Sudan University of Science and Technology
College of Graduate Studies

Determination of Complete Blood Cell Count in Sudanese Pregnant Women in the Second Trimester in Karary locality Khartoum state

تعداد الدم الكامل عند النساء الحوامل خلال الفتره الثانية من الحمل بمحلية كرري ولاية الخرطوم

A dissertation submitted in Partial Fulfillment of the Requirement for M.Sc. Degree in Medical Laboratory Science
(Hematology and Immunohematology)
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الآية

بسم الله الرحمن الرحيم

(وَتَمَّتْ كَلِمَةُ رَبِّكَ صِدْقًا وَعَدْلًا لَا مُبَدِّلَ لِكَلِمَاتِهِ وَهُوَ السَّمِيعُ الْعَلِيمُ)

من سورة الأنعام- آية (115)

I

DEDICATION

To my parents…To my husband

To my Brothers

To my sisters……To my friends

To my teachers ….To my colleagues

To my students…

To everybody   who supported   me

I dedicate this work

Acknowledgements

First of all, thanks to ALMIGHTY ALLAH who helped me throughout this study.

My gratitude are extended to my supervisor Prof. Babiker Ahmed Mohammed for his close supervision, valuable advices, and stimulating suggestions.

Thanks must also go to Aboda health care centers staff in Karary locality for their great help and assistance throughout this study.

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Abstract

This is a case control study, conducted in kararry Locality during the period from August 2017 to January 2018 , to determine CBC (complete blood count) of 80 healthy Sudanese pregnant women at second trimester as case and 40 non pregnant women at matched age were used as controls . Pregnant women at second trimester were informed about the study and agreed for participating as cases . Aquestionnaire was designed to collect information about the study group such as demographic data ,age , number of pregnancies , month of pregnancy and,history of anemi . Tow and half ml venous blood was collected in EDTA anticoagulant container , automated hematological analyzer (Sysmex KX-21N) was used to measure CBC and the result were analyzed by qi squer test using of SPSS computer program.

This study results revealed that that : There was significant decrease in hemoglobin (Hb), hematocrit (HCT) , red blood cells RBCs count ,mean cell hemoglobin (MCH) ,(MCHC) and, lymphocyt% in pregnant women when compared with control group (p.< 0.05) and no significant difference in MCV this is characteristic of physiological anemia(Hoffbrand and, Moss 2011) The physiologic hyper volemia facilitates delivery of nutrients to the fetus, protects the mother from hypotension, and reduces the risks associated with hemorrhage at delivery the decrease in blood viscosity from the lower hematocrit creates lower resistance to blood flow, (Gaiser, 2014) in pregnant due to dilution In normal pregnancy.

The result also showed that significant increase (p.=0.00) in, TWBCs neutrophil% , absolute neutrophil count and red cell distribution width (RDW) in pregnant women when compared to control group.

There was no significant difference in , Platelets count   and mean platelet volume (MPV) in pregnant women when compared to control group. There was no significant different in mean of TWBs ,and all CBC parameters of pregnant women   had three pregnant times or more when compare to other had less than three pregnant times (p≥0.05). according to age groups there is no Significant different in mean Hb and other CBC parameters in pregnant.

المستخلص

هذه دراسة تحليلية حالة وحالة ضابطة في ولاية الخرطوم في المراكز الصحية بمحلية كرري في الفترة من اغسطس2017 حتي بناير2018 لتحديد قياس الدم الكامل للحوامل السودانيات ف الجزء الثاني من فترة الحمل . تم اختيار ثمانون امراءة مشخصات كحوامل في الشهور مابين الثالث والسابع كما تم أخذ (40) عينة من النساء ف عمر الانجاب كمجموعة ضبط . تم اخذ2,5 مليلتر من الدم الوريدي من كل متطوعة وتم وضعه في وعاء يحتوي على مانع تجلط (ثنائي بوتاسيوم ثنائي امين الايثلين رباعي حمض الخليك) من كل مشاركة واستخدم جهاز تحليل الدم الاتوماتيكي لتحديد تعداد الدم الكامل وتم تحليل النتائج بواسطة برنامج الحزم الاحصائية للعلوم الاجتماعية اصداره 17.

اوضحت النتائج ان تركيز خضاب الدم ف الخليه قد انخفض (11,3جم للديسلتر) انخفاضا ذا دلاله احصائية بالنسبة للنساء الحوامل مقارنة بغير الحوامل (12,9جم للديسلتر).(مستوى معنوي 00,0) كما انخفض حجم الخلايا المكدسة وقل تركيز متوسط تركيز الخضاب ف الخلية الواحدة وكمية الخضاب داخل الخلية في حين ان مستوى حجم الخليه لم يبدي أي تاثرا .وهذا الانخفاض قد يكون سببه ارتفاع مستوى البلازما مقارنة بكمية الخلايا ف الدورة الموية وهذا مايسمي بالانيميا الطبيعية والتي تحدث اثناء فترة الحمل لتخفيف مستوى الضغط ومنع حدوث النزف وتسهل وصول الغذاء والدم الي داخل الرحم. الدراسة ايضا اظهرت نقصان ف عدد الكريات الحمراءحيث كان متوسطها(420مليون للديسلتر) مقارنة بالعينة الضابطة التي بلغ متوسطها (460مليون للديسلتر).بمستوى معنوي(00,00).

كما زاد مستوي عدد الخلايا البيضاء ف الحوامل مقارنة بالعينة الضابطة وزاد عدد الخلايا بمستوى معنوي (00,00) هذا وقد لم تبدي الصفائح الدموية أي تغيرا ف عددها او حجمها مقارنة بالعينة الضابطة .

الدراسة ايضا اوضحت انخفاضا ملحوظا ف تعداد الخلايا البيضاء ف النساء الحوامل ذوات التعليم الجامعي مقارنة بالحوامل الاخريات ولم يظهر اي تاثير او اختلاف ف تعداد الدم الكامل ف الفئات العمرية كما ان معدل مرات الحمل لم يؤثر علي تعداد الدم الكامل .

Table of content:

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List of abbreviation

CBC: complete blood count

DNA: deoxy ribonucleic acid

DTMP: deoxy thymidine monophosphate

DTTP: deoxythymidine triphosphate

DUMP: deoxyuridine monophosphate

EDTA: Ethylene diamine tetra-acetic Acid

ESR : Erythrocyte Sedimentation rate

GIT : gastro intestinal tract

HCT : heamatocrite

Hb   : hemoglobin

IDA : Iron deficiency anemia

LCD : liquid crystal display

LDH : lactate dehydrogenase

MCH : mean corpuscular hemoglobin

MCV: mean corpuscular volume

MCHC :mean corpuscular hemoglobin content

MPV : mean platelet volume

PDW: platelet distribution width

PLT: plate lete

RBC : red blood cell count

RDW : red cell distribution width

SPSS : statistical package for the social sciences

WBC : white blood cell count

Chapter one

Introduction and literature Review

Chapter One

Introduction and Literature Review

1.1 General Introduction:

Pregnancy places exhibit stresses on the hematological system and an understanding of the physiological changes that result is obligatory in order to interpret any need for therapeutic intervention (Hoffbrand and Moss ,2006).

