University of Khartoum
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ANEMIA among pregnant women attending antenatal care clinic in
Omdurman Maternity Hospital
Khartoum state March-April 2014

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To my dear children. To my lovely mother. To my husband. To all members of my family. To all women struggling around the world specially the most generous women of my country, to everyone who helped me and to my dear country Sudan.
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First and last I thank Allah

I am most grateful and appreciate to my supervisor associate professor Dr. Kamil Mirgani Ali, faculty of medicine, University of Khartoum, for his fine way of supervision, and I am very grateful to his valuable advice, and useful criticism that helped me to be specific.

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List of abbreviations:-

ANC: Antenatal Care.

AIDS: Acquired Immunodeficiency syndrome.

CBC: Complete blood count.

HIV: Human Immunodeficiency Virus.

Hb: Hemoglobin.

RBC: Red blood cells.

HC: Himatocitets is the measure of RBC found in specific volume of blood.

IDA: Iron Deficiency Anemia.

IM: Intramuscular.

IV: Intravenous

LDCs: less developed countries.

MCV: Mean corpuscular volume.

MCHC: Mean corpuscular hemoglobin concentration.

PVC: Packed Volume Cell.

SPSS: Statistical Package for social sciences.

WHO: World Health Organization.

PEM: Protein Energy Malnutrition.
Abstract:

Background: Anaemia, is one of the most common nutritional deficiency diseases observed globally and affects more than a quarter of the world’s population. It is a major public health problem affecting all ages with its highest frequency among children under five years of age and pregnant women. Globally, anaemia affects 1.62 billion people, among which 56 million (25%) are pregnant women (WHO.2011).

The objectives of this cross sectional descriptive study is to study the frequency and risk factors of anaemia among pregnant women attending antenatal care clinic in Omdurman Maternity Hospital during the period of the study March- April 2014.

Methods: Data were collected from 384 pregnant women registered in the antenatal clinic at Omdurman Maternity Hospital, through copies of standard modified WHO questionnaire based interview, and Hb concentration was determined in the antenatal clinic by laboratory scientist using the colorimetric method.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) software version 20. Cross-tabulation and significance of difference using Pearson's chi-square test was constructed.

Results: Frequency of anaemia among pregnant women was 33.8%, of whom 10.4%, 18.2%, 5.2%, had mild, moderate, severe anaemia with
Hb concentration 9 - 9.9gm/dl, 7- 9gm/dl, <7gm/dl respectively. There was significant relation between frequency of anaemia and the educational level of the women, the illiterate represent (13.8%) (P= 0.0001), house wife were (26.8 %), (P= 0.008), (25%) doesn’t take furious compound during pregnancy, (P= 0.0001) and (20%) don’t attend antenatal care or follow health counseling early in pregnancy, (P= 0.0001).

**Conclusion:** Anaemia during pregnancy is related to socio demographic and economic factors. The study recommends health education for women on the importance of early initiation of antenatal clinic attendance, iron and folic acid supplementation early in pregnancy, in addition to protection against Malaria.
المستخلص

خلفية الدراسة: الإخلاصات: أن الإثباتات من أمراض الإنتاميا بقلة نسبة الهيماتوكريتي في الدم، والإثباتات من أكثر الأمراض المنすれば عالميا، إذ أنه يصيب جميع الأعمار ونسبة أكبر لدى الأطفال دون سن الخامسة والنساء الحوامل وقدرت منظمة الصحة العالمية انتشار مرض الإنتاميا في العالم بـ 1,62% (25%) و يوجد منها ما يعادل 56 مليار من النساء الحوامل. و أن مرض الإنتاميا له تأثير على صحة الحامل و الجنين.

نوع الدراسة: دراسة وصفية.

منطقة الدراسة: أجريت هذه الدراسة في مستشفى أم درمان للولادة في الفترة من مارس إلى إبريل 2014.

أهداف الدراسة: تهدف هذه الدراسة لقياس نسبة انتشار مرض الإنتاميا ودراسة العوامل المؤثرة على المرض أثناء فترة الحمل وسط الحوامل المتغيرة على مستشفى أم درمان للولادة في الفترة من مارس إلى إبريل 2014 تم استخدام النهج الوصفي التحليلي من خلال طرح استبيان علي العينه من عدد 384 امرأة حامل.

طريقة جمع البيانات: تم أخذ البيانات لهذه الدراسة من (384) حامل من خلال استبيان وجود مباشر للنساء الحوامل و اشتمل على أسئلة لها علاقة بمرض الإنتاميا بناء علي معيار استبيان منظمة الصحة العالمية.

تحليل البيانات: تم تحليل البيانات بواسطة الحزم الإحصائية للعلوم الاجتماعية (SPSS) النسخة 20 وتم عرض النتائج في شكل جداول وتم تحديد العلاقات باستخدام اختبار كاي.

النتائج:

كشفت الدراسة النتائج التالية: نسبة مرض الإنتاميا لنساء الحوامل (33.8%)، مع وجود نسبة (10.4%, 18.2%, 5.2%) من الإنتاميا الخفيفة والمتوسطة والحادة، على التوالي.
وأوضححت الدراسة وجود علاقة بين مرض الانيميا وعدة عوامل مثل الحالة الاقتصادية والاجتماعية. كما وجد أن نسبة الانيميا وسط الامهات الحوامل غير المتعلمات حوالي (13.8%) و (8.26%%) يمثلان ربات المنازل. مع وجود نسبة (25%) لم يتناولن مركب الحديد أثناء الحمل. و تقدر نسبة اللائي لم يبدأن متابعة الحمل منذ بدايةه بمراكز الرعاية الصحية (20%).

الخلاصة: خلصت الدراسة إلى وجود عدة عوامل اجتماعية واقتصادية وديموغرافية أدت إلى حدوث مرض الانيميا لدى النساء الحوامل لذلك أوصت الدراسة باهمية متابعة الحمل بمراكز الصحة الأمومة والطفلة مع توفير وسائل الوصول والخدمات الصحية المتكاملة للحامل، مع تشجيع المراء الحامل وتنفيذها للاهمية اخذ حبوب الحديد و مكافحة مرض الملاريا.
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1-1 Introduction:-

Anemia is the most common nutritional deficiency disorder in the world, Anemia in pregnancy is defined as: a hemoglobin concentration below 11g/dl (WHO, 2009). Anemia is a symptom of a wide variety of mild to serious diseases disorders and conditions. Anemia can result from nutritional deficiencies, trauma, hemorrhage, transfusion reaction, malabsorption, chronic diseases, inherited diseases, autoimmune diseases, malignancy, and treatments for malignancy, such as chemotherapy and radiation therapy. It is a major health problem in many developing countries. It is associated with increased rates of maternal mortality, and it has a significant impact on the health of the fetus such as preterm deliveries, low birth weights, perinatal mortality and morbidity, other adverse outcomes due to the impairment of oxygen delivery to placenta. Globally, anemia affects 1.62 billion people (25%), among which 56 million are pregnant women (WHO, 2009). 95.7% of whom live in developing countries, while in America and Europe the frequency is estimated at 24.1% and 25.1% respectively (WHO,2011). Frequency of anemia in South Asian countries in 2010 was 32.9% is among the highest in the world, resulting in 68.4 million with disability-adjusted life years (DALYs), (WHO,2011).

In Africa, the frequency of anemia in pregnancy is estimated to be between 35% and 75%, and with a high frequency and severity occurring among primigravida. (Balarajane et al, 2011) The burden of disease is heavy so in Sub Saharan Africa Anemia poses a 5-fold increase in overall risk of maternal death related to pregnancy and delivery.
**Problem statement:**

In Sudan. Anemia during pregnancy is a large health problem where pregnant women in different regions of Sudan are more susceptible to anemia, irrespective of their age or parity. It is associated with poor maternal and prenatal outcomes. (Adam *et al.*, 2010), the maternal mortality ratio in Sudan was estimated at 750/100,000 live births. Sudan was one of eleven countries that are responsible for 65% of global maternal deaths according to a recent World Health Organization (WHO) estimate. (Mohammed *et al.* 2011). It is well known that the frequency of anemia rises with increasing poverty level. The recent Sudan poverty assessment prepared by the World Bank and the Sudan government stated that overall 46.5% of the population were below the poverty line with a higher rate (57.6%) among the rural population (Adam *etal*, 2010).
1-2-3 Justification:

Anemia during pregnancy is a major health problem in Sudan, as it affects the poor segment of population and Sudan is one of the poorest countries in the world, it has serious effect on the mother, birth outcome and the GDP (Growth Domestic Product). Omdurman Maternity Hospital received about 28,000 pregnant women per year (Omdurman Maternity Hospital statistical department (March 2014)). Therefore, this study will give a useful idea about the causes, prevention of anemia and tools of controlling it through the advices and health education that is informing the pregnant woman, this will help in reducing the burden of the disease, as perception is a major driver for people attitude towards the intervention.
1-2. Objectives of the study:

1-2-1 General Objectives:

To study the frequency and risk factor of Anemia among pregnant women attending Omdurman Maternity Hospital during the period of the study, (March—April 2014).

1-2-2 Specific Objectives:-

To calculate the frequency of anemia among pregnant women attending antenatal care in Omdurman Maternity Hospital.

To investigate the relationship between anaemia and the following factors: nutritional status, socio demographic, economic characteristics of pregnant women, maternal and obstetrical history, taking iron supplementation, eating habits, and some diseases.
1.3: Literature review:

1.3.1. Definition of anemia:

Anemia in pregnancy is defined by the World Health Organization (WHO) as a hemoglobin concentration below 11 g/dL. It continues to be a major health problem in many developing countries and is associated with increased rates of maternal and perinatal mortality, premature delivery, low birth weight, and other adverse outcomes (Haider, 2013). More than half of the pregnant women in the world have hemoglobin levels indicative of anemia, the frequency of anemia in developing countries is relatively high (33% to 75%). The most common cause of anemia in pregnancy worldwide is iron deficiency anemia. Anemia ranges from mild to moderate to severe and the WHO pegs the hemoglobin level for each of these types of anemia in pregnancy at 10.0 – 10.9 g/dl (mild anemia), 7 – 9.9 g/dl (moderate anemia) and < 7 g/dl (severe anemia) (WHO, 2009).

