



Mini Review

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Hemoglobin & Iron Levels in Normal Non-Pregnant & Pregnant Sudanese Ladies in Khartoum State



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Abstract

Background: Iron deficiency anaemia is the most common nutritional deficiency in the world. Because of the increased iron requirements of pregnancy and growth. Anaemia is considered when hemoglobin (Hb) is less than 11g/dl for pregnant women. Iron deficiency anaemia during pregnancy is associated with higher rates of premature birth and low birth weight. The aim of this study is to investigate the effect of hemodilution by measuring the hematological parameters in pregnant females, by measuring Hb level, PCV and iron level.

Methods: cross-sectional study performed in Khartoum state capital of Sudan during 2018 in normal non-pregnant and pregnant Sudanese ladies in Omer Sawi hospital, The National Ribat University, Khartoum, Sudan. Ten blood samples were collected from pregnant females and ten samples from healthy women were taken as controls. Aged between 20-40.

Result: Hemoglobin value in studied population showed that out of 10 pregnant females, 10 (100%) of them had normal Hb level. Iron value in studied population showed that 100% had low iron level. PCV value in studied population showed that 80% had low PCV while 20% had normal PCV.

Conclusion: According to this study the value of hemoglobin changed after applying the equation to give us a normal value compared with the value of normal non-pregnant women. This result explains the process of hemodilution that occurs in pregnant women.

Keywords: PCV; Pregnancy; Hemodilution

Abbreviations: IDA: Iron Deficiency Anemia; HB: Hemoglobin; CDC: Centers for Disease Control; SPSS: Statistical Package for Social Science; SD: Standard Deviation

Introduction

Iron deficiency anemia (IDA) is the most common nutritional deficiency in the world; estimates suggest that 2 billion persons worldwide are iron deficient. Because of the increased iron requirements of pregnancy and growth, pregnant women and infants are recognized as the groups most vulnerable to iron deficiency anemia. The most common causes of anemia in pregnancy include iron deficiency, folate deficiency vitamin B12 deficiency, hemolytic diseases, bone marrow suppression, chronic blood loss and underlying malignancies [1]. 30-50% of women become anemic during pregnancy, with iron deficiency being the most common form of anemia in more than 90% of the cases. Iron is essential to all cells. Functions of iron include involvement in energy metabolism, gene regulation, cell growth and differentiation, oxygen binding and transport, muscle oxygen use and storage, enzyme reactions, neurotransmitter synthesis, and protein synthesis. Iron is absorbed primarily in the duodenum and upper jejunum, where the acidic environment keeps iron in its soluble form [2]. Iron supplements are absorbed most effectively when taken on an empty stomach.

If gastrointestinal intolerance occurs (nausea, constipation, diarrhea, abdominal pain or cramping), taking the supplements with food or at bedtime may alleviate these symptoms. Iron deficiency anemia is characterized by a defect in hemoglobin synthesis, resulting in red blood cells that are abnormally small (microcytic) and contain a decreased amount of hemoglobin (hypochromic) [3].

Iron deficiency anemia can result from inadequate iron intake; decreased iron absorption, increased iron demand, and increased iron loss [4]. Approximately 800mg of iron are required in pregnancy, over and above the 230mg of iron that the women would have required even if she had not been pregnant, and the 150mg that she may lose through blood loss at delivery [5,6].

As iron requirements during pregnancy increase they form a particularly susceptible group especially in developing countries and affects up to 52% of pregnant women [7]. Centers for Disease Control and Prevention (CDC) has defined anemia in pregnancy as

hemoglobin (Hb) level of less than 11g/dL during the Ist and IIIrd trimesters and less than 10.5g/dL during the IInd trimester [8,9].

IDA during pregnancy is associated with higher rates of premature and low birth weight [10]. The lower hemoglobin cut-off is due to haemodilution in pregnancy as plasma volume expands up to 30-40% as compared to 20-25% increase in red cell mass [11]. Ferritin reflects iron stores and is the most accurate test to diagnose iron deficiency anemia [12-14]. It is also an acute phase reactant and can be elevated in patients with chronic inflammation or infection.