Plasma volume increases by a mean of 43 % in pregnancy, which produces a fall in hemoglobin level despite a mean increase of 25% in the total volume of circulating red cells the hemodilutory effect commences in the first trimester. The lower limit of the hemoglobin

level in normal pregnant women is about 10.5 g/dl ,and is thus less than in the non-pregnant state (Firkin *et al*,1989).

1.2 The Complete Blood Count:

The complete blood count (CBC) is one of the most frequently ordered and most time-honored laboratory tests in the hematology laboratory. This evaluation consists of nine components and offers the clinician a variety of hematological data to interpret and review that directly relate to the health of the bone marrow, represented by the numbers and types of cells in the peripheral circulation. The nine components of the CBC are the white blood cell count (WBC), red blood cell count (RBC), Hb, haematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular HB (MCH), mean corpuscular HB content (MCHC), platelet count, and red cell distribution width (RDW). Depending on the type of automated

instrumentation used, some of these parameters are directly read from the instrument and some are calculated (Ciesla**,**2007).

1.2.1 Erythrocytes:

The most important values to consider are the hemoglobin and the mean corpuscular volume (**MCV**). These values, together with the RBC count are directly measured in most hematology instruments; the hematocrit and other parameters are calculated from these values.

The red cell indices include the mean corpuscular volume (MCV), the mean corpuscular hemoglobin (**MCH**), and the mean corpuscular hemoglobin concentration (**MCHC**). The MCV is important in the evaluation of erythrocyte disorders. The MCH and MCHC are generally not of great value. the red cell distribution width (**RDW**) is a mathematical description of the variation in RBC sizes; a high RDW indicates greater variation in RBC size, (Kern ,2002)

1.2.2 Leukocytes:

Sophisticated hematology analyzers produce the total WBC count and a five-part WBC differential (percentages and absolute numbers of each cell type). More attention is paid to the percent of each cell type, but the absolute number is really more relevant than the percent (Kern ,2002**)**

1.2.3 Platelets:

The most important value to consider is the total platelet count. Hematology analyzers also give a mean platelet volume (**MPV**), analogous to the MCV. It has been suggested that larger platelets are more effective than smaller platelets; however, the MPV has generally not proven very useful (Kern ,2002)

1.2.4 Uses Of Red Cell Indices

1.2.4.1 Morphological classification of anemia:

Based on values of red cell indices, anemia is classified into three main types: normocytic normochromic, microcytic hypochromic, and macrocytic normochromic

Calculation of red cell indices is especially helpful in mild or moderate anemia when red cell changes are subtle and often difficult to appreciate on stained blood smear.

1.2.4.2 Differentiation of iron deficiency anemia from thalassemia trait: In iron deficiency, MCV, MCH, and MCHC are low, while in thalassemia trait, MCV and MCH are low and MCHC is normal (Kawthalkar,2010)

1.2.5 The Value of The Red Cell Distribution Width:

RDW, a mathematical calculation that gives insight into the amount of anisocytosis (variation in size) and, to some degree poikilocytosis (variation in shape) in a peripheral smear. The RDW is derived as follows:(Standard deviation of RBC volume/mean MCV) _100The normal value for RDW is 11.5% to 14.5%. The standard deviation of red cell volume is derived from size histogram data that plot red cell size after a large number of red cells has been analyzed by the instrument.

The usefulness of the RDW is that in many cases the RDW will become abnormal earlier in the anemia process than the MCV. Because many anemia (like iron deficiency anemia) develop over a period of time, this parameter may provide a sensitive indicator of red blood size change before the red cell indices become overtly abnormal (Ciesla,2007)

1.3 Literature Review

1.3.1 pregnancy:

Implantation and subsequent placental development in the human require complex adaptive changes of the uterine wall constituents.

1.3.1.1 Development of the blastocyst:

At the beginning of the 4th week after the last menstrual period, the implanted blastocyst is composed, from outside to inside, of the trophoblastic ring, the extra-embryonic mesoderm and the amniotic cavity and the primary yolk sac, separated by the bilaminar embryonic disk. The extra-embryonic mesoderm progressively increases, and 12 days after ovulation (around the 26th menstrual day) it contains isolated spaces that rapidly fuse to form the extra embryonic coelom as the latter forms, the primary yolk sac decreases in size and the secondary yolk sac arises from cells growing from the embryonic disk inside the primary yolk sac (Ten teacher 2012)

1.3.1.2 The First Trimester (0-12 Weeks)

Minute ventilation increases by 40% in the first trimester the womb will grow to the size of a lemon by eight weeks. Many symptoms and discomforts of pregnancy like nausea and tender breasts appear in the first trimester.

1.3.1.3 Second trimester (13-28 weeks)

Weeks 13 to 28 of the pregnancy are called the second trimester. Most women feel more energized in this period, and begin to put on weight as the symptoms of morning sickness subside and eventually fade away. The uterus, the muscular organ that holds the developing fetus, can expand up to 20 times its normal size during pregnancy(Kalverboer.2001*)*

1.3.1.4 Third trimester (29-40)

Final weight gain takes place, which is the most weight gain throughout the pregnancy. The woman's abdomen will transform in shape as it drops due to the fetus turning in a downward position ready for birth. the fetus moves regularly, and is felt by the woman. Fetal movement can become strong and be disruptive to the woman. the woman's navel will sometimes

become convex, "popping" out due to the expanding abdomen. Head engagement, where the fetal head descends into cephalic presentation, relieves pressure on the upper abdomen with renewed ease in breathing.

It also severely reduces bladder capacity, and increases pressure on the pelvic floor and the rectum. It is also during the third trimester that maternal activity and sleep positions may affect fetal development due to restricted blood flow. For instance, the enlarged uterus may impede blood flow by compressing the vena cava when lying flat, which is relieved by lying on the left side.(Kalverboer.2001)

1.3.1.5 Pregnancy Physiology:

In one early study, physiologist Magnus-Levy found an exception to the rule that basal metabolic rate varied in proportion to body surface area. As he measured woman's oxygen consumption during pregnancy, he observed that her metabolic rate increased out of proportion to increments in her body weight and surface area Subsequent studies by other investigators established the basis of this phenomenon. Per unit of weight, the fetus, placenta, and uterus together consumed oxygen(and released carbon dioxide and heat) at a higher rate than the mother. In effect, the metabolism of a pregnant woman represented the sum of two independent organisms, each metabolizing at its own rate in proportion to its own surface area(Caton,2014).

