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A Study of Serum Iron Status and Haematological Profile in Third Trimester Pregnancy in Manipur

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Abstract:
Introduction*: The main cause of anaemia in child bearing age of female is iron deficiency accounting for a prevalence of 20-80% in female population. The increased iron requirements during pregnancy both by the women and infant may be regarded as the most vulnerable group to iron deficiency anaemia.*
Aim: *To measure the haematological parameters in pregnant women in their last trimester by measuring haemoglobin level and RBC indices and to determine iron status in them by measuring serum iron, total iron binding capacity (TIBC) and serum ferritin.*
Method: *One hundred and fifty pregnant ladies in their third trimester whose haemoglobin level is below 11.0 gm/dl attending antenatal OPD or admitted in antenatal ward in Regional Institute of Medical Sciences, Imphal, Manipur during the period from Feb 2013 to Mar 2016 were included in the study. Sixty randomly selected non-anaemic pregnant women in their last trimester were selected as controls. Complete blood count, peripheral blood smear, serum iron, TIBC and serum ferritin were measured.*
Results: *Majority of the cases had mild to moderate anaemia. Out of the 150 cases, 68 % had iron levels between 41 -115 µg/dl and 10 % had iron level below 40 µg/dl. Transferrin saturation ≤15% was found in 10% of the cases. Serum ferritin level of 12 µg/l and below which is indicative of iron deficiency anaemia was found in 45 pregnant women.*
Keywords: *Anaemia, iron, ferritin, transferrin*

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I. Introduction

Iron deficiency and iron deficiency anaemia are common nutritional and haematological disorders worldwide. In young women, it is most often the result of pregnancy. On average approximately 1 gm of iron is required during normal pregnancy, 300mg of iron is required by the placenta and foetus , whereas expansion of maternal red blood cell mass requires 500mg and 200mg is lost via excretion [1]. The requirement of iron during pregnancy increases significantly than non-pregnant state. According to WHO data, anaemia is associated with 40%of maternal death world- wide. During pregnancy the demand for iron is increased to meet the needs of the expanding red cell mass and requirements of the developing foetus and placenta. The foetus derives its iron from the maternal serum by active transport across the placenta mainly in the last 4 weeks of pregnancy. The total requirement for iron can be met only by mobilising iron stores in addition to achieving maximum absorption of dietary iron [2]. One of the most significant changes is the blood volume expansion during pregnancy by 50%. Plasma volume increases disproportionately compared with the red cell mass, resulting in the physiological decrease in hematocrit. Symptomatic iron deficiency during pregnancy has deleterious effects on maternal and perinatal health [3]. Iron deficiency anaemia during pregnancy is associated with higher rates of premature birth and low birth weight and intra uterine foetal death [4].Several potential biological mechanisms were identified through which anaemia or iron deficiency could affect pregnancy outcome. Anaemia and iron deficiency can induce maternal stress and foetal stress, which stimulate the synthesis of corticotrophin – releasing hormone (CRH). Elevated CRH concentrations are a major risk factors for preterm labour, PIH and eclampsia [3].

Since serum ferritin act as both an iron storage and acute phase protein it cannot be used to evaluate iron status in the presence of inflammation. The present study is undertaken to study the prevalence of iron deficiency in pregnancy, haematological and biochemical iron profile in pregnancy in the state of Manipur.

