A Study on Serum Iron, TIBC and Nutritional Status in III Trimester Pregnancy

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Abstract- A high proportion of women in both industrialized and developing countries become anaemic during pregnancy. Estimates from the World Health Organization (WHO) report that from 35% to 75% of pregnant women in developing countries and 18% of women from industrialized countries are anaemic [(2)]. Many of these women were already anaemic at the time of conception, with an estimated prevalence of anaemia of 43% in non pregnant women in developing countries and of 12% in women in wealthier regions [(2)]. The prevalence of iron deficiency is far greater than the prevalence of anaemia and iron deficiency. In pregnancy, anaemia has a significant impact on the health status of both mother and fetus. Nutritional anaemia is the most widespread nutritional disorder in the world affecting 30 percent world population. It is more common among the expectant mothers. According to Agarwal, maternal anaemia resulted in 12 to 28 percent of fetal loss, 30 percent of perinatal and 7 to 10 percent of neonatal deaths [(2).] The remaining births have about 50% chance resulting in a low birth weight.

In the present study on iron nutritional status in third trimester pregnant women mostly primigravida has shown that haemoglobina, serum iron levels and related parameters are affected indications 0f occurrence of iron deficiency anaemia.. The serum iron level serves as an index of state of iron metabolism. Identification and correction of iron deficiency, and resulting anaemia in pregnancy is the most important safe guard against maternal and fetal morbidity and mortality and good maternal nutrition is a key factor influencing the health of both mother and child. Poor maternal health / nutrition during pregnancy, is one of the several factors that have been associated with intra uterine growth retardation (IUGR) and consequent low birth weight.

Index Terms- Haemoglobin,serum iron,serum total iron binding capacity (TIBC),serum unsaturated iron binding capacity (UIBC),serum transferrin saturation (Tf %),serum transferrin,serum total protein and serum albumin levels.

I. INTRODUCTION

Maternal nutrition and health is considered as most important regulator of human fetal growth. Pregnancy is the period of dynamic change for a mother requiring a lot of care. A woman's normal nutritional requirements increases during pregnancy in order to meet the needs of the growing fetus and maternal tissues associated with pregnancy. Proper dietary balance is necessary to ensure sufficient energy intake for adequate growth of fetus with out drawing on mother's own tissues to maintain her pregnancy.

Surveys in different parts of India indicate that about 50 to 60% of women belonging to low socioeconomic group are anaemic in the last trimester of pregnancy [(7)]. The major etiological factors being iron and folic acid deficiencies. It is well known that anaemia per se is associated with high incidence of premature births, postpartum haemorrhage, puerperal sepsis and thromboembolic phenomena in the mother. Iron requirement during pregnancy is considerable and is most limited to the second half of the pregnancy specially to the last 12 weeks [(4)]. The maternal plasma iron concentration often decreases during pregnancy and the plasma iron binding capacity increases during pregnancy. One of the most significant changes is that of blood volume expansion by a mean of 50%. Plasma volume increases disproportionately compared with red cell mass, resulting in the physiological decrease in hematocrit. During this time, iron requirement for mother and fetus average nearly 1000mg [(9)]. The amount of iron absorbed from diet together with that mobilized from stores is usually insufficient to meet the demands imposed by pregnancy. The net effect is a state of physiological anaemia that occurs during pregnancy. Current knowledge indicates that iron deficiency anaemia in pregnancy is a risk factor for preterm delivery and subsequent low birth weight, and possibly for inferior neonatal health.

The over all prevalence of iron deficiency in non-pregnant women of reproductive age in the United States 9% -11%, is higher than at other ages apart from infancy [(5)]. Risk is also increased with parity nearly three fold higher for women with 2-3 children and nearly four fold greater for women with 4 or more children thus complicating pregnancy [(5).]

In the absence of exogenous iron supplement the haemoglobin concentration and the haematocrit fall appreciably. Thus pregnancy poses a physiological iron deficiency state. If detected early and proper treatment is instituted anaemia improves promptly. If however the anaemia progresses to a severe degree and if uncared for, the mother is likely to develop complications. The fetal prognosis is adversely affected by prematurity with its hazards.