1.3.1.6 Hematology change In Pregnancy

1.3.1.6.1 Blood Volume:

Maternal plasma volume expansion begins as early as 6 weeks' gestation and continues until it reaches a net increase of approximately 50% by 34 weeks' gestation after 34 weeks' gestation, the plasma volume stabilizes

or decreases slightly. Red blood cell volume decreases during the first 8 weeks of pregnancy, increases to the pre pregnancy level by 16 weeks, and undergoes a further rise to 30% above the pre pregnancy level at term. The increase in plasma volume exceeds the increase in red blood cell volume ,resulting in the physiologic anemia of pregnancy Hemoglobin concentration, which typically ranges from 12 to 15.8 g/dL in the non pregnant woman, decreases to 11.6 to 13.9 g/dL in the first trimester, 9.7 to 14.8 g/dL in the second trimester, and 9.5 to 15.0 g/dL in the third trimester. Hematocrit , which ranges from 35.4% to 44.4% in the non pregnant woman, decreases to 31% to 41% in the first trimester, 30% to 39% in the second trimester, and 28% to 40% in the third trimester there is an increase in plasma volume from 49 to 67 mL/kg, an increase in total blood volume from76 to 94 mL/kg, and little change in red cell volume(27 mL/kg) Blood volume is positively correlated with the size of the fetus in singleton pregnancies and is greater in multiple gestations.

The physiologic hyper volemia facilitates delivery of nutrients to the fetus, protects the mother from hypotension, and reduces the risks associated with hemorrhage at delivery the decrease in blood viscosity from the lower hematocrit creates lower resistance to blood flow, which may be an essential component of maintaining the patency of the utero placental vascular bed the increase in plasma volume results from fetal and maternal hormone production, and several systems may play a role. Additionally, the expansion of plasma volume may help to maintain blood pressure in the presence of decreased vascular tone the maternal concentrations of estrogen and progesterone increase nearly 100-fold during pregnancy. Estrogens increase plasma renin activity, enhancing renal sodium absorption and water retention via the renin-angiotensin-aldosterone system fetal adrenal production of the estrogen precursor dehydroepi androsterone may be the underlying control mechanism.

Progesterone also enhances aldosterone production these changes result in marked increases in plasma renin activity and aldosterone level as well as in retention of approximately 900 mg of sodium and7000 mL of total body water the concentration of plasma adrenomedullin, apotent vasodilating peptide increases during pregnancy and correlates significantly with blood volume red blood cell volume increases in response to elevated erythropoietin concentration and the erythropoietic effects of progesterone, prolactin, and placental lactogen. both hemoglobin concentration and hematocrit decrease after conception to approximately 11.2 g/dL and 34%, respectively, by mid gestation, which is a 15% decrease from pre pregnancy levels. During the late third trimester, the hemoglobin concentration and hematocrit increase to approximately 11.6 g/dL and 35.5%, respectively, because red blood cell volume increases more than plasma volume. Women who do not receive iron supplements during pregnancy have greater decreases in hemoglobin concentration and hematocrit (Gaiser, 2014)

1.3.1.6.2 Iron status:

The daily iron requirement during pregnancy is about 3.4 mg; if spread out as a daily average over the three trimesters, it would be about 1,000 mg per pregnancy The fetus accumulates of iron from maternal stores via the placenta; added to this is the iron requirement for increased maternal blood volume and iron loss at delivery due to bleeding. Thus, a single pregnancy without supplemental iron could exhaust iron stores(McKenzie,2014).

1.3.1.6.3 Folate deficiency:

Folate requirements are increased approximately two fold in pregnancy and serum folate levels fall to approximately half the normal range with a less dramatic fall in red cell folate. In some parts of the world,

megaloblastic anemia during pregnancy is common because of a combination of poor diet and exaggerated folate requirements. Given the protective effect of folate against neural tube defects, folic acid 400 μg/ day should be taken per conceptually and throughout pregnancy. Food fortification with folate is now being practised in many countries Vitamin B12 deficiency is rare during pregnancy although serum vitamin B12 levels fall to below normal in 20-30% of pregnancies and low values are sometimes the cause of diagnostic confusion (Hoff brand and Moss ,2006).

1.3.1.6.4 Thrombocytopenia:

The platelet count typically falls by approximately 7% of women this fall is more severe and can result in thrombocytopenia (platelet count <140 x109/L). In over 75% of cases this is mild and of unknown cause, a condition referred to as incidental thrombocytopenia of pregnancy. Approximately 21% of cases are secondary to a hypertensive disorder and 4% are associated with immune thrombocytopenic purpura 10% in an uncomplicated pregnancy.(Hoffbrand and Moss ,2006,2008).

1.3.1.6.5 Anemia:

Anemia is considered to be present if the hemoglobin concentration of the red blood cells (RBCs) or the packed cell volume of RBCs (hematocrite) is below the lower limit of the95% reference interval for the individual's age, gender, and geographical location (Mary louise.2001)

1.3.1.6.5.1 Physiological adaptations in anemia:

Several mechanisms are brought into play in anemia to make more effective use of the available hemoglobin for delivery of oxygen to the tissues.

A)Increased release of oxygen from red cells A greater proportion of the oxygen attached to hemoglobin is released when the red cell passes through the tissues in anemic subjects.

B)Increased blood flow Cardiac output increases in anemia, mainly as a consequence of increased stroke volume.

C)Maintenance of blood volume. The volume of the blood is maintained within approximately normal limits by an increase in the volume of the plasma to counteract the decrease in the volume of red cells D)Redistribution of blood flow Some deviation of blood flow occurs from tissues with lesser oxygen -requirements to those with greater requirements(,Firkin *et. al* 2006)

1.3.1.6.5.2 Symptoms:

If the patient does have symptoms these are usually shortness of breath, particularly on exercise, weakness, lethargy, palpitation and headaches. In older subjects, symptoms of cardiac failure ,angina pectoris or intermittent claudication or confusion may be present. Visual disturbances because of retinal haemorrhages may complicate very severe anemia, particularly of rapid onset. (Hoffbrand and Moss ,2006)

1.3.1.6.5.3 Signs:

These may be divided into general and specific General signs include pallor of mucous membranes which occurs if the hemoglobin level is less than 9 – 10 g/dL Conversely, skin color is not a reliable sign. hyper dynamic circulation may be present with tachycardia, a bounding pulse, cardiomegaly and a systolic flow murmur especially at the apex. Particularly in the elderly, features of congestive heart failure may be present. Retinal haemorrhages are unusual Specific signs are associated with particular types of anemia, e.g. koilonychia (spoon nails) with iron

deficiency, jaundice with hemolytic or megaloblastic anemia, leg ulcers with sickle cell and other hemolytic anaemias, bone deformities with thalassaemia major. (Hoffbrand and Moss ,2008).

1.3.1.6.5.4 Classification of Anemia by Red cell indices:

The most useful classification is that based on red cell indices and divides the anaemia into microcytic, normocytic and macrocytic (Table 1.1)as well as suggesting the nature of the primary defect, this approach may also indicate an underlying abnormality before overt anemia has developed In two common physiological situations the mean corpuscular volume (MCV) may be outside the normal adult range. In the newborn for a few weeks the MCV is high but in infancy it is low (e.g. 70 fl at 1 year of age) and rises slowly throughout childhood to the normal adult range. In normal pregnancy there is a slight rise in MCV, even in the absence of other causes of macrocytosis (e.g. folate deficiency) (Hoffbrand and Moss ,2006).