II. Materials and methods

The study was carried out in the Department of Biochemistry in collaboration with the Department of Obstetrics and Gynaecology, Regional Institute of Medical Sciences, Imphal, Manipur. One hundred and fifty pregnant women in their last trimester, irrespective of their parity, whose haemoglobin level is below 11.0 gm/dl attending antenatal OPD or admitted in antenatal ward during the period from February 2013 to March 2016 were included in the study. For categorisation of anaemia into mild, moderate and severe types of anaemic pregnancy, the WHO criteria for serum iron level are used: 10.0-10.9gm/dl– mild anaemia, 7.0-9.9 gm/dl- moderate anaemia, <7.0 gm/dl- severe anaemia [5]. For iron deficiency anaemia the cut off level for serum ferritin is taken as $\leq$12µg/l. Sixty randomly selected non-anaemic pregnant women in their last trimester were selected as controls. Pregnant women suffering from other illnesses like pregnancy induced hypertension, cardiovascular diseases were excluded from the study. Ethical clearance was obtained from the Institutional Ethics Committee, Regional Institute of Medical Sciences, Imphal, Manipur, India. About 7ml of venous blood was collected, out of which 2 ml of venous blood was collected in EDTA vial for haematological investigations and 5ml in plain vial for carrying out other biochemical investigations. The haematological parameters that were carried out are haemoglobin % (Hb%), total leukocyte count (TLC), differential leucocyte count (DLC), erythrocyte sedimentation rate (ESR), platelet count, packed cell volume (PCV), RBC morphology, erythrocyte indices (MCV, MCH, MCHC). These investigations were carried out using 'MS – 9 automatic cell counter. Estimation of serum iron and total iron binding capacity (TIBC) was carried out by photometric (colorimetric) method with Lipid clearing Factor (Kit manufactured by HUMAN, Germany). Transferrin saturation was calculated from Serum Iron and TIBC using the formula, Transferrin saturation = Iron X 100/TIBC.

III. Results

Table 1: Age wise distribution of cases and controls

Age in years	Cases		Controls	
	No.	%	No	%
<20	0	0	0	0
21-30	74	49.3	42	70
31-40	70	46.7	15	25
>40	06	04	03	5

Table 1 shows that out of 150 pregnant women taken for study majority belongs to the age group of 21-30 years (49.3%).

Table 2: Parity wise distribution of cases and controls

PARITY	cases		controls	
	No	%	No	%
0	45	30	15	25
1	59	39.3	20	33.3
2	26	17.3	15	25
3	13	8.7	7	11.7
4 & above	7	4.7	3	5

It is evident from table 2 that majority of the study group were in the second gravida (39.3%) followed by that of primiparas (30%).

Table 3: Distribution of cases with degrees of anaemia

Degree of anaemia	Cases	
	No	%
10-10.9 g/dl(mild)	99	66
7-9.9 g/dl (moderate)	51	34
<7 g/dl(severe)	0	0

Out of the one hundred and fifty study subjects, 99 cases (66%) had mild anaemia while 51 cases (34%) had moderate anaemia. No cases of severe anaemia were encountered in the study.

Table 4: Haematological parameters

PARAMETERS	CASES Mean ± SD	CONTROLS Mean ± SD
Hemoglobin %	9.8±1.01	12.1±0.88
Total leucocyte count (TLC)	8444±1.53	9826±3.12
Platelet Count (lakhs/cu mm)	1.94±0.38	1.8±0.40
Packed cell Volume (%)	30.1±2.65	36.9±3.22
MCV (fl)	86.7±7.4	90.9±5.35
MCH (pg)	27.7±3.1	28.8±1.82
MCHC (gm/dl)	31.6±1.39	32.6±1.16

Table 4 shows a few important haematological parameters used in assessing iron deficiency. The mean ± SD of haemoglobin and PCV in cases were 9.8% and 30.1% respectively which were just on the lower side of normal reference. The total leukocyte and platelet counts were within normal limits.

Table 5: Distribution of the cases on the basis of serum iron, TIBC, transferrin saturation and ferritin levels

Parameters		No of cases	%
SERUM IRON LEVEL	≤40µg/dl	15	10
	41-115 µg/dl	102	68
	≥116 µg/dl	33	22
SERUM TIBC	Within normal range	21	14
	≥360-399 µg/dl	99	66
	≥400 µg/dl	30	20
SERUM TRANSFERRIN SATURATION	≤15%	15	10
	16 – 30%	90	60
	31% and above	45	30
SERUM FERRITIN LEVEL	≤12 µg/l	45	30
	13-20 µg/l	84	56
	≥ 21 µg/l	21	14

As is evident from Table 5, majority of the cases (68%) had serum iron levels between 41-115 µg/dl (iron deficiency) and 15 cases (10%) had serum iron level below 40 µg/dl. Out of the 150 cases, TIBC ≥ 400 µg/dl were found in 20% while 66% (99 cases) had TIBC between 360 and 399 µg/dl. Marked reduction in transferrin saturation (≤15 %) was found in 15 cases (10%) which is indicative of iron deficiency anaemia. Seum ferritin level 12µg/l and below (indicative of iron deficiency anaemia) was found in 30 % of the cases (45 women).