II. MATERIALS AND METHODS

The present study is conducted in the Department of Biochemistry and Department of Obstetrics and Gynecology, S.V.S. Medical College and Hospital, Mahabubnagar. A total of 40 pregnant women were studied. among these 20 were cases

and 20 weere controls. Each subject was selectedas per inclusion criteria. Pregnant women in their third trimester without any previous antenatal checkup and subjects with no iron folic acid supplementation were included.Pregnant women with any complications were excluded from the study.The biochemical parameters of cases were compared with those of normal female (control group) persons.

Collection of Blood Samples:

About 6ml of blood is collected under aseptic condition. About 1ml dispensed into clean dry bottle with EDTA for estimation of blood hemoglobin, the rest of blood is allowed to clot and serum is obtained, with precautions to avoid hemolysis.With that sample Serum iron,Total iron binding capacity,Serum total protein,Serum albumin Serum transferrin saturation, unsaturated iron binding capacity (UIBC) and serum transferrin are calculated from serum iron and TIBC. All investigations were done on same day of sample collection using semi auto analyzer.

Haemoglobin is estimated by cyanmethemoglobin Method,determination of iron binding capacity byFerrozinemethod. Transferrin saturation is calculated based on the following formula [8]: Transferrin saturation (%) = $\frac{100 \times \text{Serum Iron}}{\text{TIBC}}$

Serum transferrin is calculated based on the following equation [8]: Tf (gm/L) = 0.007× TIBC (µg/dL) or Tf (mg/dL) = 0.7× TIBC, (µg/dL)

Serum total proteins by Biuret method and determination of albumin by Bomocresol Green Method.

III. RESULTS

The present study included a total number of 40 subjects comprising of 20 cases and 20 controls.The following table shows the comparative statistical analysis of the laboratory parameters used in assessing the iron status and also in serum total protein and serum albumin that are used as markers for nutritional assessment in the present study of pregnant women during the last trimester.

COMPARATIVE STATISTICAL ANALYSIS OF ALL BIOCHEMICAL PARAMETERS in controls and cases

		Controls	Cases
Hemoglobin (gm/dL)	Mean	12.92	9.49
	S.D.	0.64	1.22
	S.E	0.31	
	t-test	11.05	
	p-value	< 0.001	
Serum Iron (µg/dL)	Mean	91.85	48.85
	S.D.	7.19	12.61
	S.E	3.24	
	t-test	13.23	
	p-value	< 0.001	
Serum TIBC (µg/dL)	Mean	317.65	426.1
	S.D.	17.66	19.64
	S.E	5.91	
	t-test	18.35	
	p-value	< 0.001	
Serum UIBC (µg/dL)	Mean	222.85	377.2
	S.D.	25.26	14.80
	S.E	6.54	
	t-test	23.57	
	p-value	< 0.001	
Serum Tf Saturation %	Mean	29.15	11.40
	S.D.	3.75	2.64
	S.E	4.13	
	t-test	18.36	
	p-value	< 0.001	
Serum Transferrin (mg/dL)	Mean	222.34	298.27
	S.D.	12.36	13.75
	S.E	0.13	
	t-test	4.90	
	p-value	< 0.001	
Serum Total Proteins (gm/dL)	Mean	7.26	6.62
	S.D.	0.31	0.49
	S.E	0.13	
	t-test	4.90	
	p-value	< 0.001	
Serum Albumin (gm/dL)	Mean	4.19	3.59
	S.D.	0.25	0.32
	S.E	0.93	
	t-test	6.50	
	p-value	< 0.001	

S.D: Standard Deviation.
S.E: Standard Error of the mean.

Statistical Analysis: Mean and standard deviation (S.D.) of all variables were calculated and compared with those of controls. Statistical significance was assessed by applying the student's t-test, p-value <0.01 were considered significant.