1.3.1: Common types of anemia during pregnancy:

1.3.1.1: Anemia of pregnancy: In pregnancy, a woman's body makes extra blood. This causes the concentration of red blood cells in her body to become diluted. This is sometimes called anemia of pregnancy (WHO, 2004). Anemia in pregnancy may be relative or absolute, relative anemia is a normal physiological phenomenon that occurs in pregnancy due to larger increase in plasma volume (approximately 45.0% in singleton and 50.0–60.0% in twin gestation) than in red cell mass, resulting in the well-known physiological anemia of pregnancy. Absolute anemia involves a true decrease in red cell mass, involving increased red cell destruction as in haemoglobinopathy, malaria, and bacterial
infection like urinary tract infection, increased red cell loss as in bleeding or decreased red cell production as in nutritional deficiency or chronic disease (WHO, 2011).

1.3.1.2: Iron deficiency anemia: Is the most common type of anemia during pregnancy, It is the lack of iron in the blood, which is necessary to make hemoglobin, the part of blood that distributes oxygen from the lungs to tissues in the body (Friis, 2010). The World Health Organization (WHO) defines iron deficiency anemia (IDA) as anemia accompanied by depleted iron stores and signs of a compromised supply of iron to the tissues (Dim et al, 2007). The baby uses the red blood cells for growth and development. If the pregnant woman stored an extra red blood cells in her bone marrow before she get pregnant, she can use that during pregnancy to help meet the baby's needs. Women who do not have adequate iron stores can develop iron deficiency anemia. Good nutrition before becoming pregnant is important to help build up these stores and prevent iron deficiency anemia (Esmat, 2010). Iron deficiency affects more people than any other condition, constituting a public health condition of epidemic proportions (WHO, 2005) Iron deficiency and anemia reduce the work capacity of individuals and entire populations, bringing serious economic consequences and obstacles to national development. It reduce the cognitive function (Akhter, 2012).

Iron deficiency is the only nutrient deficiency which is also significantly prevalent in industrialized countries. The numbers are staggering: 2 billion people – over 30% of the world’s population – are iron deficiency anemic (Blarajan, 2011). Africa carries a high burden of anaemia with a frequency of 65.8 % among pregnant
women, and in resource-poor areas, this is frequently exacerbated by infectious diseases, Malaria, HIV/AIDS, hookworm infections, schistosomiasis, and other infections such as tuberculosis are particularly important factors contributing to the high frequency of anemia (Baig et al., 2008). The WHO/World Bank has ranked iron deficiency anemia as the third leading cause of disability-adjusted life years (DALYs) lost for females 15–44 years of age. For men in this age group, iron deficiency anemia was ranked among the top 10 disease burdens (WHO, 2011). Poverty is one of the risk factors for iron deficiency in pregnant women (WHO/CDC, 2005).

Women and young children in less developed countries (LDCs), are the most seriously affected group particular, in parts of the world where iron fortification Programs are not in effect (Hayder et al., 2013). Among women, iron deficiency occurs at a higher frequency than in men due to menstrual iron losses and the extreme iron demands of a growing fetus during pregnancy, which are approximately two times the demands in the no pregnant state. The growing fetus requires a large supply of Iron taken up from maternal blood via transferrin-receptor mediated endocytosis (Carson, 2012) Once maternal iron stores are depleted, she becomes anemic and transfer of iron to the developing fetus is compromised (Molly, 2014).

1.3.1.3: The effects of iron and folic acid on birth outcomes:

Iron has been identified as a key growth factor for the developing fetus (Elzahrani, 2012) it leads to improvements in birth weight or length of gestation when iron supplementation taken during pregnancy. Studies conducted among severe maternal anemia (Hb
<8.0 g/dL) found that a birth weight values of 200–400 grams lower than in women with normal Hb levels (Koh, 2013). In addition, two more recent randomized controlled trials found that iron supplementation led to improved mean birth weight and decreased risk of low birth weight (Koh, 2013). Folic acid is necessary for cell growth and repair and essential for the formation and maturation of red blood cells. Deficiency of folate leads to slowing of DNA synthesis. IDA is associated with increased maternal and perinatal morbidity and mortality (WHO, 2009).

1.3.1.4: Vitamin B12 deficiency anemia: Other micronutrients like Vitamin B-12, Folic acid and Zinc deficiencies have also been associated with anemia in pregnancy (Aikawa, 2006) leading to a combination of both microcytic and megaloblastic anemia. Vitamin B12 is important in forming red blood cells and in protein synthesis. Eating food that comes from animals, such as milk, eggs, meats, and poultry, can prevent vitamin B12 deficiency. Women who don't eat any foods that come from animals (vegan) are most likely to get vitamin B12 deficiency they are liable to have a baby with certain birth defects of the brain and spinal cord (spina bifida) (Molly, 2014)

1.3.1.5: Folate deficiency anemia: Folate, also called folic acid, is a B-vitamin that works with iron to help with cell growth. If the pregnant woman don’t get enough folate during pregnancy, she could get iron deficiency. Folate help in reducing the risk of having a baby with certain birth defects of the brain and spinal cord if taken before conception and in early pregnancy (Chang, 2014).
1.3.1.6: Effects of anemia in pregnancy:-

Anemia increases perinatal risks for mothers and neonates; and increases overall infant mortality. The odds for fetal growth restriction and low birth weight are tripled. The odds for preterm delivery are more than doubled. Even a moderate hemorrhage in an anemic pregnant woman can be fatal (Habib, 2013).

1.3.1.7: Effects of anemia on fetus and neonate

A basic principle of fetal/neonatal iron biology is that iron is prioritized to red blood cells at the expense of other tissues, including brain. When iron supply does not meet iron demand, the fetal brain may be at risk even if the infant is not anemic (Cuervo, 2003). Although dietary deficiency may be contributory, the etiology of the vast majority of cases of iron deficiency anemia in infancy and childhood is maternal iron deficiency anemia in pregnancy. Anemia adversely affects cognitive performance, behavior and physical growth of infants, preschool and school-aged children. Anemia depresses the immune status and increases the morbidity from infections in all age groups. It adversely impacts the use of energy sources by muscles and thus the physical capacity and work. Anemia continuous to be a major health problem in many developing countries and is associated with increased rates of maternal and prenatal mortality, premature delivery, low birth weight, and other adverse outcomes (WHO, 2009).

In pregnancy, anemia has a significant impact on the health of the fetus as well as that of the mother. 20% of maternal deaths in Africa have been attributed to anemia. Fetuses are at risk of preterm deliveries, low birth weights, morbidity and perinatal mortality due
to the impairment of oxygen delivery to placenta and fetus. (Baker, 2009).

Anemia in pregnancy leads to maternal and fetal morbidity and mortality such as puerperal infections, preterm labor, poor weight gain, postpartum Anemia hemorrhage, prematurity, low birth weight, preterm delivery, fetal cognitive impairment and poor APGAR scores and even infant deaths. Being anemic also burdens the mother by increasing the risk of blood loss during labor and making it more difficult to fight infections (Hayder, 2010). Anemia during the first two trimesters, leads to greater risk for having a pre-term delivery or low-birth-weight baby (Dim, 2007)

1.3.1.8: Signs and symptoms of anemia:

The most important element of red blood cells is called hemoglobin. Hemoglobin is a protein that carries vital oxygen from the lungs through the bloodstream to the cells, tissues and organs of the body. Many symptoms of anemia are due to a decreased amount of hemoglobin in the blood. These symptoms can include dizziness, shortness of breath, weakness, palpitations, fatigue, and fainting spells, hypotension and pallor or pale skin, lips, nails, palms of hands, or underside of the eyelids, are also common symptoms (WHO, 2010).

1.3.2: Causes of anemia in pregnancy: The common causes of anemia include parasitic infestations such as malaria and hookworm, schistosomiasis, infections like HIV and hemoglobinopathies, anemia can be due to other diseases such as malaria, which can cause hemolytic anemia, and increase the risk for still birth (Aikawa, et al 2006).
In many developing countries, the physiologic changes that occur during pregnancy can be aggravated by under nutrition, leading to micronutrient deficiency states, such as anemia, that can have disastrous consequences for both mothers and newborn infants (Baig, et al 2008).

The body goes through significant changes when a woman becomes pregnant. The amount of blood in the body increases by about 20-30 percent, which increases the supply of iron and vitamins that the body needs to make hemoglobin. Hemoglobin is the protein in red blood cells that carries oxygen to other cells in the body (WHO, 2009).

Many women lack the sufficient amount of iron needed for the second and third trimesters. When the body needs more iron than it has available, the woman can become anemic. In pregnancy, when the volume of blood in the body increases by almost 50 percent to support both the pregnant woman and the growing baby. This, in turn, decreases the blood’s hemoglobin concentration. Since the body needs iron to make hemoglobin, without sufficient iron stores, red blood-cell production slows, along with their energy-boosting oxygen supply (Carson, et al 2012).

Anemia in pregnancy may be relative or absolute. Relative anemia is a normal physiological phenomenon that occurs in pregnancy due to larger increase in plasma volume (approximately 45.0% in singleton and 50.0–60.0% in twin gestation) than in red cell mass, resulting in the well-known physiological anemia of pregnancy. Absolute anemia involves a true decrease in red cell mass, involving increased red cell destruction as in haemoglobinopathy,
malaria, and bacterial infection like urinary tract infection; increased red cell loss as in bleeding; or decreased red cell production as in nutritional deficiency or chronic disease (BNF, 2015). The most common causes of Anemia in pregnancy worldwide is iron deficiency, the predisposing factors include low social-economic status, Infectious diseases eg: malaria, and inadequate child spacing (Khalafalla et al, 2012).

Broadly, causes of anemia may be classified as impaired red blood cell (RBC) production, such as in vitamin B12 deficiency, increased RBC destruction as in hemolytic anemia and sickle cell disease, anemia can also occur when there is a deficiency of hemoglobin in the red blood cells, such as in iron deficiency anemia and thalassemia. Any disease, disorder or condition that causes heavy bleeding (hemorrhage) can also cause anemia, these can include postpartum hemorrhage, postoperative hemorrhage, gastrointestinal bleeding, peptic ulcer, colorectal cancer, ulcerative colitis, ruptured aneurysm, and trauma that causes hemorrhage, and anemia can be due to 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 (WHO, 2011)

1.3.3: Risk factors behind anemia during pregnancy:

Factors that put women at risk of acquiring anemia in pregnancy include twin or multiple pregnancy spacing between two pregnancies is short and heavy menstrual flow before
pregnancy due to either fibroids or abnormal uterine bleeding. When the pregnant woman is vomiting frequently due to morning sickness, or if she does not take enough iron in her food, and if has a heavy pre-pregnancy menstrual flow, or if she has an intestinal problem that can affect the absorption of iron. Other risk factors for anemia included older maternal age, low educational level (illiteracy), farming occupation, low socioeconomic status, mild pregnancy-induced hypertension (PIH) and severe PIH. Also rate of anemia was higher among those who do not practice any form of family planning and those with increased parity (WHO, 2009) Young primigravidas also have a higher risk of anemia in pregnancy due to their age and more often than not poor nutritional status. Anemia in pregnancy is also affected by co–morbidities, and anemia was more prevalent and severe among the HIV positive mothers (Aimakhu, et al. 2013). The predisposing factors include grandmultiparity, and malaria (Haider, 2013).