Classification of Anemia by Red cell indices:

((Hoffbrand and Moss ,2006)

Microcytic, hypochromic	Normocytic, normochromic	Macrocytic
MCV < 80 fL MCH < 27 pg	MCV 80 – 95 fl MCH $\geq$ 27 pg	MCV > 95 fl
Iron deficiency IDA	Many haemolytic anemias	Megalo blastic: vitamin B 12
Thalassaemia	Anaemia of chronic disease (some cases)	folate deficiency
Anaemia of chronic disease (some cases)	After acute blood loss	Non – megaloblastic
Lead poisoning	Renal disease	alcohol, liver desease
Sideroblastic anaemia(some cases	Mixed deficiencies	Myelodysplasia
	Bone marrow failure(post – chemotherapy)	aplastic anaemia

1.3.1.6.6 Common anemia associated with pregnancy

1.3.1.6.6.1 Iron deficiency anemia:

the fore most task in the evaluation of a patient with iron deficiency is to identify and treat the underlying cause of the imbalance between iron requirements and supply that is responsible for the lack of iron the most common cause of increased iron requirements leading to iron deficiency is blood loss; in men and postmenopausal women, iron deficiency almost inevitably signifies GIT blood loss, Meckels diverticulum, hereditary hemorrhagic telangiectasia, other vascular ectasia of the bowel, and colonic polyposis .In women of childbearing age, genitourinary blood loss with menses is often responsible for increased iron requirements. Menstrual losses tend to be decreased with the use of oral contraceptives but are increased with the use of intrauterine devices. Other causes of genitourinary bleeding include uterine malignancies or fibroids; stones, infarction, infection with Schistosoma haematobium inflammatory disease, or malignancy of the urinary tract; and, rarely, chronic hemoglobinuria or hemosiderinuria resulting from paroxysmal nocturnal hemoglobinuria .Uncommonly, respiratory tract blood loss resulting from chronic recurrent hemoptysis of any cause may produce iron deficiency In two rare conditions, idiopathic pulmonary siderosis and Good pastures syndrome, hemoptysis and intrapulmonary bleeding may be in apparent but lead to the sequestration of iron in pulmonary macrophages although still within the body, this sequestered iron is lost for systemic utilization, and severe iron deficiency anemia may develop recurrent blood donation may lead to iron deficiency particularly in menstruating women, pregnancy entails the net loss of the equivalent of 1,200-1,500 ml blood. On average, 270 mg of iron is donated to the fetus, an additional 90 mg is contained in the cord and placenta, and 150 mg is present in the lochia

and blood lost at delivery, a total of slightly more than 500 mg of iron
.during pregnancy the red cell mass increases by more than a third,
requiring almost another 500 mg of iron, which is returned to stores after
delivery and not included in the net cost of a pregnancy. after delivery,
the resumption of menstruation is usually delayed for some months,but if
the infant is breast-fed, lactation requires about0.51.0 mg Fe/day
.(Hoffman et.al.2000)

1.3.1.6.6.1.1 The clinical features of iron deficiency anemia:

the general symptoms of iron deficiency anemia are those of anemia of
any cause: fatigue, dyspnea on exertion, and dizziness. There are a few
signs and symptoms that are relatively unique to iron deficiency anemia,
including spoonfingernails, glossitis (atrophy of the papillae of the
tongue, with burning or soreness), ulcerations or fissures at the corners of
the mouth(angular stomatitis), and dysphagia due to esophageal webs or
strictures. the combination of dysphagia, angular stomatitis, and
hypochromic anemia has been called the Plummer-Vinson or Paterson-
Kelly syndrome.these extreme signs of iron deficiency are now
uncommon. Pica is the habitual consumption of unusual substances. It
can be both a manifestation and a cause of iron deficiency Specific
examples of pica include geophagia (consumption of earth or clay),
pagophagia (ice), and amylophagia (laundry starch) Food pica is the
compulsive eating of one kind of food, often crunchy foods such as
celery, potato chips, carrots, or raw potatoes In most cases, pica is a
symptom of iron deficiency and disappears when the iron deficiency is
relieved However, pica can also be a cultural phenomenon and, in these
instances, can induce iron deficiency Laundry starch and clay can impair
iron absorption. Laundry starch is also extremely poor in iron, so if starch
constitutes a significant proportion of caloric intake, the diet is likely to
be deficient in iro(Kern, 2002)

1.3.1.6.6.1.2 Laboratories test :

The anemia of iron deficiency is classically microcytic (decreased MCV) and hypochromic (increased central pallor in red blood cells . However, in early iron deficiency, the MCV will be normal. Occasional microcytic and hypochromic RBCs may be present on the blood smear (Kern, 2002). The first step in laboratory evaluation should include serum ferritin or serum iron, TIBC, and iron saturation, If the iron studies indicate iron deficiency, the next step is to determine the cause, If the iron studies are not consistent with iron deficiency in a patient with a microcytic anemia, the next step is hemoglobin electrophoresis to diagnose of thalassemia or a hemoglobinopathy.

A serum lead level should be done in children whir on deficiency is excluded. A bone marrow examination should seldom be necessary to diagnose iron deficiency, but if the iron studies are indeterminate,

a bone marrow examination should be performed and stained for iron. Marrow deficient in iron usually shows mild erythroid hyperplasia; late erythroid precursors appear ragged, poorly hemoglobinized (grayish), and small. Storage iron must be completely absent; the presence of any stainable iron in the bone marrow excludes the diagnosis of iron deficiency (Kern, 2002).

1.3.1.6.6.1.3 Sequence of events of iron deficiency anemia:

Depletion of iron storeswhen the body is in a state of negative iron balance, the first event is depletion of body stores, which are mobilized for hemoglobin production. Iron absorption is increased when stores are reduced, before anemia develops and even when the serum iron level is still normal, although the serum ferritin will have already fallen. (Hoffbrad *et al*., 2005).

1.3.1.6.6.1.3.1. Iron-deficient Erythropoiesis:

with further iron depletion, when the serum ferritin is below 15 μ g/L, the serum transferrin saturation falls to less than 15% due to a rise in transferrin concentration and a fall in serum iron. This leads to the development of iron-deficient erythropoiesis and increasing concentrations of serum transferrin receptor and red cell protoporphyrin. At this stage, the hemoglobin, meancorpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) may still be within the reference range, although they may rise significantly when iron therapy isgiven (Hoffbrand *et al*., 2005).

If the negative balance continues, frank iron deficiency anemia develops. The red cells become obviously microcytic and hypochromic, and poikilocytosis becomes more marked. The MCV and MCH are reduced, and target cells may be present.

The reticulocyte count is low for the degree of anemia. The serum TIBC rises and the serum iron falls, so that the percentage saturation of the TIBC is usually less than10%. The number of erythroblasts containing cytoplasmic iron (Sideroblasts) is reduced at an early stage in the development of deficiency, and siderotic granules are entirely absent from these cells when iron deficiency anemia is established.

The erythroblasts have a ragged, vacuolated cytoplasm and relatively psychotic nuclei.

The bone marrow macrophages show a total absence of iron, except where very rapid blood loss outstrips the ability to mobilize the storage iron. Platelets are frequently increased (Hoffbrand *et al*., 2005).

