Anaemia among Under Five in Um Alghora Town and Different Associated Factors, Gezira State, Sudan (2018)

Hanaa Abd ElkarimMarganiMahgoub,

(MBBS, University of Al Zaiem Al Azhari2009)

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Department of Community and Family Medicine Faculty of Medicine University of Gezira

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Anaemia among Under Five in Um Alghora Town and Different Associated Factors, Gezira State, Sudan (2018)

Hanaa Abd Elkarim Margani Mahgoub

Supervisor Committee

Name                  Position           Sign.
Dr. Mohamed Almokhtar Mohamed Saad Eldeen       Main supervisor         .........................
Prof. Magda Elhadi Ahmed            Co-supervisor          .........................
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Hanaa Abd Elkarim Margani

Examination Committee

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<td>Dr. Abdel Rahman Ahmed Ismeil</td>
<td>External Examiner</td>
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<td>Prof. Salwa Elsanousi Hussein</td>
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Date of Exam.: 29/1/2019
Dedication

To the soul of my mother who supported me a lot in my life

&

To the rest of my family who are a great figure in my life

Hanaa
Acknowledgement

I would like to express my special gratitude to Gezira University, Family medicine program and its supportive staff members.

Furthermore, I would like also to acknowledge with much appreciation the crucial role of my supervisor, Dr. Mohamed Elmukhtar Mohamed Saad Eldeen appreciating the guidance given by him that has improved my skills. Thanks to his comments and advices. Also, it is important to mention Prof. Magda Elhadi my co-supervisor for her great and endless help and support.

Additionally, I would like also to acknowledge the staff of Um Alghra Center and the community of Um Alghra especially the women who helped me to collect the data and to complete my task.

Finally, deepest appreciation I give to all those who provided me the possibility to complete this research.
Anemia is a decrease in the total amount of red blood cells (RBCs) or hemoglobin in the blood. When anemia comes on slowly, the symptoms are often vague and may include feeling tired, weakness, shortness of breath or a poor ability to exercise. Anemia that comes on quickly often has greater symptoms, which may include confusion, feeling like one is going to pass out, loss of consciousness, or increased thirst. Anemia must be significant before a person becomes noticeably pale. Additional symptoms may occur depending on the underlying cause.

This is a descriptive analytical, community based cross-sectional study, aiming at studying prevalence of anaemia in under five years old children and different factors related to it, in Um Alghora Town, Gezira state, Sudan. Data was collected by the researcher using a structured questionnaire and hemoglobin concentration measurements. With a total of 170 mothers of under 5 years were interviewed, among the examined children (43.5%) of the children were normal, while (56.5%) of them were anemic, prevalence of anaemia among the study population was (68.2%), but within the prevalence range of Sudan and Africa, this prevalence was statistically significant with mother’s age and educational level. According to medical history, were (31.2%) had a history of some sort of disease during the past three months, while (68.8%) had not. Health education programs at community level should be initiated to increase mother’s awareness towards anaemia and factors related to it, improve weaning practice and supplementary feeding including micro nutrients.
الأنيميا عند الأطفال دون الخامسة في مدينة أم القرى والعوامل المؤثرة فيها، ولاية الجزيرة – السودان، 2018
هناك عبد الكريم ميرغني

Arabic Abstract

فقر الدم هو انخفاض في الكمية الإجمالية لخلايا الدم الحمراء (RBCs) أو الهيموجلوبين في الدم. ولأن فقر الدم يحدث ببطء، غالبًا ما تكون الأعراض غامضة وقد تشمل الشعور بالتعب أو الضعف أو ضيق التنفس أو ضعف القدرة على ممارسة الرياضة. فقر الدم الذي يأتي بسرعة غالبًا ما يكون له أعراض أكبر، والتي قد تشمل التشوش، والشعور بالغثيانية، أو فقدان الوعي، أو زيادة العطش. يجب أن يكون فقر الدم مرتفعا قبل أن يصبح الشخص شاحباً بشكل ملحوظ. قد تحدث أعراض إضافية اعتماداً على السبب الأساسي. هذه الدراسة دراسة مستعرضة وصفية تحليلية بنية على المجتمع لرصد الحالات والشواهد، بهدف معرفة انتشار مرض فقر الدم بين الأطفال دون سن الخامسة من العمر والعوامل المختلفة المتصلة بها، في مدينة أم القرى، ولاية الجزيرة، السودان. وقد تم تجميع البيانات بواسطة الباحثة عن طريق استبيان منظم وقياسات تركيز الهيموجلوبين في الدم. أجريت مقابلات مع 170 من أمهات الأطفال دون سن 5 سنوات، من بين الأطفال الذين تم فحصهم (43.5٪) من الأطفال كانوا طبيبين، في حين كان (56.5٪) منهم يعانون من فقر الدم، وكان معدل انتشار فقر الدم بين مجتمع الدراسة (68.2٪)، وهذا معدل يقع ضمن نطاق الانتشار في السودان وأفريقيا، وكان هذا معدل ذو علاقة ذات دلالة إحصائية مع عمر الأم والمستوى التعليمي. أيضاً، وفقاً للتاريخ الطبي، (31.2٪) من الأطفال كان لديهم تاريخ مرضي خلال الأشهر الثلاثة الماضية، في حين أن (68.8٪) لم يكن لديهم. ينبغي الشروع في برامج التثقيف الصحي على مستوى المجتمعات المحلية لزيادة وعي الأمهات بفقر الدم والعوامل المرتبطة به، وتحسين الممارسات المرتبطة بالغذاء والتغذية التكميلية بما في ذلك المغذيات الدقيقة.
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Chapter One