1.3.4.: Contributory factors behind anemia:-

1.3.4.1: Age:

One of predisposing factors of anemia is age of pregnant women. The young pregnant woman (less than 24 years) is more susceptible to develop anemia (Malamitsi, et al. 2006).

1.3.4.2: Education:

The effect of educational level on frequency of IDA among pregnant women showed that the less educated (the no formal and primary education group) had higher frequency of IDA than those
with secondary and post-secondary education. The less likely to maintain proper hygiene and sanitation and so are susceptible to infections (Malamitsi, et al 2006)).

1.3.4.3: Economic status:

Studies have shown that iron deficiency anemia affect the poor segment of population, and it affect the productivity of workers. For example, anemic tea pickers in sir-lanka are more tired and week than their non-anemic colleague (WHO,2009) Indonesian researchers analyzed anemic women and found that they carried out less house hold work and were less productive in non-physically strenuous factory work (Carson, 2012). According to the World health Organization (WHO), iron deficiency has been one of the most expensive diseases in the world to less productivity. Scientists analyzing the economic consequences of iron deficiency cost developing countries an average 0.6 percent of their growth domestic products (GDP) (Vivek, et al 2012).

When the damage of children's intellectual development due to iron deficiency anemia is added, the figure raises to 4 percent of GDP. And raise national productivity levels as much as 20 percent (Vivek, 2012), and (Haider, 2013).

1.3.4.4: Nutritional status:

Among the nutrition factors contributing to anemia, the most one is iron deficiency. It is due to a diet that is monotonous, but in substances (phytates) inhabiting iron absorption so that dietary iron cannot be utilized by the body (Wiss, 2014). Iron deficiency may also be aggravated by poor nutritional status, especially when it is
associated with deficiency in folic acid, vitamin A or B12, and its frequency is high among the population living in developing countries (Ogunbode, 2003).

1.3.4.5: Inter pregnancy spacing:

Regarding the effect of child spacing on the frequency of IDA among pregnant women with child spacing of less than 1 year 1-1.5 year had significantly lower mean HB and higher frequency of anemia than those with child spacing was found not to have any effect of the incidence of PEM among these pregnant women (WHO, 2009) it is therefore seem that the negative effects on nutritional status of frequent cycles of pregnancy and location are more pronounced with regard to iron status than energy status (WHO, 2009).

1.3.4.6: Bleeding:

Bleeding can be short term or persist other time. It can be caused by heavy menstrual period, bleeding from digestive or urinary tract, surgery, trauma, or cancer if bleeding significant, body can loss enough RBCs to cause anemia (Salhan et al., 2012)

1.3.4.7: Family size:

The most important biological cause of anemia is malaria and intestinal worms, biological related factors include education, household size, income, age, parity, birth and spacing of pregnancy. The more the family size the more increased risk of anemia, (WHO, 2012)

1.3.4.8: Other diseases:
In poor resources areas, some infectious diseases, Malaria, HIV/AIDS, hookworm infections, schistosomiasis, and tuberculosis are particularly important factors contributing to the high frequency of anemia. (Broek, et al 2009). Anemia can result from some diseases, and it can make other diseases worse. For example, some cancer treatments may damage the bone marrow that makes the red blood cells or damage this cells ability to carry oxygen. This makes the cancer patient weaker and less able to absorb iron (Iloabache, et al, 2007). It is estimated that malaria is responsible for 1.2 million Deaths and 2.9% of total DALYs from in low and Middle income population (WHO 2009)

1.3.4.9: Anemia and water related infections:

With regard to infection malaria is another major cause of anemia it affects 300-500 million people, and in endemic areas it may be the primary cause of all severe anemia cases (WHO 2010). Hookworms infection and in some place schostosmiasis also contribute to anemia. Approximately 44 million pregnant women have Hookworms infection and 20 million people are infected with schostosmiasis. Anemia can also be due to excessive blood loss, such as gastrointestinal infection associated with diarrhea. The most important water-related cause of anemia is diarrhea, water-born or water - related infection, Anemia effect half of preschool children and pregnant women and at least 30% to 40% in industrial countries in poorer malaria endemic countries, Anemia is one of the commonest preventable causes of death in children and pregnant women (Habib, et al 2009), (Andrew et al, 2015).

1.3.5.1: Diagnosis of anemia:
Anemia can be diagnosed with a complete blood count (CBC). A complete blood count can determine the amount of hemoglobin carried in the red blood cells and the number, size, hap, and color of the red blood cells. Because, in iron deficiency anemia, red blood cells are smaller and paler in color than normal. In vitamin deficiency anemia's, red blood cells are enlarged and fewer in number (Schuepbach, et al. 2013), the levels of the red blood cells contained in the blood (hematocrit), normal adult hematocrit values are between 38.8 and 50 percent for men and 34.9 and 44.5 percent for women, normal adult hemoglobin values are generally 13.5 to 17.5 grams per deciliter for men and 12 to 15.5 grams per deciliter for women (WHO, 2005).

Making a diagnosis also includes performing a variety of other tests to help to diagnose the underlying disease, condition or disorder causing anemia. This may include a blood test that measures ferritin, a test for vitamin B12 deficiency and tests to determine if a person has sickle cell trait or thalassemia trait (Schuepbach, et al. 2013).

The normal ranges for hemoglobin depend on the age and, beginning in adolescence, the gender. For example, the normal ranges of hemoglobin’s are: Newborns 17 to 22 gm. /dl, Babies 1 week of age 15 to 20 gm. /dl, Babies 1 month of age 11 to 15 gm. /dl, Children 11 to 13 gm. /dl, Adult men 14 to 18 gm. /dl, Adult women 12 to 16 gm. /dl, Men after middle age 12.4 to 14.9 gm. /dl, Women after middle age 11.7 to 13.8 gm. /dl (WHO, 2005).

1.3.6.1: Prevention of anemia during pregnancy:-
Pre-pregnancy counseling, dietary advice and therapy are very important for ensuring best pregnancy outcomes. It is recommended that full blood count should be checked at the booking visit in pregnancy and repeated at 28 weeks to screen for anemia. In high risk mothers and multiple pregnancies, an additional hemoglobin check should be performed near term. Dietary advice should be given to all mothers to improve intake and absorption of iron from food (Haider, et al 2013)

To prevent anemia the pregnant woman should eat food with a rich sources of iron this include, meats. Beef, lamb, liver, poultry. Chicken, duck, turkey, liver (especially dark meat), fish, egg yolk, leafy greens of the cabbage family. these include broccoli, kale, turnip greens, and collard, legumes, green peas, dry beans and peas, such as pinto beans, black-eyed peas, and canned baked beans, yeast-leavened whole-wheat bread and rolls, iron-enriched white bread, dry fruits, dark green leafy vegetables (spinach), lentils, pasta, rice, and cereals (Wiss, 2014).

Using cast iron utensils for cooking and taking iron with vitamin C (orange juice) can improve its intake and absorption. Certain foods which may inhibit iron absorption should not be taken with iron rich foods. These include polyphones (in certain vegetables, coffee), tannins (in tea), phytates (in bran) and calcium (in dairy products). Weekly iron (60 mg) and folic acid (2.8 mg) should be given to all menstruating women including adolescents, periodically, in communities where IDA is considered a problem(Baker, et al 2009)
Increased intake of iron, treatment of underlying conditions like anti-helminthes therapy are important preventive measures. Pregnant women need iron to cover their basic losses, increased RBC mass and demand from fetoplacental unit. Vitamin B12 and foliate deficiencies in pregnancy are rare and may be a result of inadequate dietary intake with the latter being more common. These vitamins play an important role in embryogenesis and hence any relative deficiencies may result in congenital abnormalities. Finding the underlying cause is crucial to the management of these deficiencies. From a neonatal perspective, delayed clamping of the umbilical cord at delivery (by 1–2 min) is important step in prevention of neonatal anemia (Koh et al, 2013).

In areas where malaria is endemic, intermittent preventive treatment with effective antimalarial and the distribution of insecticide-treated bed nets need to become implemented on a large scale (WHO, 2009). Other preventive measures include ensuring comprehensive obstetric and social history at the antenatal clinic, proper dietary counseling on proper sources of iron available to the community, family planning services encouraging at least three year intervals and discouraging eating of soil during pregnancy (Carson, et al 2012). Taking iron supplements is recommended in addition to consuming these foods. Foods that are high in vitamin C can actually help the body absorb more iron, so it is beneficial to make these additions as well. Vitamin C rich foods like citrus fruits and juices, oranges, strawberries, kiwis, tomatoes, Bell peppers (Vivek et al 2012).

Good pre-pregnancy nutrition not only helps prevent anemia, but also helps build other nutritional stores in the mother's body, eating
a healthy and balanced diet before and during pregnancy helps keep up the levels of iron and other important nutrients needed for the pregnant health and that of the growing baby (Nyuke, 2010)

Vitamin supplements containing at least 400 micrograms of folic acid are recommended for all women of childbearing age and during pregnancy. Food sources of folate include, leafy, dark green vegetables, dried beans and peas, citrus fruits and juices and most berries, fortified breakfast cereals, and enriched grain products (Salhan et al, 2012).

In order to absorb as much of the iron as possible, it's best to take your iron pills on an empty stomach. Wash them down with water or orange juice (the vitamin C helps with absorption), but not with milk (calcium interferes with absorption). Coffee and tea also hinder absorption of iron. Pre-pregnancy counseling, dietary advice and therapy are very important for ensuring best pregnancy outcomes (WHO, CDC, 2005)

Malaria prevention is important in part in preventing anemia through control of malaria and haematinics supplementation (Esmat, et al 2010). All pregnant women receive routine daily supplementation of elemental iron and folic acid. Protection against malaria is usually achieved through the use of insecticide treated bed nets, intermittent preventive treatment of asymptomatic pregnant women, and early diagnosis and prompt and effective case management of malaria. Other interventions include HIV screening and management, health education on diet, cooking, and early diagnosis and treatment of anemia which depends on the severity
and its cause as well as the gestational age of the patient (Chang, 2014).