1.3.1.6.6.2 Megaloblastic anemia:

The megaloblastic anemia are a group of disorders characterized by the presence of distinctive morphological appearances of the developing red cells in the bone marrow. The cause is usually deficiency of either cobalamin (vitamin B 12) or folate,but megaloblastic anemia may arise because of inherited or acquired abnormalities affecting the metabolism of these vitamins or because of defects in DNA synthesis not related to cobalamin or folate (Hoffbrand ,Moss2011).

1.3.1.6.6.2.1 Biochemical basis of megaloblastic anaemia:

The common feature of all megaloblastic anemia is a defect in DNA synthesis that affects rapidly dividing cells in the bone marrow and other tissues all conditions that give rise to megaloblastic changes share in common a disparity in the rate of synthesis or polymerization of the four immediate precursors of DNA: the deoxyribonucleoside triphosphates . In deficiencies of either folate or cobalamin there is a failure to convert deoxyuridine monophosphate (dUMP) todeoxythymidine monophosphate (dTMP). The coenzyme 5,10 –methylene tetrahydrofolate polyglutamate is needed for this reaction and the availability of this coenzyme is reduced in either cobalamin deficiency or folate deficiency the reduced supply of deoxythymidine triphosphate (dTTP) in megaloblastic anaemia owing to folate or cobalamin deficiency slows elongation of newly originated replicating segments from multiple sites of origin. Thus small fragments accumulate, single – stranded areas become points of weakness where mechanical or enzymatic breakage may occur, and the failure to form bulk DNA impairs contraction of newly replicated lengths of DNA, leaving the chromosomes elongated, despirillated and with random breaks. Late – replicating DNA is particularly affected and some cells become arrested and die at this stage by apoptosis, which can be

prevented in vitro by preformed thymidine. Surprisingly, measurements of dTTP concentration in megaloblasts have not shown a deficiency (Hoffbrana ,Moss2011).

1.3.1.6.6.2.2 Clinical features of megaloblastic anaemia:

The onset is usually insidious with gradually progressive symptoms and signs of anemia The patient may be mildly jaundiced (lemon yellow tint) because of the excess breakdown of haemoglobin resulting from increased ineffective erythropoiesis in the bone marrow Glossitis (a

beefy-red sore tongue) ,angular stomatitis and mild symptoms of malabsorption with loss of weight may be present because of

the epithelial abnormality Purpura as a result of thrombocytopenia and widespread melanin pigmentation (the cause of which is unclear) are less frequent presenting features . Many asymptomatic patients are diagnosed when a blood Count that has been performed for another reason reveals macrocytosis. (Hoffbrana ,Moss2011).

1.3.1.6.6.2.3 Laboratory findings:

The anaemia is macrocytic (MCV >95 fL and often as high as 120-140 fL in severe cases) and the macrocytes are typically oval in shape The reticulocyte count is low and the total white cell and platelet Couts may be moderately reduced, especially in severely anaemic patients. A proportion of the neutrophils show hypersegmented nuclei (with six or more lobes). The bone marrow is usually hypercellular and the erythroblasts are large and show failure of nuclear maturation maintaining an open, fine, lacy primitive chromatin pattern but normal

haemoglobinization Giant and abnormally shaped metamyelocytes are characteristic.The serum unconjugated bilirubin and lactate dehydrogenase (LDH) are raised as a result of marrow cell breakdown(Hoffbrana ,Moss2011).

1.3.1.7 Performing a blood count:

in the past, blood counts were performed by slow and labour-intensive manual techniques using counting chambers, microscopes, glass tubes, colorimeters, centrifuges and a few simple reagents. The only tests done with any frequency were estimations of hemoglobin concentration (Hb), packed cell volume (PCV) and white blood cell count (WBC). Hb was estimated by a method depending on optical density and was expressed as mass/volume, or even as percentage in relation to a rather arbitrary 'normal' that represented 100%. PCV was a measurement of the proportion of a column of centrifuged blood that was occupied by red cells. Now expressed as a decimal fraction representing volume/volume, it was initially expressed as a percentage. White cells were counted microscopically in a diluted blood sample in a hemocytometer, a counting chamber of known volume. All cell counts were expressed as the number of cells in a unit volume(.Bain et all,2006).

1.3.1.7.1 Automated blood cell counters:

The latest fully automated blood cell counters aspirate and dilute a blood sample and determine 8–46 variables relating to red cells, white cells and platelets. Many counters are also capable of identifying a blood specimen (e.g. by bar-code reading),mixing it, transporting it to the sampling tube and checking it for adequacy of volume and absence of clots. Some are also linked to an automated film spreader To avoid any unnecessary handling of blood specimens by instrument operators, sampling

is usually by piercing a cap. Apart from the measurement of Hb, all variables depend on counting and sizing of particles, whether red cells, white cells or platelets Particles can be counted and sized either by

electrical impedance or by light scattering automated instruments have at least two channels.

In one channel diluents is added and red cells are counted and sized. In another channel a lytic agent is added, together with diluents, to reduce red cells to stroma, leaving the white cells intact for counting and also producing a solution in which Hb can be measured. Further channels are required for a differential WBC, which is often dependent on study of cells by a number of modalities (Bain et all,2006)

1.3.1.7.2 What Does It Measure:

The test can tell your doctor a lot about your overall health. It measures the following things:

1.3.1.7.2.1 White blood cells (WBCs).

These help to fight infections. If you have high WBC levels, it tells your doctor you have inflammation or infection somewhere in your body. If it's low, you could be at risk for infection. The normal range is 4,500 to 10,000 cells per microliter (cells/µL). (A microliter is a very tiny amount – one millionth of a liter). (WebMD,2016)

1.3.1.7.2.2 RBC (red blood cell count).

This is the number of red blood cells you have. These are important because they carry oxygen through your body. They also help filter carbon dioxide. If your RBC count is too low, you may have anemia or another condition. (If you have anemia, your blood has fewer red blood cells than normal.) The normal range for men is 5 million to 6 million cells/mcL; for women it's 4million to 5 million cells/mcL.

1.3.1.7.2.3 Hb or Hbg (hemoglobin):

This is the protein in your blood that holds the oxygen. The normal range for men is 14 to 17 grams per deciliter (gm/dL); for women it's 12 to 15 gm/dL (WebMD,2016)

1.3.1.7.2.4 HCT (hematocrit) :

This is some time also referred to a packed cell volume (PCV) or erythrocyte volume fraction .it is the proportion of blood volume that is occupied by red blood cell. For normal subjects it is about 46% for men and 38% for women .hematocrit measurement is considered as integral part of complete blood count result, along hemoglobin concentration, white blood count and platelet count .Most of the modern automated analyzer have the facility to measure hematocrit. Both elevated and depressed value of hematocrit is suggestive of some malfunctioning on the body(Singh, 2010)

1.3.1.7.2.5 MCV (mean corpuscular volume):

This is the average size of your red blood cells. If they're bigger than normal, your MCV score goes up. That could indicate low vitamin B12 or folate levels. If your red blood cells are smaller, you could have a type of anemia. A normal-range MCV score is 80 to 95. (Web MD,2016).