Introduction

Introduction:

Childhood anaemia is a condition where a child has an insufficient hemoglobin (Hb) level to provide adequate oxygen to the body tissues. For children between 6 and 59 months (generally referred to as under-fives), the threshold Hb level for being nonanemic is 11.0 grams per deciliter (g/dL). Anaemia has numerous potential etiologies. Followed by acute blood loss and heredity or acquired diseases, the most common cause of anaemia in young children is low consumption and absorption of iron-rich foods (ie, meat and meat products). (Kejo, D., Petrucka, P. M., et al, 2018)

These conditions most often lead to iron deficiency anaemia, which accounts for approximately half of all anaemia cases globally, with under-five children and women being the most affected. Although relevant across the life span, anaemia in under-five children is a special case given its significance to underpinning a range of morbidities and mortality within this population subset. Not only are these patterns concerning due to their highly preventable and treatable nature, but they also project potential long-term individual and social consequences. At the individual level, childhood anaemia contributes to poor motor and cognitive development, poor school performance, as well as increased morbidity and mortality. (Miller J. L., 2013)

Anaemia is a condition in which the number of red blood cells (and consequently their oxygen-carrying capacity) is insufficient to meet the body’s physiologic needs. Specific physiologic needs vary with a person’s age, gender, residential elevation above sea level (altitude), smoking behavior, and different stages of pregnancy. Iron deficiency is thought to be the most common cause of anaemia globally, but other nutritional deficiencies (including folate, vitamin B12 and vitamin A), acute and chronic inflammation, parasitic infections, and inherited or acquired disorders that affect hemoglobin synthesis, red blood cell production or red blood cell survival, can all cause anaemia. (WHO., 2011)
Problem statement:

Globally, anaemia affects 1.62 billion people (95% CI: 1.50–1.74 billion), which corresponds to 24.8% of the population (95% CI: 22.9–26.7%). The highest prevalence is in preschool-age children (47.4%, 95% CI: 45.7–49.1), and the lowest prevalence is in men (12.7%, 95% CI: 8.6–16.9%). However, the population group with the greatest number of individuals affected is non-pregnant women (468.4 million, 95% CI: 446.2–490.6). (de Benoist B et al., 2008.)

Anemia during infancy and young childhood period is associated with poor health and impaired cognitive development, leading to reduced academic achievement and earnings potential in their adulthood life. However, there is scarcity of information showing the magnitude of iron deficiency anemia among young children.

Iron deficiency and iron deficiency anaemia (IDA) are major public health problems in the Middle Eastern countries. According to the WHO, the highest number of pre-school children, pregnant and non-pregnant women suffering from IDA live in the Eastern Mediterranean countries includes the Middle East and North Africa. The prevalence of IDA among preschool children was 20–67%, among school children was 12.6–50% and among pregnant women was 22.7–54%. (Mirmiran, P. et a, 2012)

Prevalence of anaemia among children (% of children under 5) in Sudan was 57.20 as of 2016. Its highest value over the past 26 years was 85.40 in 1990, while its lowest value was 57.20 in 2016.

Definition: Prevalence of anaemia, children under age 5, is the percentage of children under age 5 whose hemoglobin level is less than 110 grams per liter at sea level. (WHO, http://apps.who.int/gho/data/node.main.1?lang=en)
Justification:

- There is a high prevalence of anaemia among under-five years children in the study area.
- Most of the types are due to infectious diseases, inappropriate weaning and malnutrition, where they are preventable.
- No previous published studies were found in the study area.
Objectives:

General objective:

To assess the prevalence and factors related to anaemia among under five years children in Um Alghora Town, Gezira state, Sudan, 2018.

Specific objectives:

1. To determine the prevalence of anaemia among the under five years children.
2. To identify contributing factors to anaemia to under five years children.
Chapter Two

Literature Review

Anemia is a decrease in the total amount of red blood cells (RBCs) or hemoglobin in the blood, or a lowered ability of the blood to carry oxygen. When anemia comes on slowly, the symptoms are often vague and may include feeling tired, weakness, shortness of breath or a poor ability to exercise. Anemia that comes on quickly often has greater symptoms, which may include confusion, feeling like one is going to pass out, loss of consciousness, or increased thirst. Anemia must be significant before a person becomes noticeably pale. Additional symptoms may occur depending on the underlying cause. (Janz TG.et al, 2013)

The three main types of anemia are due to blood loss, decreased red blood cell production, and increased red blood cell breakdown. Causes of blood loss include trauma and gastrointestinal bleeding, among others. Causes of decreased production include iron deficiency, a lack of vitamin B12, thalassemia, and a number of neoplasms of the bone marrow. Causes of increased breakdown include a number of genetic conditions such as sickle cell anemia, infections like malaria, and certain autoimmune diseases. It can also be classified based on the size of red blood cells and amount of hemoglobin in each cell. If the cells are small, it is microcytic anemia. If they are large, it is macrocytic anemia while if they are normal sized, it is normocytic anemia. Diagnosis in men is based on a hemoglobin of less than 130 to 140 g/L (13 to 14 g/dL), while in women, it must be less than 120 to 130 g/L (12 to 13 g/dL). Further testing is then required to determine the cause. (Janz TG.et al, 2013)