The overall iron requirement during pregnancy is significantly greater than that in the non-pregnant state despite the temporary respite from iron losses incurred during menstruation. Iron requirement increase notably during the second half of pregnancy because of the expansion of the red blood cell mass and the transfer of increasing amount of iron to both the growing fetus and the placental structures [15].

Approximately 65% of the stored iron is in the circulating red cells in the adult women, additional iron stores located in the bone marrow, liver and spleen in the form of ferritin. The first pathologic changes to occur in iron-deficiency anemia is the depletion of iron stores in the bone marrow, liver and spleen, resulting in a depressed serum ferritin level, the serum iron level falls [16]. During pregnancy, haemodilution leads to reduced hemoglobin concentration, whereas both serum iron and ferritin concentration decrease and total iron-binding capacity increases [17]. This results in dilutional drop in Hb concentration creating a low viscosity state facilitating oxygen transport to the tissues including placenta.

The prevalence of iron deficiency anemia in developing countries is 52% [18]. It has decreased in the developed countries over the past several decades and this has been variously attributed to iron fortification, prophylactic iron supplements, better health care and public health programs aimed at women and children [19]. For diagnosis of IDA in pregnancy ferritin level <12µg/L is considered as the gold standard [20] Serum iron can be normal or high if the pregnant female is on oral iron even with IDA [21] The serum iron Values 40-155µg/dl [22].

The estimation of ferritin is expensive and cannot be routinely done in all cases especially in developing countries. As the blood volume can increase by up to 1.5L then the actual haemodilution should be considered in anemia diagnosis and iron level can also be affected by this increased volume. This pilot study was designed to investigate the level of Hb and iron in pregnancy in relation to the PCV as an indicator of hemodilution.

Methods

This is an analytical, cross-sectional study performed in Khartoum state capital of Sudan during 2018 in normal and pregnant Sudanese ladies in Omer Sawi hospital, The National Ribat University, Khartoum, Sudan. A total number of 20 ladies were included, 10 healthy pregnant subjects aged between 20-40 years and 10 non pregnant. All pregnant subjects were selected

randomly during their antenatal visits. Ethical Approval of this study was obtained from the National Ribat University NRU.

The objectives of the study were explained to all individuals participating in the study. Questionnaire interviews with all participants were done covering information about age, pregnancy number, pregnancy stage, iron and folic acid intake. A five ml of blood sample was collected in EDTA for Hb, PCV and iron level.

Hb, PCV and Iron levels were measured using COBAS INTEGRA 400 plus ug/dl. All the data collected in this study were analyzed using the statistical package for social Science (SPSS) computer program version 20. Data were expressed as means with standard deviation(SD). P≤0.05 was considered statistically significant.

After obtaining the result, we applied a calculation of the haemoglobin and iron parameter by this law:-

$$\text{Hb x plasma} - \text{Normal Pcv}$$

$$\text{Iron x plasma} - \text{Normal Pcv}$$

Result

The study was carried out on ten normal pregnant women, four in the second trimester and six in the third trimester and the values were compared with ten non pregnant women were taken as control .

In this study we have three groups:-

- Group 1 values for ten pregnant women
- Group 2 values for ten pregnant women after application the equation.
- Group 3 values for ten non pregnant women (control)

Table 1: Hemoglobin in pregnant and normal women.

	N	Mean	T value	P. value	
Group 1	10	11.65±0.67	3.557	0.002	Significant
Group 2	10	14.45±0.40			
Group 1	10	11.65±0.67	24.77	0	Significant
Group 3	10	38.56±0.87			
Group 2	10	14.45±0.40	26.079	0	Significant
Group 3	10	38.56±0.87			

Table 2: Iron in pregnant and normal women.