1.3.1.7.2.6 MCH (mean corpuscular hemoglobin).

The mean amount of hemoglobin per red cell (MCH) is reliably estimated By automated electronic counting devices by dividing the total amount of hemoglobin by the number of red cells in a sample of blood. Women normal range 29.5 ±2.5 pg (Firkin *et al*., 1989)

1.3.1.7.2.7 MCHC(meancorpuscularhemoglobin concentration)

This measures how concentrated the hemoglobin is in your typical red blood cell. It's how densely packed the hemoglobin molecules are inside the cells. (WebMD,2016).

1.3.1.7.2.8 RDW (red cell distribution width):

How your much your red blood cells vary in size (anisocytosis)?

1.3.1.7.2.9 MPV (mean platelet volume):

The size of the platelets in your blood.

1.3.1.7.2.10 PDW (platelet distribution width):

How much your platelets vary in size?

1.3.1.7.2.11 White Blood Cell Differential:

There are five types of white blood cells. This test shows how many of each type you have: neutrophils, lymphocytes, monocytes, eosinophils, and basophils. (WebMD,2016).

1.3.1.7.3 Integration of information from the CBC:

Because the MCV, RDW, reticulocyte count, and peripheral smear all provide complementary information, integration of these parameters leads to the correct diagnosis or provide significant insight as to the differential diagnosis For example, an anemia presenting with a low MCV and high RDW in which the reticulocyte count is low is almost always iron deficiency anemia. The finding of hypochromic, microcytic cells along with wide variation in cell shape and size makes the diagnosis very likely. Iron studies and a ferritin level can then be obtained. at the other end of

the spectrum, anewly occurring anemia that presents with a high MCV and high RDW in which the reticulocyte count is high is most likely to be associated with autoimmune hemolysis. a finding of spherocytes on examination of the peripheral blood smear would be highly suggestive of this diagnosis and would provoke further laboratory investigation such as obtaining a direct antiglobulin test(Schmaier , Lazarus 2012)

1.4 previous studies

At Omdurman Al Saudi Maternity Hospital: astudy revealed that there were significant decreased in RBCs count, hemoglobin (Hb) and packed cell volume (PCV) of pregnant women compared to non-pregnant women (P value <0.05) and significant decreased in mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) of pregnant women (P value <0.05). TWBCs count was increased significantly (P.value< 0.050) in contrast platelets count significantly lower than the normal control (P. value <0.05) (Elgari, 2013).

At the University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria results obtained for the hematological parameters indicate that only Haematocrit (Hct) showed significant differences amongst the three groups; highest amongst subjects in the third trimester and lowest amongst subjects in the second trimester (p < 0.05). Hemoglobin concentration (Hbc), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), and Erythrocyte Sedimentation Rate (ESR) were found to be highest amongst subjects in the second trimester; Red Blood Cell (RBC) count and   White Blood Cell (WBC) count were highest amongst subjects in the first trimester of pregnancy. These differences were however, not statistically significant (p > 0.05). Among the anthropometric parameters studied, only weight showed significant

differences in the three groups of pregnant subjects (p < 0.05); being highest amongst subjects in the third trimester and lowest in subjects in the first trimester Haematological values in pregnant women in Port Harcourt, Nigeria.(Dapper 2006)

1.5 Rationale

Pregnancy is associated with several hematological change, ranging from anemia to thrombocytosis ,indicated by Hb decreasing and plateletes increasing. Hematological abnormalities are relatively common in general practice medicine .In order to assist in clarifying the cause of these abnormalities and help in some instances with diagnosis in this study try to assess the impact of pregnancy on HB, RBC indices ,PLT and TWBS, and then may help to establish secondary prevention medication in pregnant.

1.6 Objectives:

1.6.1 General objective:

To determine some haematological parameters in pregnancy at second trimester.

1.6.2 Specific objectives:

To measure and compare (CBC) between pregnant in second trimester and normal healthy woman.

To compare the result with demographic data

To relate variation in CBC in second trimester

Chapter two

Materials and methods

Chapter two

Materials and methods

2.1 Study design:

This is analytical case control study conducted from august 2017 to january 2018.Aimed to measured complete blood count in pregnant woman at second trimester (case) and non pregnant at child bearing age women individual (control) .

2.2 Study area and population:

This study was conducted in primary healthy care center in Karary in hematology department , sample size of 80 venous blood samples was collected from diagnosed pregnant at second trimester and 50 samples were collected from healthy woman at child bearing age as control

2.3 Sampling:

Women whom diagnosed as pregnant at second trimester were selected and data collected using self –administrated per-coded questionnaire which was specifically designed to obtain information that helped in study

2.4 Procedure of sample collecation:

1- Pregnant women either was sat or lid down right on an examination table.

2- the arm was positioned on the armrest so that the vein identified become under some tension and its mobility was reduced.

3-the skin was cleaned up with 70% alcohol (ethanol) to dry.

4- Personal detailed were check up on the form and on blood vials

5-Atourniquet was applied to the arm ,tight sufficiently to distened the vein but not cause discomfort.

6- Two and half ML of blood sample were taken from the superficial vein of the forearm.

7- Blood was collected in K2 EDTA anticoagulant container

8- EDTA,blood sample were analyzed by sysmex 21(Dacie and Lewis,2006).

2.5 Requirement of Test:

1- Automated hematological analyzer KX 21N (sysmex) for determination of CBC

2-EDTA

3-Alchol swab 70%alcohol(ethanol)

4-Cotton,Torniquet and Blister

2.6 Inclusion Criteria:

 Diagnosed pregnant woman at second trimester

Non pregnant woman at reproductive age as control group for comparing

2.7 Exclusion criteria

 Non Pregnant women

Pregnant woman at third trimester or at first trimester

Pregnant women had recent infection that are known to affect the parameters we investigate.

Pregnant non consent for investigation also exclude

2.8 Data analysis:

The collected data proceed for analysis using SPSS version 17 computerized program and the data presented in form of tables

2.9 Methods:

Fully automated multichannel instruments(sysmex21) require only that an appropriate blood sample is presented to the analyzer and usually measure from 8 to 20 components for the basic CBC and white blood cell differential Impedance counting systems depends on the fact that red cells are poor conductors of electricity, where as certain diluents are good conductors (Dace and Lewis, 2011).

