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SERUM LEVEL OF IRON AND TRANSFERRIN IN PREGNANCY AND POSTPARTUM PERIOD

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Abstract: This study presents a composite picture of haemoglobin (Hb), serum level of iron (SI), total iron binding capacity (TIBC) and percent iron saturation of transferrin in women during different trimesters of pregnancy and postpartum period. The results were correlated with age and parity. A total of 75 subjects, 15 from each trimester and 15 postpartal, were studied and compared with 15 nonpregnant normal subjects. Signs of increased iron demand, increased iron turnover and obvious iron deficiency, were demonstrated throughout pregnancy, by decrease in haemoglobin, SI, percent iron saturation of transferrin and increased TIBC; especially in older age group and multigravidae. SI, TIBC and percent iron saturation of transferrin are more sensitive indices of iron status and provide us an opportunity to replenish iron stores of an iron deficient pregnant mother at an earlier date thus preventing anaemia.

Key words : pregnancy postpartum SI TIBC percent iron saturation of transferrin latent anaemia

INTRODUCTION

Nutritional status of mothers of child bearing age has been used as the health status indicator in such women by WHO, in evaluating progress towards attainment of health for all by the year 2000 (1). Iron is an important nutritional constitutent. A large number of women in our country enter pregnancy with inadequate iron reserve, if not with frank anaemia, and some develop progressive anaemia during its progress. During pregnancy the fetus requires large quantities of iron and obtains these supplies from the mother, whether her iron stores are normal or deficient. It is especially important to recognise latent iron deficiency during pregnancy to prevent anaemia. Conventional methods to diagnose anaemia are not adequate with their inherent limitations. It was anticipated that measurements of SI, TIBC and percent iron saturation of transferrin during different trimesters of pregnancy and postpartum period, would reflect the iron needs of the pregnant women and contribute to an understanding of the nature of physiological anaemia in pregnancy.

METHODS

Forty five adult pregnant women at different periods of gestation, fifteen during their postpartum period and fifteen normal nonpregnant women (total seventy five) were the subjects of study. They were selected from antenatal clinic at random on the basis of their apparent health. The age of the subjects ranged from 16 to 35 years. None of them had taken iron in any form while selected for the study. Fifteen puerperal subjects were selected similarly from postnatal wards of the Government Medical College, Nagpur. The normal nonpregnant women were chosen of the matching age

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group from the college staff to act as controls. The informed written consent was obtained from all subjects. All samples were collected in the morning between 10 AM to 12 noon to avoid low values later in the day due to normal diurnal variation (2).

From each subjects 10 ml blood was collected from an antecubital vein with whole glass, iron free sterile syringe in test tubes, thoroughly cleaned by boiling in iron free double glass distilled water and following investigations were done:

1) Estimation of haemoglobin by cyanomethaemoglobin method.

2) Serum iron estimation.

3) iron binding capacity of serum.

Estimation of SI and TIBC was done as per procedures recommended for the Iron Panel of the International Committee for Standardisation in Haematology and published as reference method (3,4). These methods have been devised after inter laboratory testing of the variables, and presented accuracy and reproducibility.

4) The percent iron saturation of transferrin was then calculated by following formula :

$$\frac{SI \times 100}{TIBC}$$

The mean and standard deviation was calculated for all observations, and statistical significance of results observed by applying students 't' test (one tailed).

RESULTS

The levels of Hb, SI, TIBC and percent iron saturation of transferrin at different periods of gestation are shown in Table I and Fig. 1.

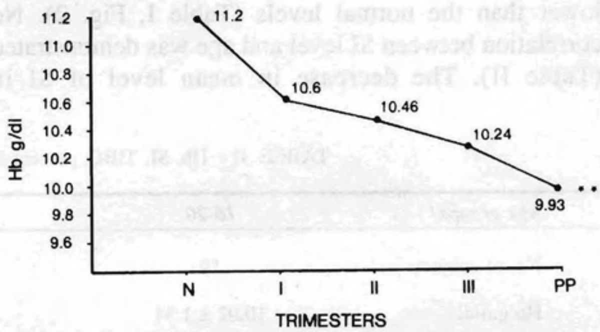

Fig. 1 : Mean levels of haemoglobin at different periods of gestation. **Highly significant.

TABLE I : Hb, SI, TIBC, percent iron saturation of transferrin at different periods of gestation.

	Normal	Trimester			Postpartal
		I	II	III	
No. of subjects	15	15	15	15	15
Hb gm/dl	11.02 ± 1.38	10.60 ± 1.92	10.46 ± 1.02	10.24 ± 1.25	9.93 ± 0.77**
SI mcg/dl	105 ± 24.46	94 ± 13.46	84.26 ± 19.28**	84.73 ± 19.60**	94 ± 26**
TIBC mcg/dl	286.4 ± 35.43	293.21 ± 32.19	369.85 ± 46.86***	425.8 ± 59.82***	459.35 ± 62.90***
Percent iron saturation of transferrin.	36.8 ± 9.55	32.42 ± 6.8	22.57 ± 5.42***	19.73 ± 5.03***	21.66 ± 5.13***

**Highly significant;

***Very highly significant.

Haemoglobin: There was continuous decrease in the mean level of Hb throughout pregnancy, which was not statistically significant in various trimesters as compared to normal, but was highly significant in postpartal group when compared to normal control group. The mean Hb level continuously decreased in age group 31-35 years, though not significantly (Table II). The decline in mean level of Hb was not significant in 2nd gravidae but was significant in multigravidae when compared to nulliparous group (Table III).