Certain groups of individuals, such as pregnant women, benefit from the use of iron pills for prevention. Dietary supplementation, without determining the specific cause, is not recommended. The use of blood transfusions is typically based on a person's signs and symptoms. In those without symptoms, they are not recommended unless hemoglobin levels are less than 60 to 80 g/L (6 to 8 g/dL). These recommendations may also apply to
some people with acute bleeding. Erythropoiesis-stimulating medications are only recommended in those with severe anemia. (Qaseem A. et al, 2013)

Anemia is the most common blood disorder, affecting about a third of the global population. Iron-deficiency anemia affects nearly 1 billion people. In 2013, anemia due to iron deficiency resulted in about 183,000 deaths – down from 213,000 deaths in 1990. It is more common in women than men, during pregnancy, and in children and the elderly. Anemia increases costs of medical care and lowers a person's productivity through a decreased ability to work. The name is derived from Ancient Greek: ἀναιμία anaimia, meaning "lack of blood", from ἄν- "not" and ἁἷμα haima, "blood". (GBD, 2015)

**Signs and symptoms**

Anemia goes undetected in many people and symptoms can be minor. The symptoms can be related to an underlying cause or the anemia itself. Most commonly, people with anemia report feelings of weakness or fatigue, and sometimes poor concentration. They may also report shortness of breath on exertion. In very severe anemia, the body may compensate for the lack of oxygen-carrying capability of the blood by increasing cardiac output. The patient may have symptoms related to this, such as palpitations, angina (if pre-existing heart disease is present), intermittent claudication of the legs, and symptoms of heart failure. On examination, the signs exhibited may include pallor (pale skin, lining mucosa, conjunctiva and nail beds), but this is not a reliable sign. There may be signs of specific causes of anemia, e.g., koilonychia (in iron deficiency), jaundice (when anemia results from abnormal break down of red blood cells — in hemolytic anemia), bone deformities (found in thalassemia major) or leg ulcers (seen in sickle-cell disease). In severe anemia, there may be signs of a hyperdynamic circulation: tachycardia (a fast heart rate), bounding pulse, flow murmurs, and cardiac ventricular hypertrophy (enlargement). There may be signs of heart failure. Pica, the consumption of non-food items such as ice, but also paper, wax, or grass, and even hair or dirt, may be a symptom of iron deficiency, although it occurs often in those who have normal levels of hemoglobin. Chronic anemia may result in behavioral disturbances in children as a direct result of impaired neurological development in infants, and reduced academic
performance in children of school age. Restless legs syndrome is more common in those with iron-deficiency anemia. (Einollahi, Behzad. 2014)
Causes

The causes of anemia may be classified as impaired red blood cell (RBC) production, increased RBC destruction (hemolytic anemias), blood loss and fluid overload (hypervolemia). Several of these may interplay to cause anemia eventually. Indeed, the most common cause of anemia is blood loss, but this usually does not cause any lasting symptoms unless a relatively impaired RBC production develops, in turn most commonly by iron deficiency. (NHLBI, 2018)

Impaired production

- Disturbance of proliferation and differentiation of stem cells
  - Pure red cell aplasia
  - Aplastic anemia affects all kinds of blood cells. Fanconi anemia is a hereditary disorder or defect featuring aplastic anemia and various other abnormalities.
  - Anemia of renal failure by insufficient erythropoietin production
  - Anemia of endocrine disorders
- Disturbance of proliferation and maturation of erythroblasts
  - Pernicious anemia is a form of megaloblastic anemia due to vitamin B12 deficiency dependent on impaired absorption of vitamin B12. Lack of dietary B12 causes non-pernicious megaloblastic anemia
  - Anemia of folic acid deficiency, as with vitamin B12, causes megaloblastic anemia
  - Anemia of prematurity, by diminished erythropoietin response to declining hematocrit levels, combined with blood loss from laboratory testing, generally occurs in premature infants at two to six weeks of age.
  - Iron deficiency anemia, resulting in deficient heme synthesis
  - Thalassemias, causing deficient globin synthesis
  - Congenital dyserythropoietic anemias, causing ineffective erythropoiesis
  - Anemia of renal failure (also causing stem cell dysfunction)
• Other mechanisms of impaired RBC production
  o Myelophthisic anemia or myelophthisis is a severe type of anemia resulting from the replacement of bone marrow by other materials, such as malignant tumors or granulomas.
  o Myelodysplastic syndrome
  o anemia of chronic inflammation
  o Leukoerythroblastic anemia is caused by space-occupying lesions in the bone marrow that prevent normal production of blood cells. (Mitchell RS et al, 2007)

**Increased destruction**

Anemias of increased red blood cell destruction are generally classified as hemolytic anemias. These are generally featuring jaundice and elevated lactate dehydrogenase levels.

