hb <5g/dl. The study also found out that the highest prevalence of Anaemia of all the three levels was in children aged 6-11 months. Both studies by Mukaya (2009) and Mbuya (2003) concur with this present study that Anaemia is indeed a silent epidemic that calls for urgent intervention such as availing of improved diagnostic tests, optimizing compliance, appropriating referral practices and treatment guidelines.

The study also assessed degree of presentation of Anaemia amongst the participants. Out of 102 Anaemic clients, 20 (19.7%) had Severe Anaemia, 42 (41.1%) had Moderate Anaemia and 40 (39.2%) had Mild Anaemia. Majority of the children who had Moderate- Mild Anaemia had no clinical signs, a condition that could slowly enhance progression of the disease to its severe state. Two similar studies by Soares (2011) and Mukaya (2009) carried out in West Africa and Uganda respectively also depicted Moderate Anaemia as the highest degree of presentation. This burden requires a concerted effort such as community based Anaemia control programs and appropriating funds into research to develop better diagnostic and treatment targets.

Out of 102 Anaemic clients, 38 (37%) were associated with malnutrition, 35 (34.3%) had malaria, 9 (8.8%) had helminthes, 8 (7.8%) had sickle cell disease, 2 (1.7%) had HIV/AIDS and 10 (10.4%) were of unknown cause. The leading cause of Anaemia was malnutrition, which was also reflected in the poor feeding habits amongst the participants. Under nutrition in children leads to micronutrient deficiency like iron. This affects erythropoeitc activities as well as aggravating severity of other diseases, resulting into Anaemia. Malaria was second to malnutrition despite participants reporting regular use of ITN's and observing other malaria control measures. Malarial Anaemia was high among children who either had severe or poorly treated malaria. Helminthic Anaemia was majorly due to hookworm infection observed in children under five years of age. Sickle cell disorder (HBSS or HBAS) was observed in 7.3% of Anaemic participants. HBSS and HBAS accounted for 90% and 10% of sickle cell Anaemia respectively. HIV/AIDS was least (1.7%) of the aetiological factors. This is probably because of an integrated HIV-care network in Rwenzori region that has played an important role in HIV prevention and management. 10% of the Anaemia cases were of unknown cause. This calls for more studies in Anaemia aetiology, prevention and treatment.

V. CONCLUSION

Prevalence of Anaemia in children is high in moderate form and malnutrition is a major predisposing factor. The control of Anaemia should be made a priority by considering an integrated community and hospital based approach involving diagnostics, treatment, prevention and research strands.

RECOMMENDATIONS

The government should provide a community based nutritional support program targeting high risk groups such as giving supplements to children and educating parents on nutritional values.

Ministry of Health should design Anaemia control programs that could include availability of improved diagnostic tests, optimizing compliance, appropriating referral practices and implementation of standard treatment guidelines.

Allocating funds into Anaemia research.

- *Conflict of interest*

  Authors declare no conflict of interest

ACKNOWLEDGMENTS

The main author wishes to thank the co-authors for the supervision and academic contribution towards this report. Our sincere gratitude to the subjects who participated in study.

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