1.3.7.1: Treatment of anemia during pregnancy:-

Oral ferrous sulphate 200 mg 2–3 times daily (each tablet provides 60 mg elemental iron) is the most common preparation used. Alternative preparations include ferrous gluconate and ferrous fumarate. In the first week following initiation of iron therapy, there is often no rise in hemoglobin level but reticulocytosis is observed (Salhan, et al 2012). Hemoglobin level usually starts rising in the second week and the expected improvement in hemoglobin is approximately 1 g/dL per week. Common adverse effects of iron therapy include nausea, constipation and occasionally diarrhea (reduced by taking tablets after meals) (WHO, CDC, 2005).

Parenteral iron is required for those not tolerating oral iron or who need rapid correction of anemia (severe anemia in last month of pregnancy) and where oral therapy has failed. Parenteral iron can be administered intramuscular (IM) or intravenous (IV). The main drawbacks of IM route are pain, staining of skin, myalgia, arthralgia and injection abscess. Intravenous iron can be administered as total dose infusion; however, utmost caution is needed as anaphylaxis can occur. Iron dextran and iron polymaltose preparations can be used by both IM and IV routes (Blaragan, 2011).

Two newer IV preparations – iron sucrose and ferric gluconate are associated with reduced side-effects. Each iron sucrose ampoule contains iron sucrose equivalent to 50 mg elemental iron. Iron sucrose may be administered undiluted by slow intravenous injection at a rate of 1 mL (20 mg iron) solution per minute not
exceeding 100 mg iron per injection, it may also be administered by IV infusion. Infusion must be administered as every 2.5mL iron sucrose diluted exclusively in a maximum of 100 mL of 0.9% NaCl (saline), immediately prior to infusion. The solution must be infused at a rate of 100 mg/15 minutes. Unused diluted solution must be discarded (Salhan, et al. 2012).

Blood transfusion should be considered when a patient has decompensated owing to a drop in hemoglobin concentration and needs a more rapid rise in hemoglobin. Packed red cell transfusion may be indicated for pregnant women with severe anemia (Hb of 6 g/dL or less) close to due date or less than 8 g/dL if they have increased risk of blood loss at delivery (Elzahrani, 2012).

Correction of anemia in pregnancy can be achieved either with haematinics or by blood transfusion (Blarajan, 2011).

1.3.7.2: Management during labor:

Cross-matched blood should be available if needed in case of significant hemorrhage at the time of delivery. Strict asepsis is very important. In case of severe anemia with congestive cardiac failure, active management of third stage (with methyl ergometrine) is contraindicated (WHO, 2011).

1.3.7.3.: Postpartum management:

Close monitoring should be performed for signs of decomposition, infection or thrombosis. Appropriate thromboprophylaxis and contraceptive advice should be provided and hematinic supplementation should continue (Haider, 2012).
1.3.7.4: Recent advances in treatment of anemia are:

Erythropoietin is the new agent used in treatment of anemia in following situations: Erythropoietin deficient anemia, severe or progressing iron-deficiency anemia, Jehovah’s Witnesses or other refusal of blood transfusion, placenta previa (or placenta accrete), preoperative and postoperative patients, autologous blood donation, hemoglobinopathies. Erythropoietin is gaining popularity as a therapeutic option during pregnancy and the postpartum period (WHO, 2011).

1-4 previous studies:

Study carried by Broek (2009). To study the Frequency of anemia in pregnancy In Ethiopia, was found to be 41.9% with urban areas having a frequency of 35.9% compared to rural population 56.8 %. anemia in pregnancy leads to maternal and fetal morbidity and mortality such as puerperal infections, preterm labor, poor weight gain, postpartum anemia, hemorrhage, prematurity, low birth weight, pre term delivery, fetal cognitive impairment and poor APGAR scores and even infant deaths. Being anemic also burdens the mother by increasing the risk of blood loss during labor and making it more difficult to fight infections (Aikawa, 2006).

Study carried by Akhtar, et al (2012) represent the frequency of anemia in pregnancy in Eastern Uganda was 46%. Anemia is a common problem in most developing countries and a major cause of morbidity and mortality especially in malaria endemic areas. 20% of maternal deaths in Africa have been attributed to anemia.
Study carried by (Grantham, 2008) Anemia affect a half of preschool children and pregnant women and at least 30% to 40% in industrial countries in poorer malaria endemic countries. The frequency among pregnant women was 52%. Anemia is one of the commonest preventable causes of death in children and pregnant women.

In 1993 the World Bank rated anemia as the eighth leading cause of disease in young girls and women in the developing world, the average frequency of anemia in the world is 41.8% (WHO, 2009).

Study carried by Elzaharani, et al (2012) frequency of anemia about 56.7% among pregnant women in India.

Study carried by Adinma et al, (2003) Frequency of anemia in pregnancy in Nigeria is between (30-40%).

Study carried by Mayaer, (2009) out on selected countries in South Eastern Africa showed a frequency of 58%, 76%, 75.6% and 74.4 in Mozambique, Rural Zaire, Coastal Kenya and Tanzania respectively

Study carried by Van den, et al (2010) in Malawi, on the urban population on women attending antenatal clinic at St. Elizabeth Hospital in Blantyre, the frequency was 57.1%

Study carried by Adinma, (2008). In Kenya, to assess the frequency of anemia among pregnant, conducted in Kakamega put frequency of anemia in pregnancy at 25.7%. Another study conducted in Kericho District had frequency of anemia in pregnancy at 24.5%. While almost 70% of pregnant women in Kenya were moderately anemic. This is despite routine
supplementation with iron for all pregnant women attending antenatal clinics.

Study carried by Friday, *et al* (2004). Which is a Perspective study in severe anemia in pregnancy that was done in Kisumu District and it studied frequency and risk factors of the respondents who developed obstetric complications, 22% were found to be anemic. Poor pregnancy care, illness during pregnancy, socioeconomic conditions of mother and sanitary conditions of the household among other things also significantly increased frequency of anemia in this subjects.

Study carried by (Ogunbode,2003) in Kilifi District, 10% of women booked for antenatal care had severe anemia (Hb<7g/dl) with 76% having Hb, 11g/dl and the main causes of anemia were reported as iron deficiency often exacerbated by hookworm infestation, malaria, folate deficiency and HIV infection .

Study carried by Mohamed, (2006) in Sudan showed frequency of anemia as 67%, this high frequency of anemia in this study is therefore not surprising as Sudan is one of the poorest countries in the world. The recent Sudan poverty assessment prepared by the World Bank and the Sudan government stated that overall 46.5% of the population was below the poverty line with a higher rate (57.6%) among the rural population.

Study carried by Adam *et al* (2011) in Kasalla Eastern Sudan showed that the frequency is (36.2%).

Study carried by Haidar (2010)In Ethiopia, overall frequency of anemia was found to be 41.9%.
Study carried by Vivek, et al (2012) showed that anemia in pregnancy is a common problem in most developing countries and a major cause of morbidity and mortality especially in malaria endemic areas. In pregnancy, anemia has a significant impact on the health of the fetus as well as that of the mother. 20% of maternal deaths in Africa have been attributed to anemia.

Study carried by (Grantham, 2008) showed that anemia affect a half of preschool children and pregnant women and at least 30% to 40% in industrial countries in poorer malaria endemic countries, Anemia is one of the commonest preventable causes of death in children and pregnant women.

Study carried by Koh, et al (2013) represent about half of the global maternal deaths due to anemia occur in South Asian where anemia frequency is 46.9%, resulting in 68.4 million years lived with disability (YLD).
Methodology:

2-1 Study design:

A descriptive, cross-sectional, Hospital based study was conducted among the pregnant women at Omdurman Maternity Hospital with objective to study the frequency of anemia among the pregnant women, and to relate it to socio demographic factor.

2-2 Study area:

Omdurman Maternity Hospital.

2-2-1 Location:

Omdurman Maternity Hospital is located in Omdurman province which is located in Khartoum state boarded in the north by north state, in the east Omdurman and karrary locality, in the west bounded by north kordofan state in the south Omdurman locality.
2-2-2 Types of buildings:
Houses are made of bricks and cement as well and very small percentages built up with local material as mud, regarding the Hospital it’s made of reinforced concrete construction building.

2-2-3 Health and Medical Services:
The Hospital is specialized in serving women through different units: Anti-natal clinic, Family planning, Ultra sound, Investigation of Aids, Investigation and early detection of breast cancer, Dental clinic for pregnant women, nutrition section, mother and child health care clinic, Ante-natal ward, Post natal wards for normal delivery and caesarian section, New-natal care unit which has 20 incubator and 76 baby cots. Total number of beds in the Hospital are378 bed.

2-3 Study Populations:
The study participants were pregnant women attending antenatal care clinic in Omdurman Maternity Hospital, during the period of the study.

Sample technique:

2-4 Sample size:
Sample size was determined using the following statistical formula.

\[ n = \frac{z^2(pq)}{d^2} \]

Where \( z \) ≡ the value of standard normal value corresponding to 95% level of significance (\( z=1.96 \))

\( P \) ≡ expected frequency

\( q \) ≡ Non expected frequency
(p = q) = 0.05

\[ \text{D} \equiv \text{is marginal error (d=0.05)} \]

According to the rule above the number of samples was calculated to be

\[ n = \frac{(1.96)(1.96)(0.5)(0.5)}{(0.05)^2} = 384 \]

2-5 Data collection:

Interviewer-administered questionnaire was used to collect the stated objectives of the study. The sample was taken from the first 30 booked pregnant women in the antenatal clinic each day twice per week during the period of the study March-April 2014. Total of 420 pregnant women after signing an informed consent, were face-to-face interviewed, and about 36 prefer to write their answers in the questionnaire. 22 from them did not show their gravidity history, in addition to 14 were not sure if they had malaria or typhoid fever. So, the sample remains 384 pregnant women. Data was obtained with respect to age, socioeconomic status, number of meals per day, HB concentration, some diseases that can cause anemia e.g. malaria, number of pregnancies and other variables that can affect
in causing anemia. HB concentration is determined by the antenatal laboratory with laboratory scientist using the colorimetric method.