2.9.1 Principle of sysmex model 21 hematological analyzer:

Measurement of blood cells (RBCs ,WBCs ,and platelet count). And hemoglobin concentration obtained by aspiration of small volume of well mixed (EDTA) blood by sample probe and mixed with isotonic diluent in nublazer. Diluted aspiration delivered to RBCs as perture bath for providing information about RBCs and platelet. Other portion of aspiration sample induced into WBCs bath in which hemolytic reagent (stromatolyzer) added to break down (RBCs) and realese of hemoglobin which measured in build colorimeter. Based in cyanomethmoglobin method (HICN).The through three sensing apertures for each cell type, cell counted and size information generated in triplicate pulses acting to electronic conductively.

mentioned pluses convert into digital number using in build calculator programmed and designed for RBCs WBCs ,count .some portion of diluted sample delivered to in build hemoglobin meter at the same time. Hence three value directly measured (RBCs ,Hb) and displayed on (LCD) other value of red cell indices ,leukocyte differential and absolute count calculated from given information ,the result printed out according to the setting mode .on the other hand platelet count and histogram determined from pulses acting to size of platelet (Dace and Lewis,2006)

2.10 Ethical consideration:

An informed consent from selected individuals was taken after being informed with all detailed objectives of the study

Chapter three

Results

Chapter Three

Results

Data analysis:

Table (3.1)Demographic characteristic of study participants:

Characteristic		Frequency	Percent
Sample	**Case**	80	61.5 %
	Control	50	38.5 %
	Total	130	100 %
age	**≥30**	68	52.3%
	<30	62	47.7%
Educational level	**university**	79	60.8%
	No university	51	39.2%
No of pregnant	**≥3**	49	61.3%
	<3	31	38.7%

The result show that There was significant decrease in Hb, HCT, ,MCH,MCHC and RBCs count , in pregnant women when compared with control group there was no significant difference in MCV between pregnant and non pregnant .also significant increase appear in RDW table (3.2)

There was significant increase in TWBCs, neutrophil% and absolute neutrophil count in pregnant women when compared with control group. There was significant decrease in lymph and not effect in lymph absolute in pregnant when compared with non pregnant (table 3.2).

There was no significant difference in , Pletlets count , MPV ,PDW and P-LCR in pregnant women when compared with control group.(table 3.2).

There is significant decrease in TWBs and neutrophils in pregnant had university education when compare with pregnant had no university education table (3-3). There was no significant effect of age table (3-4) in CBC and not effect of times of pregnant table (3-5) in CBC at second trimester.

Table (3-2) Comparison of CBC between pregnant at second trimester and non pregnant:

Test	Type	N	Mean	Std. Deviation	p-value
RBCS	Case	80	4.2293	0.43529	0.000
	control	50	4.6112	0.48377	
Hb	Case	80	11.536	1.3344	0.000
	control	50	12.916	1.1381	
HCT	Case	80	35.666	2.9845	0.000
	control	50	38.804	3.1927	
MCV	Case	80	84.681	6.1047	0.805
	control	50	84.910	4.4135	
MCH	Case	80	27.395	2.7720	0.022
	control	50	28.250	1.4260	
MCHC	Case	80	32.315	2.0047	0.000
	Control	50	33.272	0.8303	
RDWSD	Case	80	45.283	4.8619	0.001
	Control	50	43.140	1.8474	
RDWCV	Case	80	14.155	1.9163	0.001
	Control	50	13.296	0.8753	

Test	Type	N	Mean	SD	P
TWBC	Case	80	7.07375	2.085741	0.000
	Control	50	5.77800	1.246266	
Lym%	Case	80	28.700	7.3794	0.000
	Control	50	34.782	8.3566	
Mix%	Case	80	7.231	3.6882	0.061
	Control	50	8.470	3.5644	
Neutro%	Case	80	64.026	8.5629	0.000
	Control	50	56.748	7.7712	
Lymabs	Case	80	1.923	0.4053	0.494
	Control	50	1.990	0.6159	
Mixabs	Case	80	.504	0.2892	0.676
	Control	50	.484	0.2084	
Neuabs	Case	80	4.639	1.8686	0.000
	Control	50	3.302	0.9734	

Test	Type	N	Mean	SD	P
Platelets	Case	80	268.475	65.2828	0.210
	Control	50	282.360	53.8326	
PDW	Case	80	12.184	1.7603	0.896
	control	50	12.150	1.1657	
MPV	Case	80	9.661	0.8250	0.115
	control	50	9.854	0.5600	
PLCR	Case	80	23.085	6.2370	0.263
	control	50	24.224	4.4317	

Table (3-3) Effect of educational level in CBC in pregnant at second trimester :

CBC	university	N	Mean	SD	p.value
twbc	yes	47	6.50638	1.482713	0 .007
	no	33	7.88182	2.536417	
Rbcs	yes	47	4.1960	.43023	0.418
	no	33	4.2767	.44469	
Hb	yes	47	11.453	1.2258	0.510
	no	33	11.655	1.4870	
mcv	yes	47	85.166	5.9683	0.400
	no	33	83.991	6.3215	
Hct	yes	47	35.598	2.9870	0.809
	no	33	35.764	3.0245	
Mch	yes	47	27.438	2.6284	0.869
	no	33	27.333	3.0053	
mchc	yes	47	32.179	1.9042	0.472
	no	33	32.509	2.1548	
pletlets	yes	47	259.957	61.7713	0.165
	no	33	280.606	69.1235	
Lym	yes	47	29.270	6.8456	0.413
	no	33	27.888	8.1188	

mix	yes	47	7.372	3.8125	0.686
	no	33	7.030	3.5520	
neut roph il	yes	47	63.304	8.4455	0.371
	no	33	65.055	8.7539	
lyma bsolu t	yes	47	1.843	.3555	0.034
	no	33	2.036	.4485	
mixa bs	yes	47	.474	.2832	0.283
	no	33	.545	.2970	
neua bs	yes	47	4.177	1.2762	0.016
	no	33	5.297	2.3491	
rdws d	yes	47	45.389	4.8789	0.816
	no	33	45.130	4.9090	
rdwc v	yes	47	14.100	1.8484	0.761
	no	33	14.233	2.0356	
pdw	yes	47	12.451	1.9735	0.105
	no	33	11.803	1.3404	
mpv	yes	47	9.723	.8362	0.425
	no	33	9.573	.8133	
plcr	yes	47	23.787	6.5030	0.232
	no	33	22.085	5.7869	

p.v ≥0.05

Table(3-4) Effect of no of pregnant in CBC in pregnant :

para metr	No of pre group	N	Mean	SD	P.value
twbc	morethan3	49	6.98980	2.297394	0 .654
	lessthan3	31	7.20645	1.726641	
rbcs	morethan3	49	4.2547	.40912	0 .514
	lessthan3	31	4.1890	.47794	
Hb	morethan3	49	11.539	1.3720	0 .983
	lessthan3	31	11.532	1.2950	
hct	morethan3	49	35.492	2.7157	0.515
	lessthan3	31	35.942	3.3953	
mcv	morethan3	49	83.753	5.8107	0.087
	lessthan3	31	86.148	6.3625	
mch	morethan3	49	27.216	2.9631	0.478
	lessthan3	31	27.677	2.4600	
mchc	morethan3	49	32.433	2.0815	0.513
	lessthan3	31	32.129	1.8955	
pletlet	morethan3	49	275.061	64.8493	0.259
	lessthan3	31	258.065	65.6607	
lym	morethan3	49	29.773	7.4711	0.102
	lessthan3	31	27.003	7.0166	
mix	morethan3	49	7.020	3.8501	0.524
	lessthan3	31	7.565	3.4520	
neutro	morethan3	49	63.153	8.6499	0.254
	lessthan3	31	65.406	8.3761	
lymabs	morethan3	49	1.951	.4311	0.432
	lessthan3	31	1.877	.3631	
mixabs	morethan3	49	.484	.3057	0.439
	lessthan3	31	.535	.2627	
neuabs	morethan3	49	4.547	2.1107	0.584

	lessthan3	31	4.784	1.4253	
rdwsd	morethan3	49	45.122	5.1656	0.714
	lessthan3	31	45.535	4.4096	
rdwcv	morethan3	49	14.306	2.1694	0.336
	lessthan3	31	13.916	1.4295	
pdw	morethan3	49	12.016	1.6047	0.288
	lessthan3	31	12.448	1.9802	
mpv	morethan3	49	9.620	.7842	0.581
	lessthan3	31	9.726	.8952	
plcr	morethan3	49	22.561	5.6756	0.348
	lessthan3	31	23.913	7.0526	