	N	Mean	T value	P. value	
Group 1	10	17.90±0.86	4.292	0	Significant
Group 2	10	22.25±0.53			
Group 1	10	17.90±0.86	2.539	0.021	Significant
Group 3	10	14.89±0.80			
Group 2	10	22.25±0.53	7.783	0	Significant
Group 3	10	14.89±0.80			

The Hb measurement as mean±SD were taken and were found significantly lower than the normal value for all. Table 1 The

mean of Hb is 11.65 ± 0.67 , 14.45 ± 0.40 , 38.56 ± 0.87 in group 1, 2 and 3 respectively. Figure 1 There was significant difference. The Iron Hb measurement as mean \pm SD were taken and were found

significantly lower than the normal value for all. Table 2 The mean of Iron 17.90 ± 0.86 , 22.25 ± 0.53 , 14.89 ± 0.80 in group 1, 2 and 3 respectively. Figure 2 There was significant difference.

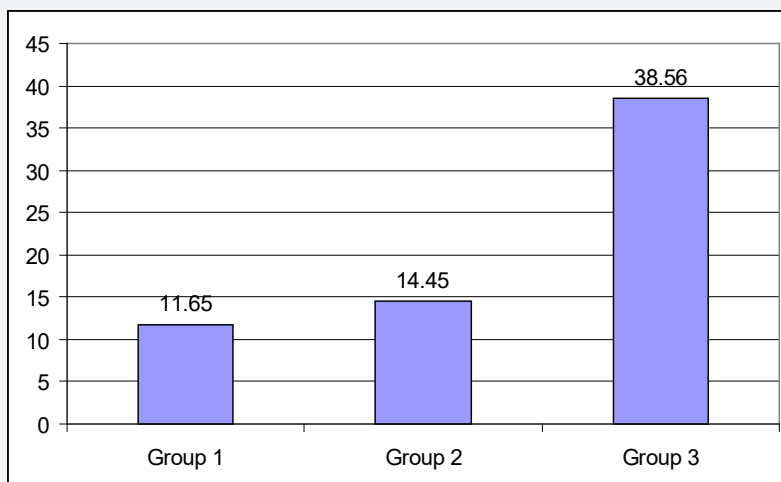


Figure 1: Haemoglobin in pregnant and normal women.

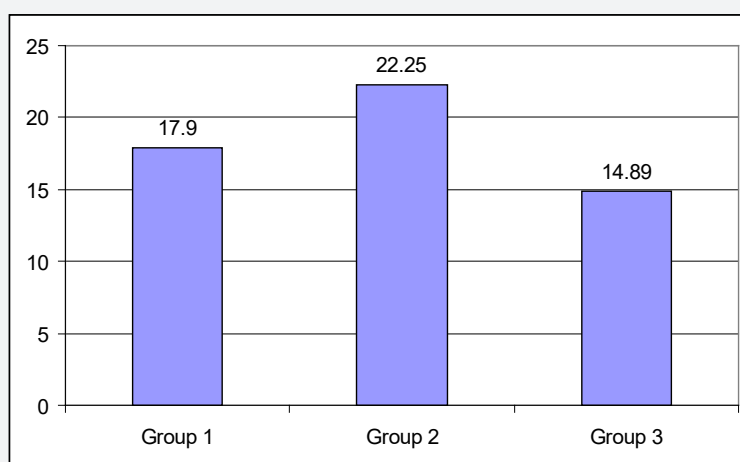


Figure 2: Iron in pregnant and normal women.

Discussion

Hemoglobin concentration and hematocrit, because of their low cost and quick assessment, are most commonly used to screen for iron deficiency; these measures reflect the amount of functional iron in the body. Iron deficiency anemia in pregnancy is an important preventable cause of maternal and perinatal morbidity and mortality.

Anemia in pregnancy has been defined by criteria from the Centers for Disease Control and Prevention (CDC) as a hemoglobin level of less than 11g/dL during the first and third trimesters and less than 10.5g/dL during the second trimester. In this study mean hemoglobin level was more than 11gm/dl in test group after applied the equation, this result explains the process of hemodilution that occurs in pregnant women.

Two pregnant women have normal PCV and eight of them have normal PCV. Low serum iron was found in all pregnant women. Iron transfer from mother to fetus occurs against the concentra-

tion gradient. Most iron transfer to the fetus occurs after 30 weeks of gestation which correspond to the time of peak efficiency of maternal iron absorption.

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