2-6 Data Statistical analysis:

Both the laboratory and questionnaire data were checked and cleaned for completeness and consistency. Participants with missing data on number of deliveries, the not sure about malaria or typhoid, and hemoglobin level were excluded from the analyses. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) software version 20. There was cross-tabulation of various variables against hemoglobin concentration profile. Pearson's chi-square test was used to evaluate the effect of these variables on the hemoglobin concentration profile at the 95% confidence level. Statistical significance was set at P < 0.05.

4.1. Analysis of participants: socio-demographic data:

Table (1); Socio-demographic profile of pregnant women attending antenatal clinic in Omdurman Maternity Hospital

(n=384)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(15 – 25) yrs.</td>
<td>173</td>
<td>45.0</td>
</tr>
<tr>
<td>(26 – 35) yrs.</td>
<td>134</td>
<td>34.9</td>
</tr>
<tr>
<td>(36 – 45) yrs.</td>
<td>77</td>
<td>20.1</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table (1) show the socio demographic characteristic result: the pregnant women at age (15-25) years were 45%, followed by (26-35) years were 35% and (36-45) years were 20%.

Educational:

19% illiterate and only 8.1% university educational

Family income:

42.5% had income (< 900) SDG/month, while 20.5% had (900-1350) SDG/month, and 37% had (1351-1800) SDG/month. Regarding the occupation 74.2% pregnant woman were house wife.
Table (2): frequency of anemia among pregnant women in antenatal clinic in Omdurman Maternity Hospital

(n=384)

<table>
<thead>
<tr>
<th>Anemia</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anemic</td>
<td>130</td>
<td>33.8</td>
</tr>
<tr>
<td>Not anemic</td>
<td>254</td>
<td>66.2</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>100</td>
</tr>
</tbody>
</table>

From table (2), frequency of anemia among pregnant women in Omdurman Maternity Hospital is 33.8%.
Table (3): Hb% among pregnant women in Omdurman Maternity Hospital.

\[ n=384 \]

<table>
<thead>
<tr>
<th>Hb%</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 50%</td>
<td>20</td>
<td>5.2</td>
</tr>
<tr>
<td>51 – 60 %</td>
<td>70</td>
<td>18.2</td>
</tr>
<tr>
<td>61 – 70 %</td>
<td>40</td>
<td>10.4</td>
</tr>
<tr>
<td>More than 70%</td>
<td>254</td>
<td>66.2</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>100</td>
</tr>
</tbody>
</table>
Table (3) shows the severity of anemia among pregnant women, 20= 5.2% pregnant woman had severe anemia (Hb <50%).

Table (4): The relation between anemia and age of pregnant women in Omdurman maternity hospital.

(n= 384)

<table>
<thead>
<tr>
<th>Age group</th>
<th>No.</th>
<th>Anemic</th>
<th></th>
<th>Not anemic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>15 – 25year</td>
<td>173</td>
<td>64</td>
<td>16.7</td>
<td>109</td>
<td>28.3</td>
</tr>
<tr>
<td>26 – 35year</td>
<td>134</td>
<td>45</td>
<td>11.7</td>
<td>89</td>
<td>23.3</td>
</tr>
<tr>
<td>36 – 45year</td>
<td>77</td>
<td>21</td>
<td>5.4</td>
<td>56</td>
<td>14.6</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
<td>254</td>
<td>66.2</td>
</tr>
</tbody>
</table>
Table (4) shows the relation between age of pregnant women and frequency of anemia, among the age group (15 - 25 year) about (16.7%) were anemic. The relation is not significant.

\[ X^2 = 2.26 \text{ not Significant } \quad \text{P. value=} 0.324 \]

Table (5): The relation between educational level and anemia among pregnant women in Omdurman maternity hospital. (n= 384)

<table>
<thead>
<tr>
<th>Educational level</th>
<th>No.</th>
<th>Anemic</th>
<th>Not anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
</tr>
<tr>
<td>Illiterate</td>
<td>73</td>
<td>53</td>
<td>13.8</td>
</tr>
<tr>
<td>Primary</td>
<td>155</td>
<td>44</td>
<td>11.4</td>
</tr>
<tr>
<td>Secondary</td>
<td>125</td>
<td>21</td>
<td>5.4</td>
</tr>
<tr>
<td>University</td>
<td>31</td>
<td>12</td>
<td>3.1</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
</tr>
</tbody>
</table>
Table (5) shows the relation between educational level of pregnant women and frequency of *anemia*. Illiterate rate is 13.8% among the anemic group, while 3.1% among the graduated group. P. value was 0.0001. This finding is statistically significant.

Table (6): The relation between *anemia* among pregnant women in Omdurman maternity hospital, and the monthly income of the pregnant woman family.

(n= 384)

<table>
<thead>
<tr>
<th>Family income</th>
<th>No.</th>
<th>Anemic</th>
<th>Not anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
</tr>
<tr>
<td>&gt; 450SDG</td>
<td>79</td>
<td>43</td>
<td>11.1</td>
</tr>
<tr>
<td>900-1350 SDG</td>
<td>163</td>
<td>53</td>
<td>13.8</td>
</tr>
<tr>
<td>1351-1800SDG</td>
<td>142</td>
<td>34</td>
<td>8.9</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
</tr>
</tbody>
</table>
Table (6) describes the relation between the monthly income of the family of the pregnant woman and frequency of anemia among pregnant women. 13.8% of anemic pregnant women are from the family with income (>1350 SDG/month). There is strong statistical relationship (P. value = 0.0001).

Table (7): The relation between anemia among pregnant women in Omdurman maternity hospital and the occupation of the pregnant woman.

\[(n=384)\]

<table>
<thead>
<tr>
<th>Occupation</th>
<th>No.</th>
<th>Anemic</th>
<th>%</th>
<th>Not anemic</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laborer</td>
<td>87</td>
<td>21</td>
<td>5.4</td>
<td>66</td>
<td>17.1</td>
</tr>
<tr>
<td>House wife</td>
<td>245</td>
<td>103</td>
<td>26.8</td>
<td>142</td>
<td>36.9</td>
</tr>
<tr>
<td>Students</td>
<td>12</td>
<td>6</td>
<td>1.5</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>384</td>
<td>130</td>
<td>33.8</td>
<td>254</td>
<td>66.2</td>
</tr>
</tbody>
</table>

\[X^2 = 9.54\] Significant \[P. Value = 0.008\]
Table (7) shows the relation between occupation of pregnant women and frequency of *anemia*, housewife anemic pregnant women represent 26.8%. This finding is statistically significant P. value was 0.008.

Table (8): The relation between *anemia* and family size of the pregnant woman in Omdurman maternity hospital.

(n=384)

<table>
<thead>
<tr>
<th>Family size</th>
<th>No.</th>
<th>Anemic</th>
<th></th>
<th>Not anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>6 &lt;</td>
<td>135</td>
<td>22</td>
<td>5.7</td>
<td>114</td>
</tr>
<tr>
<td>= 6</td>
<td>90</td>
<td>34</td>
<td>8.9</td>
<td>56</td>
</tr>
<tr>
<td>&gt;6</td>
<td>159</td>
<td>74</td>
<td>19.2</td>
<td>85</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
<td>254</td>
</tr>
</tbody>
</table>

$X^2 = 31.1$ Significant  P. Value = 0.0001
Table (8) shows the relation between anemia and the family size of pregnant woman, 19.2% are anemic among families has more than (6) person. P. value 0.000. This finding is statistically high significant.

Table (9): The relation between anemia among pregnant women in Omdurman maternity hospital, and number of meals taken per day. (n=384)

<table>
<thead>
<tr>
<th>No. Of meals</th>
<th>No.</th>
<th>Anemic</th>
<th>Not anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
</tr>
<tr>
<td>One meal</td>
<td>17</td>
<td>12</td>
<td>3.1</td>
</tr>
<tr>
<td>Two meals</td>
<td>125</td>
<td>90</td>
<td>23.4</td>
</tr>
<tr>
<td>Three meals</td>
<td>242</td>
<td>28</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>384</strong></td>
<td><strong>130</strong></td>
<td><strong>33.8</strong></td>
</tr>
</tbody>
</table>

$X^2 = 145$ Significant P. Value = 0.0001
Table (9) shows the relation between number of meals taken per day among pregnant women and anemia, about 23.4% who eat only (2) meals/day were anemic. P. value was 0.0001. This finding is statistically significant.

Table (10): The relation between anemia among pregnant women in Omdurman maternity hospital, and drinking tea or coffee immediately after meal.

(n=384)

<table>
<thead>
<tr>
<th>Tea + Coffee</th>
<th>No.</th>
<th>Anemic</th>
<th></th>
<th>Not anemic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Drinks</td>
<td>232</td>
<td>90</td>
<td>23.4</td>
<td>142</td>
<td>36.91</td>
</tr>
<tr>
<td>Not drink</td>
<td>152</td>
<td>40</td>
<td>10.4</td>
<td>112</td>
<td>29.11</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
<td>254</td>
<td>66.02</td>
</tr>
</tbody>
</table>

\[ X^2 = 6.384 \quad \text{Significant} \quad \text{P. Value} = 0.0115 \]

Table (10) shows the relation between anemia and drinking tea or coffee immediately after eating, among pregnant women, 23.4%
anemic pregnant women who take tea or coffee. P. value was 0.0115. This finding is statistically significant.

Table (11): The relation between anemia among pregnant women in Omdurman Maternity Hospital and taking ferrous compounds during pregnancy period.

(n=384)

<table>
<thead>
<tr>
<th>Iron taking</th>
<th>No.</th>
<th>Anemic</th>
<th></th>
<th>Not anemic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Take</td>
<td>227</td>
<td>34</td>
<td>8.8</td>
<td>193</td>
<td>50.3</td>
</tr>
<tr>
<td>Not take</td>
<td>157</td>
<td>96</td>
<td>25.0</td>
<td>61</td>
<td>15.9</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
<td>254</td>
<td>66.2</td>
</tr>
</tbody>
</table>

\[ X^2 = 88.34 \text{ significant} \quad P. \text{ Value} = 0.0001 \]
Table (11) shows the relation between anaemia and taking furious compounds during pregnancy period among pregnant women, about 25.0% from the pregnant women who does not take iron are anemic. P. value was 0.0001. This finding is statistically significant.

<table>
<thead>
<tr>
<th>Anti natal checking</th>
<th>No.</th>
<th>Anemic</th>
<th>Not anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
</tr>
<tr>
<td>Checking</td>
<td>217</td>
<td>53</td>
<td>13.8</td>
</tr>
<tr>
<td>not checking</td>
<td>167</td>
<td>77</td>
<td>20.0</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
</tr>
</tbody>
</table>

X² =19.8 Significant P. Value = 0.0001

Table (12): The relation between anemias among pregnant women in Omdurman maternity hospital and initiation of antenatal checking during pregnancy.