III. Discussion

The present study was undertaken to find out the prevalence of iron deficiency anaemia in pregnant women in their last trimester in the state of Manipur. In Manipur, the prevalence of anaemia was about 3.8% (Hb <11gm/dl). Defining anemia as Hb<11g/dl**,** Singh K et al [6] found that the prevalence of anemia was 15.3%. Khandait DW et al [7] found 59.9% prevalence of anaemia in their study with 621 pregnant women. Similarly, a prevalence rate of 22% was found by Alper BS et al [8] in their study on 182 pregnant women.In this study, maximum number of cases (56%) were in the age group of 21-30 years of age. This observation was similar to the findings of Alli R and Satyanarayan M [9] where severe anaemia was common in the age group of 20-30 years with gravidity 2 and 3.Iron deficiency results mainly from decreased bio available dietary iron and increased iron requirements during the period of rapid growth of foetus. Anaemia during pregnancy affect both the mother and foetus , it may even impair oxygen delivery to the foetus interfering with intra uterine growth. Placental weight, volume and surface area are reduced if mother is anaemic and may results in bad foetal outcome like foetal loss, prenatal death and neonatal death [10].

In this study the number of anaemic cases did not increase with the increase in parity. Maximum number of cases were found in the 1st gravid followed by primipara. These observations were different from the observations of Idowu OA et al [5] where they found that primigravida are more at the risk of developing anaemia more than multigravida. Similar observation was made by Agarwal P and Chaturvedi B [11]. Risk of iron deficiency is particularly high in women with high parity and short intervals between pregnancies.

In our study, 66% of the cases were suffering from mild anemia while 34% had moderate anaemia. A single case of severe anemia (Hb<7g/dl) was not encountered in this study. These findings were in agreement with Hyder SM et al [12] who observed that despite high prevalence of anemia amongst the case studied, severe anaemic cases were not detected and also with that of Hassan R et al [13]. Among 150 cases studied, majority (68 %) had serum iron level between 41-115 µg/dl while 33 cases (22%) had level 116 µg/dl and above. Javed MT et al [14] found the mean serum iron level of 212.2 µg/dl in pre-delivery women which was higher than the present findings. In the present study, serum TIBC levels was found to be normal in 21 cases (14%), severe increase in 30 cases (20%) and rest had TIBC levels between 360-399 µg/dl. These findings were comparable with those of Chang LL et al [15] who observed increase in serum TIBC value of 470 µg/dl in the third trimester women when compared to the first trimester. The rise may also serve the useful purpose of enhancing mobilization of iron from maternal stores thus enabling easier transport of iron to the foetus. Serum ferritin is considered a very important parameter in characterization of iron deficiency and anaemia in pregnancy. In the present study, serum ferritin level ≤12 µg/dl was seen in 45 cases (30%), 84 cases(56%) had serum ferritin level between 13-20 µg/dl, while only 21 cases(14%) had normal serum ferritin level. Rusia et al [16] showed a highly significant correlation ($p<0.001$) between maternal Hb concentration and serum ferritin indicating that iron deficiency was the most important cause of anaemia among the cases studied. A fall in serum ferritin may be the result of iron utilization for expansion of maternal red blood cell mass.

IV. Conclusion

The incidence of iron deficiency with anaemia among the cases was 30%. Proper interpretation of the routinely performed haematological parameters help in early recognition of impending antepartum and postpartum complications. The study population appears small, therefore needs a larger sample size to be more conclusive.

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