Significane level at p.value $p < 0.05$

Table (3-5) Effect of age in cbc in pregnant at second trimester

CBC	agegroupe	N	Mean	SD	P.value
twbc	less than 30	38	6.97368	1.894042	0.686
	more than 30	42	7.16429	2.264339	
rbcs	less than 30	38	4.1879	.47385	0.422
	more than 30	42	4.2667	.39930	
Hb	less than 30	38	11.503	1.3629	0.832
	more than 30	42	11.567	1.3238	
Hct	less than 30	38	35.671	3.5171	0.989
	more than 30	42	35.662	2.4495	
mcv	less than 30	38	85.450	5.7861	0.287
	more than 30	42	83.986	6.3680	
mch	less than 30	38	27.582	2.4255	0.570
	more than 30	42	27.226	3.0716	
mchc	less than 30	38	32.274	1.9453	0.862
	more than 30	42	32.352	2.0799	
pletlet	less than 30	38	262.263	61.2159	0.422
	more than 30	42	274.095	69.0068	
Lym	less than 30	38	28.413	7.2891	0.743
	more than 30	42	28.960	7.5388	
Mix	less than 30	38	7.334	3.2070	0.814
	more than 30	42	7.138	4.1121	
neutro	less than 30	38	64.208	8.3815	0.858

	more than 30	42	63.862	8.8221	
lymabs	less than 30	38	1.892	.3830	0.527
	more than 30	42	1.950	.4273	
mixabs	less than 30	38	.489	.2380	0.677
	more than 30	42	.517	.3312	
neuabs	less than 30	38	4.582	1.5777	0.797
	more than 30	42	4.690	2.1157	
rdwsd	less than 30	38	45.361	4.9203	0.892
	more than 30	42	45.212	4.8671	
rdwcv	less than 30	38	14.021	1.9092	0.555
	more than 30	42	14.276	1.9377	
pdw	less than 30	38	12.387	1.8495	0.329
	more than 30	42	12.000	1.6765	
mpv	less than 30	38	9.739	.8695	0.423
	more than 30	42	9.590	.7864	
plcr	less than 30	38	23.318	6.8948	0.752
	more than 30	42	22.874	5.6530	

Significane level at p.value $p < 0.05$

Chapter four

Discussion , Conclusion and Recommendation

Chapter four

Discussion Conclusion and Recommendations

4.1. Discussion:

In this study there was significant decrease in hemoglobin (Hb) ,red blood cells count(RBCS) mean cell hemoglobin (,MCH) mean cell hemoglobin concentration(MCHC) and ,hematocrit(HCT) . This is be is agree with study done at Omdurman Al Saudi Maternity Hospital: which revealed that there were significant decreased in RBCs count , hemoglobin (Hb) and ,hematocrit(HCT)   of pregnant women when compared with non-pregnant women(Elgari, 2013)also there was no significant difference in MCV this is characteristic of physiological anemia(Hoffbrand and, Moss 2011) The physiologic hyper volemia facilitates delivery of nutrients to the fetus, protects the mother from hypotension, and reduces the risks associated with hemorrhage at delivery the decrease in blood viscosity from the lower hematocrit creates lower resistance to blood flow, (Gaiser, 2014) in pregnant due to dilution In normal pregnancy, there is an increase in erythropoietic activity However, at the same time, an increase in plasma volume occurs, and this results in a progressive decrease in Hb , HCT and RBCs The level returns to normal about a week after delivery(Daice and Lewis, 2011). The anemia of iron deficiency is classically microcytic (decreased MCV) and hypochromic (increased central pallor in red blood cells . However, in early iron deficiency, the MCV will be normal(kern 2002).

RDW appear as significant increase in CV and SD in pregnant women at second trimester when compared with control it indicate anisocytosis . it me be due to iron and folate supplement intake by women at second trimester(hematinic).

 There was significant increase in TWBCs, Neutrophils% ,Neutrophils absalute   in pregnant when compared with control this was agree with study done in Omdurman locality (Hoyam,2016) . leukocyte count ranges during pregnancy are higher than non pregnant values, and the upper values approach 15,000/µL. During labor and

the early puerperium, values may become markedly elevated, attaining levels of 25,000/µL or even more. However, values average 14,000 to 16,000/µL . The cause for this marked increase is not known (Cunningham *et al* 2014).   Plate let show as no significant different platelet indices show no significant change   between test and control. between pregnant and non pregnant women(P≥0.05).this agree with study done by (Eltoum;2016)

 No significant different in Hb, MCV, TRBCs and MCHC (p≥0.05) ,and also no significant different in lymphocytes , and mix in pregnant women had university education when compare with pregnant women have under university (p≥0.05) there is significant decrease in TWBs and neutrophils in pregnant had university education , also insignificant increase in mean of platelet (P≥0.05).   There was no significant different in mean of TWBs ,and all CBC parameter   of pregnant women had three pregnant times or more when compare with other had less than three pregnant times (p≥0.05). according to age groups there is no Significant different in mean Hb and other CBC parameter in pregnant

women had 30 years old or more when compared with other had less than 30 years old (p≥0.05).

4.2.Conclusions:

1. There was significant decrease in Hb, HCT, MCH, MCHC RBCs , and lymphocytes count in pregnant women at second trimester when compared with control group .

2. There was no significant difference in MCV between pregnant and non pregnant .

3. There was significant increase in TWBCs, neutrophil%, absolute neutrophil count and RDW in pregnant women at second trimester when compared with control group.

4. There was no significant effect of age in CBC and not effect of times of pregnant in CBC at second trimester.

5. There is significant decrease in TWBs and neutrophils in pregnant had university education when compare with pregnant had no university education.

Recommendations:-

1. CBC should be consider and done as routines test for pregnant

2. Normal values should be done in Sudan ,to established data base for pregnant women

3. Follow up of general healthy of pregnant women, should be done regularly during pregnancy,

4. Iron profile should be done when Hb, MCV, and MCHC were less than normal.

Chapter five

References' and Appendices

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Appendix

Questionnaire to determine CBC of pregnant women in second trimester attended in Karary   Locality

Consent:

Do you agree to use your data and result of blood test in this research?

1. yes……………

2. no………………..
NO ( )

Personal data :

Name:…………………………………………………………….

Age:………………………………………………………………

Educational level …………………………………………………...

Month of pregnancy

………………………………………………………………………

….

Medical

history…………………………………………………………

…………………………………………………………………

………………………………………………………..

Result:

WBC……… RBC……. HGB……

HCT………. MCV…… MCH…..

MCHC……. PLT……. LYM%.....

NEUT%....... MIX%....... LYM#......

NEUT#........ MIX#........ RDW

PDW……… MPV……