(n=384)
Table (12) shows the relation between anemia among pregnant women, and initiation of antenatal care during pregnancy. 20% are anemic pregnant women not follows anti-natal care early in pregnancy. P. value was 0.0001. This finding is statistically significant.

Table (13): The relation between anemia and number of deliveries among pregnant woman in Omdurman maternity hospital

\[ (n=384) \]

<table>
<thead>
<tr>
<th>Anemia</th>
<th>No. of deliveries</th>
<th>No.</th>
<th>Anemic</th>
<th>Not anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>yes</td>
<td>%</td>
</tr>
<tr>
<td>First time</td>
<td>150</td>
<td>28</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>Less than 5 times</td>
<td>61</td>
<td>46</td>
<td>11.9</td>
<td></td>
</tr>
<tr>
<td>More than 5 time</td>
<td>173</td>
<td>56</td>
<td>14.6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
<td></td>
</tr>
</tbody>
</table>

\[ X^2 = 62.7 \quad \text{Significant} \quad P. \text{ Value} = 0.0001 \]
Table (13) shows the relation between anemia among pregnant women and number of deliveries. 14.6% of the pregnant women who delivered more than 5 times are anemic. P. value was 0.0001. This finding is statistically significant.

Table (14): The relation between anemia and inter pregnancy intervals among pregnant women in Omdurman maternity hospital (n=384)

<table>
<thead>
<tr>
<th>Period</th>
<th>No.</th>
<th>Anemic</th>
<th>Non-Anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
</tr>
<tr>
<td>One year</td>
<td>54</td>
<td>17</td>
<td>4.4</td>
</tr>
<tr>
<td>Two years</td>
<td>171</td>
<td>68</td>
<td>17.7</td>
</tr>
<tr>
<td>More than 3 years</td>
<td>159</td>
<td>45</td>
<td>11.7</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
</tr>
</tbody>
</table>

$X^2 = 4.99$ Not Significant  P. Value = 0.082
Table (14) shows the relation between anemias and inter pregnancy intervals among pregnant women. 17.7% are the anemic pregnant women who had only 2 year pregnancy spacing P. value was 0.082. This finding is not significant.

Table (15): The relation between anemia among pregnant women in Omdurman maternity hospital and eating non-food items (pica) (n=384)

<table>
<thead>
<tr>
<th>Eating</th>
<th>No.</th>
<th>Anemic</th>
<th></th>
<th>Non-Anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>164</td>
<td>83</td>
<td>21.6</td>
<td>81</td>
</tr>
<tr>
<td>No</td>
<td>220</td>
<td>47</td>
<td>12.2</td>
<td>173</td>
</tr>
<tr>
<td></td>
<td>384</td>
<td>130</td>
<td>33.8</td>
<td>254</td>
</tr>
</tbody>
</table>

$X^2=35.9$ Significant P.Value=0.0001

Table (15) shows the relation between anemia and eating non-food items among pregnant women, about 21.6% are the anemic
women who used to eat pica during pregnancy. P. value was 0.0001. This finding is statistically significant.

Table (16): The relation between anemia and morning sickness among pregnant women in Omdurman maternity hospital

(n=384)

<table>
<thead>
<tr>
<th>Anemia</th>
<th>morning sickness</th>
<th>No.</th>
<th>Anemic</th>
<th>%</th>
<th>Not anemic</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>157</td>
<td>41</td>
<td>10.7</td>
<td>116</td>
<td>30.2</td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>227</td>
<td>89</td>
<td>23.1</td>
<td>138</td>
<td>36.0</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
<td>254</td>
<td>66.2</td>
</tr>
</tbody>
</table>

$X^2 = 7.10$  Significant  P. Value = 0.008

Table (16) shows the relation between anemia and morning sickness among pregnant women. 23.1% of the pregnant women
were suffering from severe morning sickness. P. value was 0.008. This finding is statistically significant.

Table (17): The relation between \textit{anemia} among pregnant women in Omdurman maternity hospital and uterine fibroid

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
\textbf{Uterine fibroid} & \textbf{No.} & \textbf{Anemic} & \textbf{Not anemic} \\
\hline
\textbf{YES} & & & \\
\hline
\textbf{No} & & & \\
\hline
\textbf{Total} & & & \\
\hline
\end{tabular}
\end{table}

X^2 = 3.13 \hspace{1cm} \text{Not Significant} \hspace{1cm} P. Value = 0.077

Table (17) shows the relation between \textit{anemia} among pregnant women and uterine fibroid. Only 1.6\% are the anemic pregnant women who had uterine fibroid, compared with 32.2\% free from
the uterine fibroid are anemic. The relation is not significant. P. value was 0.077.

Table (18): The relation between anemia and severity of menstruation before pregnancy among pregnant women in Omdurman maternity hospital.

(n=384)

<table>
<thead>
<tr>
<th>Menstruation</th>
<th>No.</th>
<th>Anemic</th>
<th>Non-Anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>yes</td>
<td>%</td>
</tr>
<tr>
<td>Normal</td>
<td>234</td>
<td>51</td>
<td>13.2</td>
</tr>
<tr>
<td>Heavy</td>
<td>150</td>
<td>79</td>
<td>20.5</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
</tr>
</tbody>
</table>

$X^2 = 45.5$  Significant  P. Value = 0.000

Table (18) shows the relation between anemia among pregnant women and severity of menstruation. 20.5% represent the anemic pregnant women who suffered from heavy menstruation be for
pregnancy. P. value was 0.000. This finding is statistically significant.

Table (19): The relation between malaria and anemia among pregnant women in Omdurman maternity hospital

\[(n=384)\]

<table>
<thead>
<tr>
<th>Anemia</th>
<th></th>
<th>Anemic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaria</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>102</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>282</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>384</td>
<td>130</td>
</tr>
</tbody>
</table>

\[X^2 = 164\] Significant P. Value = 0.000

Table (19) describe the relation between anemia and malaria among pregnant women, 22.6% are the anemic pregnant women that had
malaria during pregnancy. P. value was 0.000. This finding is statistically high significant

Table (20): The relation between anemia among pregnant women in Omdurman maternity hospital and typhoid fever (n=384)

<table>
<thead>
<tr>
<th>Having</th>
<th>No.</th>
<th>Anemic</th>
<th>Non-Anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td>No</td>
<td>370</td>
<td>121</td>
<td>31.5</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
</tr>
</tbody>
</table>

X² = 6.01 Significant P. Value = 0.014

Table (20) describes the relation between anemia among pregnant women, and typhoid fever. 2.3% are anemic pregnant women who
suffered from typhoid fever. P. value was 0.014. This finding is statistically high significant.

Table (21): The relation between anemia among pregnant women in Omdurman maternity hospital and knowledge about the reasons of anemia (n=384)

<table>
<thead>
<tr>
<th>Knowing</th>
<th>No.</th>
<th>Anemic</th>
<th>Non-Anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Yes</td>
<td>188</td>
<td>47</td>
<td>12.2</td>
</tr>
<tr>
<td>No</td>
<td>196</td>
<td>83</td>
<td>21.6</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130</td>
<td>33.8</td>
</tr>
</tbody>
</table>

$X^2 = 12.9$ Significant P. Value = 0.0001

Table (21) shows the relation between anemia among pregnant women and knowledge about the reasons of anemia. 21.6% are
the anemic pregnant women who ignores the causes of anemia. P. value was 0.0001. This finding is statistically significant.

Table (22): The relation between anemia among pregnant women in Omdurman maternity hospital and vaginal bleeding during pregnancy (n=384)

<table>
<thead>
<tr>
<th>Bleeding</th>
<th>No.</th>
<th>Anemic</th>
<th>Non-Anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>%</td>
</tr>
<tr>
<td>Yes</td>
<td>27</td>
<td>21</td>
<td>5.4</td>
</tr>
<tr>
<td>No</td>
<td>357</td>
<td>109</td>
<td>28.4</td>
</tr>
<tr>
<td></td>
<td>384</td>
<td>130</td>
<td>33.8</td>
</tr>
</tbody>
</table>

$X^2 = 25$ Significant P. Value = 0.0001

Table (22) shows the relation between anemia and vaginal bleeding during pregnancy period among pregnant women. 5.4%
of the pregnant women complained of vaginal bleeding are anemic. P. value was 0.0001. This finding is statistically high significant.

Table (23): The relation between anemia among pregnant women in Omdurman maternity hospital and kidney problems (n=384)

<table>
<thead>
<tr>
<th>Kidney problems</th>
<th>Anemia</th>
<th>Non-Anemic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Yes (%)</td>
</tr>
<tr>
<td>Yes</td>
<td>23</td>
<td>15 (3.9)</td>
</tr>
<tr>
<td>No</td>
<td>361</td>
<td>115 (29.9)</td>
</tr>
<tr>
<td>Total</td>
<td>384</td>
<td>130 (33.8)</td>
</tr>
</tbody>
</table>

$X^2 = 10.7$ Significant P. Value = 0.0001

Table (20) shows the relation between anemia among pregnant women and kidney problems. 3.9% are anemic pregnant women.
who from suffered from kidney problems. P. value was 0.0001. This finding is statistically high significant.

**Result of tables:-**

A total of 384 study participants were involved in the study. From table (1) that represent the socio demographic characteristics of the pregnant women, number of 173 (45.0%) represent the age group (15-25) year, and 77 (20.1%) from age (36-45) year. Regarding educational level 173 (19.0%) are illiterate compared by 31 (8.1%) are graduated. About (42.5%) 163 has family income(<1350SDG/ month). House wife are about 285 (74.2%).

Table (2) it is clear that frequency of *anemia* among pregnant women in Omdurman Maternity Hospital is 33.8%.
Table (3) describes the severity of anemia about 20 (5.2%) has severe anemia.

Table (4) shows the relation between age of pregnant women and frequency of *anemia*, about (16.7%) were anemic among the age group (15 -25 year, the relation is not significant.

Table (5) shows the relation between educational level of pregnant women and frequency of *anemia*. The anemic Illiterate were 13.8, while 3.1% among the graduated group were anemic. P. value was 0.0001. This finding is statistically significant.

Table (6) describes the relation between the monthly income of the family of the pregnant woman and frequency of *anemia* among pregnant women.13.8% of anemic pregnant women among the family with income (>1350 SDG/month). There is strong statistical relationship (P. value = 0.0001).