• Intrinsic (intracorporuscular) abnormalities cause premature destruction. All of these, except paroxysmal nocturnal hemoglobinuria, are hereditary genetic disorders.
  o Hereditary spherocytosis is a hereditary defect that results in defects in the RBC cell membrane, causing the erythrocytes to be sequestered and destroyed by the spleen.
  o Hereditary elliptocytosis is another defect in membrane skeleton proteins.
  o Abetalipoproteinemia, causing defects in membrane lipids
  o Enzyme deficiencies
    ▪ Pyruvate kinase and hexokinase deficiencies, causing defect glycolysis
    ▪ Glucose-6-phosphate dehydrogenase deficiency and glutathione synthetase deficiency, causing increased oxidative stress (favism syndrome)
  o Hemoglobinopathies
    ▪ Sickle cell anemia
    ▪ Hemoglobinopathies causing unstable hemoglobins
• Paroxysmal nocturnal hemoglobinuria

• Extrinsic (extracorpustural) abnormalities
  o Antibody-mediated
    ▪ Warm autoimmune hemolytic anemia is caused by autoimmune attack against red blood cells, primarily by IgG. It is the most common of the autoimmune hemolytic diseases. It can be idiopathic, that is, without any known cause, drug-associated or secondary to another disease such as systemic lupus erythematosus, or a malignancy, such as chronic lymphocytic leukemia.
    ▪ Cold agglutinin hemolytic anemia is primarily mediated by IgM. It can be idiopathic or result from an underlying condition.
    ▪ Rh disease, one of the causes of hemolytic disease of the newborn
    ▪ Transfusion reaction to blood transfusions
  o Mechanical trauma to red blood cells
    ▪ Microangiopathic hemolytic anemias, including thrombotic thrombocytopenic purpura and disseminated intravascular coagulation
    ▪ Infections, including malaria
    ▪ Heart surgery
    ▪ Haemodialysis (Gyorkos TW et al, 2011)

Blood loss

• Anemia of prematurity from frequent blood sampling for laboratory testing, combined with insufficient RBC production
• Trauma or surgery, causing acute blood loss
• Gastrointestinal tract lesions, causing either acute bleeds (e.g. variceal lesions, peptic ulcers) or chronic blood loss (e.g. angiodysplasia)
• Gynecologic disturbances, also generally causing chronic blood loss
• From menstruation, mostly among young women or older women who have fibroids
• Infection by intestinal nematodes feeding on blood, such as hookworms and the whipworm Trichuris trichiura.

The roots of the words anemia and ischemia both refer to the basic idea of "lack of blood", but anemia and ischemia are not the same thing in modern medical terminology. The word anemia used alone implies widespread effects from blood that either is too scarce (e.g., blood loss) or is dysfunctional in its oxygen-supplying ability (due to whatever type of hemoglobin or erythrocyte problem). In contrast, the word ischemia refers solely to the lack of blood (poor perfusion). Thus ischemia in a body part can cause localized anemic effects within those tissues. (Brooker S.et al, 2008)

**Fluid overload**

Fluid overload (hypervolemia) causes decreased hemoglobin concentration and apparent anemia:

• General causes of hypervolemia include excessive sodium or fluid intake, sodium or water retention and fluid shift into the intravascular space.

• From the 6th week of pregnancy hormonal changes cause an increase in the mother's blood volume due to an increase in plasma. ("ISBT: 8. 2018)

**Intestinal inflammation**

Certain gastrointestinal disorders can cause anemia. The mechanisms involved are multifactorial and not limited to malabsorption but mainly related to chronic intestinal inflammation, which causes dysregulation of hepcidin that leads to decreased access of iron to the circulation.

• Helicobacter pylori infection.

• Gluten-related disorders: untreated celiac disease and non-celiac gluten sensitivity. Anemia can be the only manifestation of celiac disease, in absence of gastrointestinal or any other symptoms.

• Inflammatory bowel disease. (Stein J. et al, 2016)
Previous studies:

In a WHO report that stated that, Prevalence of anemia among children (% of children under 5) in Sudan was 57.20 as of 2016. Its highest value over the past 26 years was 85.40 in 1990, while its lowest value was 57.20 in 2016. (Definition: Prevalence of anemia, children under age 5, is the percentage of children under age 5 whose hemoglobin level is less than 110 grams per liter at sea level.) (WHO, 2016).

In a cross-sectional study conducted in 2014 in three large hospitals in Khartoum State (Khartoum Teaching Hospital, Alribat University Hospital and Alsuadi Teaching Hospital) in July 2012, when 381 women were included in the study after being consented. All deliveries in the three hospitals during a period of one week (6 working hours a day) were included regardless of their mode of delivery or number of fetuses. Three groups: 151, 130 and 100 women were selected from Alsuadi Teaching Hospital, Khartoum Teaching Hospital and Alribat University Hospital, respectively, the study revealed that the main risk factors for low birth weight in the study were found to be: lack of adequate education (OR= 1.9, 95% CI= 1.03-3.47; P= 0.04), gestational age (OR= 5.5, 95% CI= 2.8-10.9; P< 0.001), presence of moderate or severe anemia (OR= 3.19, 95% CI= 1.35-7.58; P= 0.008). (Saeed OAM, et al 2014)