IV. DISCUSSION

Pregnancy is anabolic state that is orchestrated via hormones which facilitates the availability of nutrients to highly specialized maternal tissue characteristic of reproduction and their transfer to the developing fetus. In developing countries like India the maternal nutritional status and outcome of pregnancy can be aggravated by under nutrition contributing to micro nutrient deficiencies (especially iron). Nutritional anaemia is most wide spread nutritional disorder observed in pregnant women. Anaemia is a major contributor to maternal mortality, the case fatality rate vary from less than 1% to more than 50% depending on the available obstetric care and severity of anaemia, cardiac failure being an important cause of maternal mortality. In India anaemia is responsible for 17% of maternal deaths and case fatality rate of pregnancy anaemia approaches 6 to 17%. Anaemia has far reaching health implications, such as increased maternal mortality and morbidity, intra uterine growth retardation, low birth weight, increased neonatal mortality and depressed immuno-competence. The present study is aimed at assessing iron and nutritional status in third trimester pregnant women attending antenatal OP at our S.V.S hospital.

In the present study 60% of cases (12) showed a decreased haemoglobin level and this decrease was found at cut off value of <10gm% which is considered as anaemia (defined by Federation of Obstetrics and Gynaecological Society of India). The serum iron was found to be decreased in 17 cases (85%). TIBC of serum was increased in 19 cases (95%). The serum Transferrin levels were in the reference range, but the protein is less saturated with iron (mean 11.4%). The iron need is not uniformly distributed throughout pregnancy but it is mostly limited to the second half of pregnancy. The amount of iron absorbed from the diet and that mobilized from the stores are inadequate to meet the demand. This sets a physiological iron deficiency state during pregnancy.

Many women enter pregnancy without sufficient iron stores resulting from heavy menstrual periods, previous pregnancies, breast feeding, or poor nutrition. It is difficult to meet the increased requirement for iron through diet, and anaemia often develops unless iron supplements are given. Several studies done in India have shown that the high phytate content in cereals interfere with iron absorption. Measures like addition of vitamins C to the diet may promote iron absorption and prevent iron deficiency anaemia. If supplemental iron is not added to the diet, iron deficiency anaemia will result. Hence iron supplements are strongly recommended as the principal strategy to overcome iron deficiency.

Nutritional status: The deposition of protein is not linear throughout pregnancy. Early during pregnancy the protein requirement for fetal development is minimal, where as the requirement for maternal volume expansion and tissue growth may be substantial. Late in pregnancy, the fetus may account for a major increase in protein needs.Poor maternal health / nutrition during pregnancy, is one of the several factors that have been associated with intra uterine growth retardation (IUGR) and consequent low birth weight Nutritional status assessment provides scope for dietary improvement and potential need for supplementation of specific nutrient for individual pregnant women.

In the present study the nutritional status is quantitated by assessing the serum total proteins and albumin. The serum total protein concentration in cases was found to be lowered in 6 cases (30%) the rest of 14 cases (70%) showed a normal level. The serum albumin concentration was lowered in 6 cases (30%) the rest of 14 cases (70%) showed a normal levels. These changes indicate that protein nutritional status is only moderately decreased.

V. CONCLUSION

From the results of the present study it can be summarised that iron deficiency status in pregnancy as highly prevalent and commonest cause for anaemia during pregnancy is iron deficiency. The present study also indicates even when protein nutritional is adequate in most of the cases iron deficiency can occurs, as iron sources, factors responsible for absorption, also play important role in maintaining iron nutritional status.

REFERENCES

[1] Anaemia and iron deficiency: effect of pregnancy outcome; Lindsay H Allen. American journal of clinical nutrition, vol.71, No.5, 1280S-1284S, May 2000.

[2] A study of nutritional status of Pregnancy women of some villages in Balasore District Orrisa; Subarnalata Saboo and Basumati Panda.

[3] Absorption of non-heme iron from food during normal pregnancy. Jon FR Barrett, Paul G Whittaker, John G Williams, research manager, Tom Lind.

[4] Clinical obstetrics; Mudaliar and Menon's, 10th edition.

[5] Iron status during pregnancy; setting the stage for mother; Theresa O Scholl.

[6] Medical complication during pregnancy; Burrow Gevard.N, 5th edition.

[7] Park's text book of preventive and social medicine, 2nd edition.

[8] Tietz text book of Clinical chemistry and Molecular Diagnostics, 4th edition

[9] William's obstetrics; Cunningham F.Gary, 22nd edition.

[10] Freidberg (1958): cited by Saidhi S.K. Philips

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