Table (7) shows the relation between occupation of pregnant woman and frequency of *anemia*, house wife anemic pregnant women represent 26.8%. This finding is statistically significant P. value was 0.008.

From table (8) Majority of anemic pregnant women (19.2%) were in families with more than (6) person, compared with (5.7%) among families with less than (6) persons, followed by (8.9%) in families of (6) persons. (P- Value=0.0001). There is a relation between anemia and economic status of the pregnant women.
Table (9) Show about (23.4%) of pregnant women used to eat tow meals per day, and (7.2%) takes 3 meals, only (3.1%) eat one meal/day. There is significant relation between numbers of meals and anemia (P-value=0.0001).

Table (10) shows significant relation between anemia and drinking tea or coffee immediately after eating among pregnant women. A total of (38.8%) are anemic pregnant women who drinks tea or coffee immediately after food, compared with (26.3%) does not drink tea or coffee. P-value=0.0001.

Table (11) Show significant relation between anaemia and taking furious compounds during pregnancy period among pregnant women P-value=0.0001, as (8.8%) are anemic pregnant women takes furious compounds during pregnancy, compared with (25%) not take it.

Table (12) show the relation between anemia among pregnant women, and initiation of antenatal care during pregnancy. 20% are anemic pregnant women not follow anti-natal care early in pregnancy. P. value was 0.000. This finding is statistically significant.

Table (13) show the relation between anemia among pregnant women and number of deliveries. 14.6% of the pregnant women
who delivered more than 5 time are anemic. P. value was 0.0001. This finding is statistically significant.

Table (14) Show the relation between anemia and inter pregnancy intervals among pregnant women. 17.7% are the anemic pregnant women who had only 2 year pregnancy spacing  P. value was 0.082. This finding is not statistically significant.

Table (15) show the relation between anemia and eating non-food items among pregnant women, about 21.6% are the anemic pregnant women who used to eat pica during pregnancy. P. value was 0.0001. This finding is statistically significant.

Table (16) shows the relation between anemia and morning sickness among pregnant women, about 23.1% of the pregnant women were suffering from severe morning sickness.  P. value was 0.008. This finding is statistically significant.

Table (17) shows the relation between anemia among pregnant women and uterine fibroid. Only 1.6% are the anemic pregnant women who had uterine fibroid, compared with 32.2% free from the uterine fibroid are anemic. The relation is not significant. P. value was 0.077.

Table (18) shows the relation between anemia among pregnant women and severity of menstruation. 20.5% represent the anemic pregnant women who suffered from heavy menstruation be for pregnancy. P. value was 0.0001. This finding is statistically significant.
Table (19) describes the relation between anemia and malaria among pregnant women. Rate of 22.6% are the anemic pregnant women had malaria during pregnancy. P. value was 0.000. This finding is statistically high significant. 20% are anemic pregnant women not following anti-natal care early in pregnancy. P. value was 0.000. This finding is statistically significant.

Table (20) describes the relation between anemia among pregnant women, and typhoid fever. 2.3% are anemic pregnant women who suffered from typhoid fever. P. value was 0.014. This finding is statistically high significant.

Table (21) shows the relation between anemia among pregnant women and knowledge about the reasons of anemia. 21.6% are the anemic pregnant women who ignores the causes of anemia. P. value was 0.0001. This finding is statistically significant.

Table (22) shows the relation between anemia and vaginal bleeding during pregnancy period among pregnant women. 5.4% of the pregnant women complained of vaginal bleeding are anemic. P. value was 0.0001. This finding is statistically high significant.

Table (23) shows the relation between anemia among pregnant women and kidney problems. 3.9% are anemic pregnant women who from suffered from kidney problems. P. value was 0.0001. This finding is statistically high significant.
Discussion:-

A descriptive, cross –sectional, Hospital based study was conducted among the pregnant women in the Ante-natal clinic at Omdurman Maternity Hospital with an objective to study the frequency of anemia among the pregnant women, and to relate it to its factors. It revealed the following finding as explained in the discussion below.

Frequency of anemia among pregnant women attending Omdurman Maternity Hospital is 33.8%. There is an actually problem of anemia among pregnant women this results of the frequency of anemia is similar to the findings of a the frequency in study carried by (Habib, 2009) that show the frequency was 34.2%, and it is not so far from study carried by (Aimakhu, 2006) and( Koh, 2013) , that mentioned the frequency was 36.6%. 35%, respectively, Comparing with other studies, the frequency is
higher than study carried by (Okonofua et al, 2003) 22%, (Khdija, 2006) 25.7%, Baker,( 2009) 24.5 %, but it is lower than other studies carried by (WHO, 2009), (Adina et al, 2009), (WHO, 2011) that showed frequency as, 54%, 76%, and 56.8% respectively. The frequency is high in these studies due to poor pregnancy care and illness during pregnancy, also, it is differ from other study carried by (Agarwal, 2006) in India to assess the nutritional statues among pregnant women shows the frequency as 87.2%, study carried in Tanzania the frequency observed 60% (Tatija, 2006), and that carried by (Aluka, et al 2001) showed frequency of 64.2%. However, the result of the present study was much lower than WHO report, (62.7%) in Ethiopia (WHO, 2008). This might have happened due to the model used to estimate frequency of anemia and the time difference.

As seen in this study the frequency of anemia is low as compared to the frequency of anemia reported from, Eastern Nigeria as 70.7% (Uneke, 2007), 65.1% carried by (Haggaz et al 2009) in Kenya, 69.1% by (Ouma, 2007) in Uganda, 63.1% by (Mbule, 2013) in Tanzania, study in China, 58.6% by (Ma et al 2009), and study in Malaysia showed 57.6% carried by (Rosmawati, 2009). This variation might be due to study population differences. Comparing the frequency with the developed countries, it is clearly observed that the frequency is 18% among pregnant women in the developed counters (WHO, 2013), it is lower than ours, due to the socioeconomic developments, higher standard of living, better utilization of health care facilities along with increasing literacy rate are associated with the low frequency of anemia in developed countries.
The study showed that the higher percentage of anemia (16.7%) is among the young age group of pregnant women (15-25 year), this finding agree with other studies among the same age group shows the frequency of anemia in Ethiopia carried by Getachew, (2012) was 35.2%, Malaya by Ismail (2012) was 32.2%, Nigeria by Karaoglo, et al (2010) about 29.8%, so the frequency is high in this age group. Other study carried in Kaiya by Mwenesi et al (2008) showed frequency among the same age group as (80%), and a high frequency (80.5%) of anemia observed among teenage pregnant women (15-19 year) confirm to the observation of Ogbeido et al, (2010), this agree with what stated by WHO (2007): (One of the predisposing factors of anemia is age of pregnant women. The young pregnant women (less than 24 years) are more susceptible to develop anemia ).This result agrees with study in Mlawy 36.4% Thangalela et al, (2010 %), showed that the younger pregnant women are suffering from Anemia more than other age group within the reproductive age, this high frequency of anemia is possible due to lack of care about nutrition, as IDA is nutritional disease, also, most of the pregnant women in this age are primigravida, and anemia is common among this group.

The study showed that a significant association between pregnant women level of education and anemia, P. Value (0.0001), about (13.8%) of anemic pregnant women was illiterate, followed by (11.4%) are pregnant women from primary basic, while (3.1%) among graduated group, this agrees with other prospective study showed the frequency 53.7%, (Malmitsi, et al (2009)) found that anemia was most common among illiterate women 53.7% as compared with 37.1% in literate women, it was found that anemia increases steadily with decrease in the level of educational
attainment, this finding is supported by other studies carried by Andrew (2012), Haider (2013) conducted to assess the risk factors of anemia during pregnancy, shows frequency as 30.8%, 42.3% respectively, also the finding agree with the study carried by Adinma (2002) represent 30.8% from anemic pregnant women are illiterate, it agree with other study with the frequency of anemia among unemployed (illiterate) pregnant women was 89%, WHO (1992), this high frequency recorded among this group indicate the poverty borne out of unemployed that contributed significantly to anemia as the woman cannot afford to look early for antenatal care, eat nourished food and prevent possible infection. From different studies it was observed that, the effect of educational level on frequency of IDA among pregnant women showed that the less educated (the no formal and primary education group) had higher frequency of IDA than those with secondary and post-secondary education. They are less likely to maintain proper hygiene and sanitation and so are susceptible to infections). (WHO, 2010).

Results of the economic status of respondents in this study, showed percentage of (11.1%) pregnant women from families had monthly income less than 900 SDG per month, which is low economic stander, this agree with other study that showed frequency as (42.5%) are anemic pregnant women with low income, WHO (2010), it is same as cross-sectional study in India carried by WHO (2009), that show there was a trend of decreasing severity of anemia with higher per capita income, the study shows that the proportion of pregnant women suffering from anemia in classes I and II were less (47.61% and 71.42%, respectively) as compared
with the lower socioeconomic status the frequency was, (93.51%, 94.9%, in classes III-V respectively). It was obvious that as the socioeconomic status decreased, the frequency of anemia increased. (Salhan et al., 2012). This result agrees with what stated by WHO iron deficiency has been one of the most expensive diseases in the world to less productivity. Scientists analyzing the economic consequences of iron deficiency cost developing countries an average 0.6 percent of their growth domestic products (GDP) the high frequency of anemia in this study is probably related to the low socioeconomic status of the women, which may have impact on their nutritional status and health seeking behavior. (WHO, 2009).

The study showed there is a strong relationship between taking furious compounds during pregnancy period and frequency of anemia in the study p. value 0.0001, about (25%) are the anemic pregnant women that does not take ferrous compound during pregnancy, it is similar to study that showed frequency as (64%) Molly (2014), this result agree with that reported by WHO (2010) (among the nutrition factors contributing to anemia, the most one is iron deficiency. It is due to a diet that is monotonous, but in substances (phytates) inhabiting iron absorption so that dietary iron cannot be utilized by the body. This also agree with what stated by WHO (2012) Iron deficiency may also be aggravated by poor nutritional status, especially when it is associated with deficiency in folic acid, vitamin A or B12, as is often the case in population living in developing countries) it agree with the statement reported: iron supplementation is necessary to prevent determination of anemic condition during increased of physiological burden of pregnancy, Akhtar, (2009).
The study demonstrated strong relation (P. value 0.0001) between heavy menstruation before pregnancy and anemia, about (20.5%) of the pregnant women were suffered from heavy menstruation before pregnancy. This finding agree with the result of studies shows a statistically significant association between anemia and history of excess menstrual bleeding (56.4%), Esmat (2010). Other study represent, 43% (Bag, et al 2008), and 47%. WHO, CDC (2005). The result agreed with the statement that (Bleeding can be short term or persist other time. It can be caused by heavy menstrual period, bleeding from digestive or urinary tract, surgery, trauma, or cancer if bleeding significant, body can loss enough RBCs to cause anemia). WHO, (2011).