WHO regional estimates generated for preschool-age children and pregnant and non-pregnant women indicate that the highest proportion of individuals affected by anemia are in Africa (47.5–67.6%), while the greatest number affected are in South-East Asia where 315 million (95% CI:291–340) individuals in these three population groups are affected. (WHO, 2008)

In a study to determine the prevalence of anaemia and associated factors among under-fives and their mothers in a rural area of Western Uganda. A cross-sectional investigation using both qualitative and quantitative methods of data collection, they found that the overall prevalence of Fe-deficiency anaemia among children and their mothers was 26.2 % and 17.9 %, respectively. Place of birth, age of the child, factors related to complementary foods, and formal education and nutrition knowledge of the mother were major factors that were significantly associated (r = 0.05, P = 0.05) with low Hb levels among the children. (Kikafunda, J., F. et al. 2009).
An Ethiopian study with the aim to determine the prevalence of anemia and determinant factors among children aged 6–59 months living in KilteAwulaelo Woreda, eastern zone. Found that the majority were from households with annual income below 10,000 Ethiopian birr [AOR = 4.86; 95% CI (3.2, 7.3)] and were more likely to become anemic. The prevalence of anemia among the children is found to be high. It was associated with annual household income, age, and nutritional status of the child. (Gebreegziabiher, G., et al, 2014)

A cross-sectional study of children aged 6-60 months was carried out in nine Local Government Areas (LGAs). A total of four hundred (400) under-five children were selected by purposive sampling method. Two hundred were from the urban and another two hundred from the rural locations. Height, weight, and mid-upper arm circumferences of the children were measured. Weighed 3-day food record for 20% of the sub sample was analyzed for proximate composition. Blood samples for determination of hemoglobin (Hb). The results showed that 70.5% of under-fives were anemic and 48.1% were iron deficient. Anaemia was prevalent in both rural and urban locations; however, it was more in rural settings. Educational levels of parents, mosquito bites, child’s size and appearance ratings, and vitamin/mineral drops consumption were the socio-economic factors associated with prevalence of anaemia. (Onyemaobi, G.A. et al, 2011)

A study in Tanzania found that, Anaemia is extremely common in south-eastern United Republic of Tanzania, even in very young infants. Further implementation of the Integrated Management of Childhood Illness algorithm should improve the case management of anaemia. However, the asymptomatic nature of most episodes of anaemia highlights the need for preventive strategies. The EPI has good coverage of the target population and it may be an appropriate channel for delivering tools for controlling anaemia and malaria. Globally, anaemia affects 1.62 billion people (95% CI: 1.50–1.74 billion), which corresponds to 24.8% of the population (95% CI: 22.9–26.7%). The highest prevalence is in preschool-age children (47.4%, 95% CI: 45.7–49.1). (Schellenberg, D., et al, 2003)

Another study in Nigeria, found stated that: Anaemia is a global public health problem. It affects more than 56 million people globally. This study was designed to investigate the
prevalence and types of anaemia among the children attending the Pediatrics Department of Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto North-Western Nigeria. Out of the four hundred children tested, 139 (34.8%) were anemic, revealing five etiological types of anaemia among the children: Iron deficiency 62 (44.6%), sickle cell 43 (31.0%), normocytic normochromic 19 (13.7%), anaemia of chronic diseases 10 (7.1%), and megaloblastic 5 (3.6%) and three morphologic classification (i.e., normocytic anaemia 48 (34.5%), macrocytic anaemia 18 (13.0%), and microcytic anaemia 73 (52.5%)). (Mainasara, A., et al, 2017)

In study conducted in Canada, included were 1647 healthy children (median age 36 months) with survey, anthropometric, and laboratory data. An association was found between increasing duration of breastfeeding and lower serum ferritin (P = .0015). Exploratory analysis suggested an increasing cumulative probability of iron deficiency with longer total breastfeeding duration with an adjusted odds ratio of 1.71 (95% confidence interval: 1.05-2.79) for iron deficiency in children breastfed over versus under 12 months of age. The relationship between total breastfeeding duration and iron deficiency anemia did not meet statistical significance. (Maguire, J. L. et al, 2013)

Studies have revealed that haematologic and biochemical alterations occur in malaria infected blood and there are common complications associated with this disease. Haematologic alterations that are associated with malaria infection include anaemia, thrombocytopenia, and disseminated intravascular. (Hussain, M. M., et al, 2013).
Chapter Three
Methodology

Study design
Community based, cross sectional, descriptive and analytical study.

Study area
Um Alghora is the capital of Um Alghora locality, about 45 Kilometers east to Wad Medani. The total number of populations is about 218,000 persons, with 25,433 under five years old children. Most of the population work in agriculture. Most of Sudanese tribes in the area, like Shokria, Galeen, Koahla and Batahin.
There are five primary schools and two secondary schools.

Study settings:
Um Alghora Hospital has threespecialists, three general practitioners, seven nurses, three lab assistants, two pharmacist assistants and five guards and cleaners, it consists of a clinic for the physician, laboratory, nutrition and vaccination unit, pharmacy, short stay and long stay ward, labor room, theater and a reception.

Study population:
Children between 6 months and five years of age and their mothers, living in the study area during the period of the study.

Inclusion criteria:
All children aged 6 months to five years, who were met during the survey and their mothers’ who agreed to participate.

Exclusion criteria:
Refused to participate.
Children less than 6 months or above 5 years, or not from Um Alghora town.
Sample size:

The sample size was calculated using Steven Thompson equation.

\[ n = \frac{N \times p(1-p)}{\left[ N - 1 \times \left( \frac{d^2}{z^2} \right) \right] + p(1-p)} \]

- \( n \) = the required sample size
- \( N \) = Total population
- \( p \) = Baseline levels of the indicators or prevalence = 0.86
- \( z \) = the value in the normal distribution that gives the level of confidences = 1.96
- \( d \) = the desire margining or error (\( d = 0.05 \))

\[
\frac{2000 \times 0.86(1 - 0.86)}{[2000 - 1 \times (0.0025 \div 3.8416)] + 0.86(1 - 0.86)}
\]

\( n \approx 170 \)

Sample size: 170

Sample technique:

The total number of households in the study area was 2,000 and the sample was 170, thus from every 12 households a respondent was selected, in case of no child of under-five the next door was selected using a systemic random sampling technique.

Data collection tools:

Data was collected by the researcher from a structured questionnaire and hemoglobin concentration results, the questionnaire (Annex1) was pre-tested and modified from community and family medicine department of Gezira university after being reviewed with supervisor, it consists of socio-demographic variables such as (mothers’ age, educational level, occupation, fathers’ educational level and occupation plus the child age and gender) as independent variables. The Hb level measurement was requested and done in the lab of the health center and used as a dependent variable. After the data have been
collected from each visit, the collected data checked to ensure that it was complete and of good quality.

**Data analysis:**

Data was analyzed using (SPSS) statistical Package for Social Sciences, version (24). To obtain descriptive statistic like frequency percentage and chi squire to detect the relation between the variable like the associations between some variables such as education level, occupation against child Hb level.

**Ethical consideration:**

Approval was obtained from the ethical committee (Faculty of Medicine, University of Gezira) and Ministry of health. An informed verbal consent was obtained from every mother before participation in the study, also, a permission was obtained from the mothers to take a blood sample to measure the Hb level for the child. Participants were assured that collected data will be strictly confidential, and will not be disclosed for any reason, and will be used only for research purposes. Free samples of Iron and Folic acid were distributed for some of the participants.
Chapter Four

Results

The following result represents 170 under-five children and caretaker in Um Alghora town using a structured questionnaire, by interviewing their mothers.

Table 1: Socio-demographic characteristics distribution among the parents of under-five children, n=170.

<table>
<thead>
<tr>
<th>Mother's Age group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25</td>
<td>39</td>
<td>22.9</td>
</tr>
<tr>
<td>26-35</td>
<td>85</td>
<td>50.0</td>
</tr>
<tr>
<td>36-45</td>
<td>30</td>
<td>17.6</td>
</tr>
<tr>
<td>&gt;45</td>
<td>16</td>
<td>9.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother’s educational level</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>43</td>
<td>25.3</td>
</tr>
<tr>
<td>Primary</td>
<td>31</td>
<td>18.2</td>
</tr>
<tr>
<td>Secondary</td>
<td>61</td>
<td>35.9</td>
</tr>
<tr>
<td>University</td>
<td>35</td>
<td>20.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother’s Occupation</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housewife</td>
<td>112</td>
<td>65.9</td>
</tr>
<tr>
<td>Working mother</td>
<td>58</td>
<td>34.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Father’s educational level</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>39</td>
<td>22.9</td>
</tr>
<tr>
<td>Primary</td>
<td>34</td>
<td>20.0</td>
</tr>
<tr>
<td>Secondary</td>
<td>57</td>
<td>33.5</td>
</tr>
<tr>
<td>University</td>
<td>40</td>
<td>23.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Father’s Occupation</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee</td>
<td>57</td>
<td>33.5</td>
</tr>
<tr>
<td>Farmer</td>
<td>53</td>
<td>31.2</td>
</tr>
<tr>
<td>Free business</td>
<td>56</td>
<td>32.9</td>
</tr>
<tr>
<td>Jobless</td>
<td>4</td>
<td>2.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household Monthly income</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 500 pounds</td>
<td>22</td>
<td>12.9</td>
</tr>
<tr>
<td>500 and less than 1000</td>
<td>110</td>
<td>64.7</td>
</tr>
<tr>
<td>1000 pound and more</td>
<td>38</td>
<td>22.4</td>
</tr>
<tr>
<td>Total</td>
<td>170</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The most frequent age group is 26-35 with 85 (50.0%) mothers. The mean age was 27.2 years and the SD. was ±8.9. The majority of them were educated 74.7%, (not illiterate). 65.9% were housewives. Most of their husbands had secondary education and were farmers and free workers. The majority of them (77.6%) have an income of less than one thousand SDG.

![Pie chart showing the number of under-five years children in the family, n=170.](image)

**Figure 1: Number of under-five years children in the family, n=170**

Majority of families had two children (41.2%)
Table 2: Age of the under-five children (last one), n=170.