The study showed a significant relation between malaria and anemia, P. value 0.0001, almost (22.6%) from the anemic pregnant women has malaria, this agree with other studies conducted in Tanzania, by Matteli et al (2007), and Eastern Sudan WHO (2007) found the frequency of malaria among pregnant women was (33.6%, 62%) respectively, this might be due to the fact that malaria is a significant public health in Sudan. Adam, et al (2005). This agree with what stated by WHO (2009): (The most common causes of Anemia in pregnancy worldwide is iron deficiency, the predisposing factors include low socio-economic status, Infectious diseases eg: malaria, and inadequate child spacing). However it agree with the statement that malaria is a major cause of anaemia in pregnancy in endemic areas. Malaria in pregnancy has been a cause of severe anemia. In areas with high frequency of malaria (WHO, 2010) frequency of anemia among pregnant women with Malaria was up to 68.75% as compared to those without malaria infection (42.31%). Vivek, et
al, (2012) Malaria causes hemolytic anemia and in severe cases is also a risk factor for stillbirths, low birth weight and fetal anemia. WHO (2009), it is known malaria is associated the economic status, WHO (2014) reported: Malaria is responsible for 1.2 million deaths and 29% total DALYs from low and middle income, and most of the participant were from low economic stander.

There is a significant relation (p. value 0.0001) between initiation of anti natal care and anemia. About (20%) are anemic women had irregular or late ANC in the second or third trimester, this might be due the fact that increase in trimester may cause reduction in maternal iron reserves. , the result agree with other study represent (81.5%), Massawe et al (2008 ), and other study conducted inThailand , to determine the risk factor of anemia among pregnant mothers showed frequency of (65.2%) , are anemic pregnant women due to late antenatal booking . since early antenatal care results in better monitoring and early detection of anaemia and its correction by appropriate supplementation. Dim et al (2007), the peak of anaemia recorded in this study (2nd, 3rd trimester,) coincides with the period when haemodilution is at its peak. This may have contributed to the high frequency recorded in the 2nd and 3rd trimester This finding is agree with other study conducted in Kenya, WHO,(2008) show that only 5.4% of the anemic women initiated antenatal care in their first trimester and 42.7% and ,51.9% in their second and third trimester respectively, this agree with what stated by Akhtar,et al (2012). The high frequency of anemia in the second and third trimester may also be attributed to late initiation of antenatal care. This finding agree with what stated by WHO (2010) That, late antenatal care
attendance, causes late detection and missing of opportunity to correct the deficiency through iron supplementation early in pregnancy. However, this result is at variance with the report of WHO (WHO, 2005). In which anaemia is said to be significantly higher in the 3rd trimester of pregnancy than the first two trimesters. Anemia during the first two trimesters, leads to greater risk for having a pre-term delivery or low-birth-weight baby (WHO, 2012).

Regarding the family size the relation is significant with anemia, (p. value 0.0001) about 19.2% represent anemic pregnant women from families with more than 6 person, the finding is similar to previous study revealed that a total of 34% represented anemic women in joint families (more than 6 person), this agreed with what stated by Aimakhu, (2005) that IDA is common among joint family than nuclear one.

Significant relation (p. value 0.0001) is clearly observed between drinking tea or coffee immediately after food, rate of (23.4%) no other previous study is found, the association is possible due present of tannin in tea and coffee which can reduce the absorption of iron.

4-2: Conclusion:

From the analysis of the study results it is found, from 384 pregnant women included in the study the frequency of anemia among pregnant women is high 33.8%. In the light of the results it is obvious that anemia among pregnant women was related to socio-economic conditions, knowledge about the reasons of anemia, taking furious compounds during pregnancy, suffering from heavy
menstruation be -for pregnancy, family size of the pregnant woman, anti natal checking and malaria, in addition to that the study results are in the conclusions as follow:

Frequency of anemia among young pregnant women (15-25year) was (16.7%), followed be (11.7%) among the age group (26-35 year). About (13.8%)represents the anemic pregnant women among families of low economic stander, regarding the occupation (26.8%) from the pregnant women are house wife, (25%) are women who didn’t take furious compound during pregnancy, .about(20.5% ) of anemic pregnant women had heavy menstruation be for pregnancy , (22.6%) pregnant women suffering from malaria during pregnancy .In addition to(13.8%) represents the anemic pregnant women that did not initiate antenatal care or following health counselling early in pregnancy.

4-3: Recommendation:

Early diagnosis of anemia through investigating and screening of pregnant women for anemia by taking blood samples for full hologram.

Routine iron supplementation should be encouraged as a prophylactic measure.

Creation of awareness on the magnitude of anemia within the pregnant women, through applying interventional measures and
programs to educate the mothers on the need to initiate antenatal care early.

Establish health education talks on nutrition needs for the mother and the growing fetus, with concentration on food rich in iron in each area, considering the economic status of the pregnant women. Therefore, formulation of strategies to reduce the adverse consequences of anemia in order to improve maternal health and reduce poor prenatal outcome, so an integrated package of intervention are recommended.

4-4-1: References:


Esmat, B., Mohammad, R., Behnam, S. (2010). “Frequency of iron deficiency anemia among iranian pregnant women; a systematic


pregnancy outcomes: systematic review and meta-analysis. Bmj, **346**, 34-43.


4-4-2 Questionnaire:-

University of Khartoum
Graduate College
Medical and Health Studies Board
Questionnaire for the study of the frequency of anemia among pregnant women at Omdurman Maternity Hospital 2014.
Basic information:

1. Age of the pregnant woman:

2. Educational level of the pregnant woman:
   Illiterate (   ) Primary education (   )
   Secondary education (   ) University and above (   )

3. Monthly income of the family of the pregnant woman per month:
   >450SDG (   ) 900-1350SDG (   ) 1351-1800SDG (   )

4. Occupation of the pregnant woman:
   Laborer (   ) house wife (   ) student (   )

5. Family size of the pregnant woman:
   >6 Persons (   ) =6 persons (   ) < 6 (   )

6. Number of meals taken per day:
   One meal (   ) two meals (   ) three meals (   )

7. Drinking tea or coffee immediately after eating:
   Yes (   ) No (   )

8. Taking furious compounds during pregnancy period:
   Yes (   ) No (   )

9. Periodic antenatal checking during pregnancy:
Checking ( ) Not checking ( )

10. Number of deliveries among pregnant woman:
   First time ( ) More than 5( ) Less than 5 times ( )

11. Inter pregnancy intervals among the pregnant woman:
   One year ( ) Three years ( ) More than three years ( )

12. Desire for eating non-food items:
   Yes ( ) No ( )

13. Severity of morning sickness a:
   Normal ( ) Sever ( )

14. Uterine fibroid during pregnancy:
   Yes ( ) No ( )

15. Severity of menstruation before pregnancy:
   Normal ( ) Heavy ( )

16. Malaria during pregnancy:
   Yes ( ) No ( )

17. Typhoid fever during pregnancy:
   Yes ( ) No ( )

18. Knowledge about the reasons of anemia among pregnant women:
   Yes ( ) No ( )
19. Vaginal bleeding during the pregnancy period:

   Yes (  )       No (  )

20. Kidney problems during pregnancy:

   Yes (  )       No (  )

21. Hb% among pregnant women: …… %

4-4-3 Arabic questionnaire:-

جامعة الخرطوم

مجلس الدراسات العليا

مجلس الدراسات الطبية والصحية

استبيان دراسة معدل انتشار مرض الأنيميا وسط النساء الحوامل بمستشفى أم درمان للولادة

ولاية الخرطوم 2014
البيانات الاساسية:

1. عمر الأم:
   - 15-25 سنة ( )
   - 26-35 سنة ( )
   - 36-45 سنة ( )

2. المستوى التعليمي للام:
   - اميه ( )
   - اساس ( )
   - ثانوي ( )
   - جامعية ( )

3. الدخل الشهري للأسرة بالجنيه السوداني:
   - > 450 ( )
   - 1350-900 ( )
   - 1351-1800 ( )

4. وظيفة الحامل:
   - عامله ( )
   - ربة منزل ( )
   - طالبة ( )

5. حجم الأسرة:
   - اقل من سته أشخاص ( )
   - سته أشخاص ( )
   - أكثر من سته أشخاص ( )

6. - معلومات عن الممارسات والسلوك وبعض الامراض المتعلقة بالحمل:

7. عدد الوجبات في اليوم:
   - وجبه ( )
   - وجبتين ( )
   - 3 وجبات ( )
7. هل تتناول الحامل الشاي أو القهوة بعد الاكل مباشرة؟

نعم (  )  لا (  )

8. هل تناولت الحامل مركبات الحديد أثناء الحمل؟

نعم (  )  لا (  )

9. المتابعه الدوريه للحمل أثناء الحمل:

نعم (  )  لا (  )

01. عدد الولادات:

بكريه (  )  أقل من 5 ولادات (  )  أكثر من 5 ولادات (  )

11. الفترة الزمنیه بين الولادات:

سنة (  )  3 سنوات (  )  أكثر من ثلاث سنوات (  )

21. هل تفضل الحامل اكل اشياء غير الطعام مثل الطين?

نعم (  )  لا (  )
31. هل تعاني الحامل من الغثيان الصباحي؟
نعم (      ) لا (      )

41. هل تعاني الحامل من وجود لحمي بالرحم؟
نعم (      ) لا (      )

51. هل كانت تشكو من غزارة في الدورة الشهرية قبل الحمل?
نعم (      ) لا (      )

61. هل اصبت الحمل بمرض الملاريا؟
نعم (      ) لا (      )

17. هل تحشح الحامل من أمراض في المعدة مثل التيفويد مع الحمل؟
نعم (      ) لا (      )

18. هل تعرف الحامل أعراض و أسباب الانميا؟
نعم (      ) لا (      )

19. هل تشير الحامل من نزيف مهبلي مع الحمل؟
نعم (      ) لا (      )
02. هل تشك الحامل من أمراض في الكلى:

نعم ( )
لا ( )

12. نسبة الهموغلوبين...........%