<table>
<thead>
<tr>
<th>Age in month</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-12</td>
<td>60</td>
<td>35.3</td>
</tr>
<tr>
<td>13-24</td>
<td>64</td>
<td>37.7</td>
</tr>
<tr>
<td>25-36</td>
<td>32</td>
<td>18.9</td>
</tr>
<tr>
<td>37-48</td>
<td>12</td>
<td>7.1</td>
</tr>
<tr>
<td>49-60</td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>170</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Almost three quarters of them were under two years of age.

Table 3: Sex of the under-five children (last one), n=170.

<table>
<thead>
<tr>
<th>No.</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>72</td>
<td>42.4</td>
</tr>
<tr>
<td>Female</td>
<td>98</td>
<td>57.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>170</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

The most frequent sex was female 57.6%.
Table 4: History of complications during last pregnancy among the mother’s, n=170.

<table>
<thead>
<tr>
<th>No.</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>19</td>
<td>11.2</td>
</tr>
<tr>
<td>No</td>
<td>151</td>
<td>88.8</td>
</tr>
<tr>
<td>Total</td>
<td>170</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Very few of the mothers 11.2%, had complications during their last pregnancy.

Figure 2: Hb Status among the under-five children (last one), n=170

43.5% of the children were normal, while 56.5% of them were anemic.

Table 5: Descriptive Statistics of Hb levels among the under-five children (last one), n=170

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>5.1</td>
<td>10.8</td>
<td>7.3</td>
<td>±1.683</td>
</tr>
</tbody>
</table>
Table 6: PALM examination of the under-five children (last one), n=170.

<table>
<thead>
<tr>
<th>Status</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>13</td>
<td>7.6</td>
</tr>
<tr>
<td>Average</td>
<td>109</td>
<td>64.1</td>
</tr>
<tr>
<td>Pale</td>
<td>26</td>
<td>15.3</td>
</tr>
<tr>
<td>Very pale</td>
<td>22</td>
<td>12.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>170</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Those who were pale or very pale were 28.2%.

Table 7: Type of breastfeeding among the under-five children (last one), n=170.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive</td>
<td>147</td>
<td>86.5</td>
</tr>
<tr>
<td>Not Exclusive</td>
<td>23</td>
<td>13.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>170</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Most of themothers 86.5% had breastfed their children exclusively.
Table 8: Weaning status among the under-five children (last one), n=170.

<table>
<thead>
<tr>
<th>Status</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not weaned</td>
<td>81</td>
<td>47.6</td>
</tr>
<tr>
<td>Weaned in 2 years</td>
<td>82</td>
<td>48.2</td>
</tr>
<tr>
<td>Weaned in &lt; 2 years</td>
<td>7</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>170</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Almost half of the mothers 48.2% had weaned their children in two years.

Table 9: Supplementary feeding of the last child among the study population, n=170.

<table>
<thead>
<tr>
<th>Supplementary feeding</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food with milk</td>
<td>137</td>
<td>80.6</td>
</tr>
<tr>
<td>Food only</td>
<td>33</td>
<td>19.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>170</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

80.6% of respondents had food plus milk as a supplementary food.
The vast majority of the children 91.8% had completed their vaccination doses according to their age.
Figure 4: History of malaria of under 5 years' children (last one) in the last 3 months among the study population, n=170

High percentage of the children had no disease during the last three months.
Table 10: Cross tabulation between Socio-demographic characteristics and Hb Level among the under-five children (last one), n=170.

<table>
<thead>
<tr>
<th>Mother’s Age group</th>
<th>Hb Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Abnormal</td>
</tr>
<tr>
<td>&lt;25</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td>26-35</td>
<td>34</td>
<td>51</td>
</tr>
<tr>
<td>36-45</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>&gt;45</td>
<td>9</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother’s educational level</th>
<th>Hb Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Abnormal</td>
</tr>
<tr>
<td>Illiterate</td>
<td>37</td>
<td>6</td>
</tr>
<tr>
<td>Primary</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>Secondary</td>
<td>15</td>
<td>46</td>
</tr>
<tr>
<td>University</td>
<td>2</td>
<td>33</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother’s Occupation</th>
<th>Hb Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housewife</td>
<td>44</td>
<td>68</td>
</tr>
<tr>
<td>Working mother</td>
<td>30</td>
<td>28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Father’s educational level</th>
<th>Hb Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>Primary</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Secondary</td>
<td>33</td>
<td>24</td>
</tr>
<tr>
<td>University</td>
<td>12</td>
<td>28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Father’s Occupation</th>
<th>Hb Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee</td>
<td>21</td>
<td>36</td>
</tr>
<tr>
<td>Farmer</td>
<td>40</td>
<td>13</td>
</tr>
<tr>
<td>Free business</td>
<td>11</td>
<td>45</td>
</tr>
<tr>
<td>Jobless</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household Monthly income</th>
<th>Hb Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 500 pounds</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>500 and less than 1000</td>
<td>59</td>
<td>51</td>
</tr>
<tr>
<td>1000 pound and more</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>96</td>
</tr>
</tbody>
</table>

Chi square test was performed to measure the relation between mother’s age, educational level, occupation and fathers’ educational level, occupation and household monthly income versus Hb Status among the under-five children. All these relationships were statistically significant (P. value = 0.011, 0.038, 0.000, 0.008 and 0.000) respectively, except for the fathers’ educational level (P. value = 0.231).
Chapter Five
Discussion

The result of this study showed that:

A total of 170 under-five children and caretaker in Um Alghora town were interviewed, among them 96 (56.5%) were anaemic, while 74 (43.5%) were not. (Minimum = 5.1, maximum = 10.8, mean = 7.3, Std. Deviation = ± 1.683). According to WHO/UNICEF/UNN (2001) classification, (10.9%) were mild, (73.1%) moderate and (16.0%) were severely anaemic. Accordingly, anaemia is classified as a serious public-health issue by WHO. However, the prevalence of anaemia observed in the present study was lower than the estimated mean for Africa in general, which is approximately 60% (WHO, 2008). And also, lower than Sudan overall prevalence (57.2%) in 2016. (WHO, 2016)

The prevalence rate of anaemia is similar to many countries, the PHNI (2008) statistics reported the prevalence of anaemia in many countries of the world by WHO. For example, in Ghana (2005) the prevalence was 84%, Mali was 82.7% for children 6-59 months in 2006. Gambia had 76% for 1-5 years.

Mothers’ age showed that half of them (50.0%) were in the age group 26-35 years, while about a quarter (27.0%) were older than 35 years. A Chi square test was performed to measure the relation between mother’s age and Hb Status among the under-five children it was significant (P value = 0.011).

25.3% of mothers were illiterate, while 20.6% were graduated, this showed a great variation in education level between mothers. To measure the relation between mother’s educational level and Hb Status among the under-five children a chi² test was performed and it was significant (P value = 0.038), this shows the effect of mothers education on child nutrition which corelate with his Hb level, this is similar to the results obtained by (Kikafunda, J., F. et al. 2009) who found that the relationship between mothers’ formal education and their children Hb levels was statistically significant (P. value = 0.05)
Most of the mothers were housewives (65.9%), another Chi square test was done to measure the relation between mother’s occupation and Hb Status among the under-five children; it was significant (P value = 0.000).

Two thirds of the mothers’ (77.6%) their household monthly income was less than 1,000 SDG, this is higher than an Ethiopian study by (Gebreegziabiher, G., et al, 2014) which found that the majority were from the low economical class.

73.0% of the children were between 6 months and two years, there is a significant statistical relation between child’s age and Hb Status. (Onyemaobi, G.A. et al, 2011)

42.4% of the children were males, while 57.6% were females. No statistical relation was found between gender and Hb Status and this is not matching the results of (Romano Ngui et al, 2012).

Concerning the clinical examination (PALM examination), (64.1%) were average, (7.6%) were normal, (15.3%) were pale and (12.9%) were very pale.

147 (86.5%) were exclusively breastfed, while only 23 (13.5%) were breastfed unexclusively.

47.6% of the children not weaned yet, while (48.2%) weaned after 2 years and (4.1%) were weaned before completing 2 years of breastfeeding. Weaning status was not statistically significant as tested by Ch² test with Hb Status.

(80.6%) were supplemented by ordinary diet and milk, while (19.4%) were supplemented by ordinary diet only.

According to medical history, (31.2%) had a history of malaria during the past three months, while (68.8%) had not. Studies found that in heavily endemic malaria areas, it is almost inevitable that malarial infection will be associated with anaemia, although malaria may not be the primecause of it.
Chapter Six

Conclusion and Recommendations

Conclusion

- A total of 170 mothers of under 5 years were interviewed and their Hb level was measured to assess anaemia and factors contributing to it in Um Alghora town.

- Prevalence of anaemia among the study population was (56.5%), but within the prevalence range of Sudan and Africa.

- There were statistically significant relationships between mother’s age and educational level with Hb level measurements of the children.

- The relationships were statistically significant between mother’s age, educational level, occupation and fathers’ occupation and household monthly income versus Hb Status among the under-five children. (P. value = 0.011, 0.038, 0.000, 0.008 and 0.000) respectively, but was not significant for the fathers’ educational level (P. value = 0.231).

- These results assure that mother’s age, educational level and occupation plus fathers’ occupation and household monthly income were probably anemia risk factors in the study area.
Recommendations

Regarding the results of this study, the following recommendations should be considered:

1- Health education programs should be initiated to increase mother’s awareness towards anaemia and factors related to it.

2- Improve weaning practice and supplementary feeding including micro nutrients.

3- Promote nutritional educational programs at community level.
References


WHO, Global Health Observatory Data Repository/World Health Statistics (http://apps.who.int/gho/data/node.main.1?lang=en?)


Annex 1: questionnaire

بسم الله الرحمن الرحيم

كليه الطب - جامعة الجزيرة
قسم علوم الأسرة والمجتمع
ماجستير طب الأسرة - الدفعة الرابعة

استبيان حول مرض فقر الدم والعوامل المرتبطة به لدى الأطفال دون سن الخامسة

في مدينة أم القرى - محلية أم القرى - ولاية الجزيرة

الرقم المستنسل: .................................

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<td>3/</td>
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</tr>
<tr>
<td>4/</td>
<td>عمل الأب: موظف</td>
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<td>التحصين حسب عمر الطفل: كامل غير كامل</td>
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</table>

- 35 -