Serum iron : There was continuous decrease in mean SI level throughout pregnancy which was highly significant in II and III trimester. There was highly significant rise in postpartal period though it was still lower than the normal levels (Table I, Fig. 2). No correlation between SI level and age was demonstrated (Table II). The decrease in mean level of SI in multigravidae was highly significant when compared to nulliparous group.

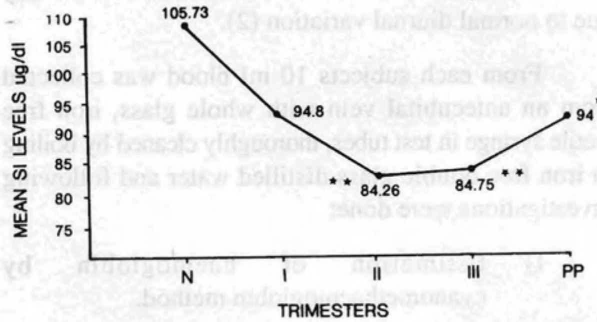

Fig. 2 : Mean levels of serum iron at different periods of gestation.
**Highly significant.

TABLE II : Hb, SI, TIBC, percent iron saturation of transferrin in different age groups.

Age groups	*16-20*	*21-25*	*26-30*	*31-35*
No. of subjects	19	23	18	15
Hb gm/dl	10.02 ± 1.34	10.88 ± 1.17**	9.80 ± 1.54	9.69 ± 0.77
SI mcg/dl	90.14 ± 20.44	97.17 ± 21.86	90.15 ± 17.40	76.84 ± 15.26*
TIBC mcg/dl	386.62 ± 82.84	386.94 ± 55.02	387.50 ± 98.71	387.30 ± 65.69
Percent iron saturation of transferrin.	25 ± 9.81	25 ± 5.71	24 ± 7.95	21 ± 5.09

*Significant; ** Highly significant.

TABLE III : Hb, SI, TIBC, percent iron saturation of transferrin at different gravid states.

Parity	*Nulliparae*	*Primigravidae*	*Second gravidae*	*Multigravidae*
No. of subjects	5	23	21	26
Hb gm/dl	10.7 ± 0.87	10.80 ± 1.64	10.3 ± 1.14	9.58 ± 0.99**
SI mcg/dl	110.8 ± 20.20	97.4 ± 24.36	96.78 ± 24.21	82.11 ± 13.26**
TIBC mcg/dl	263.2 ± 22.06	358.26 ± 68.90**	357.40 ± 81.47**	382.64 ± 67.11***
Percent iron saturation of transferrin.	42 ± 10.5	28 ± 10.1***	27 ± 6.8***	21 ± 5***

**Highly significant; ***Very highly significant.

Total iron binding capacity : There was a continuous increase in mean TIBC level throughout preganancy and postpartum period. This rise was not significant in Ist trimester, but very highly significant in II and III trimesters and postpartal period (Table I, Fig. 3).

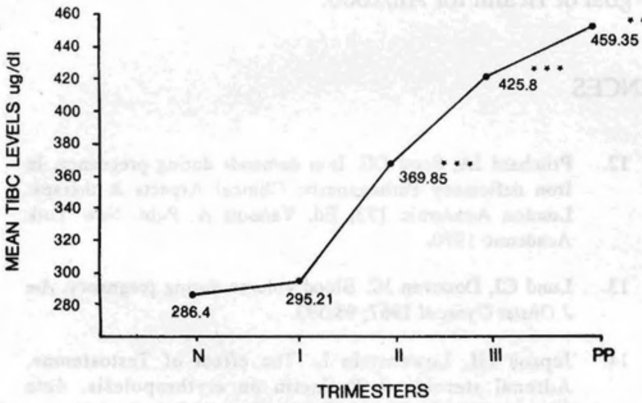

Fig. 3 : Mean levels of total iron binding capacity at different periods of gestation.

***Very highly significant.

Table II shows no significant relationship in TIBC mean levels in different age groups. The increases in the mean levels of TIBC with parity were statistically highly significant in 2nd gravidae and very highly significant in multiparous group (Table III).

Percent iron saturation of transferrin showed a continuous significant decrease throughout pregnancy and postpartum period (Table I, Fig. 4). It decreased insignificantly with increase in age (Table II). It also showed decreased levels as the parity increased. This decrease was very highly significant (Table III).

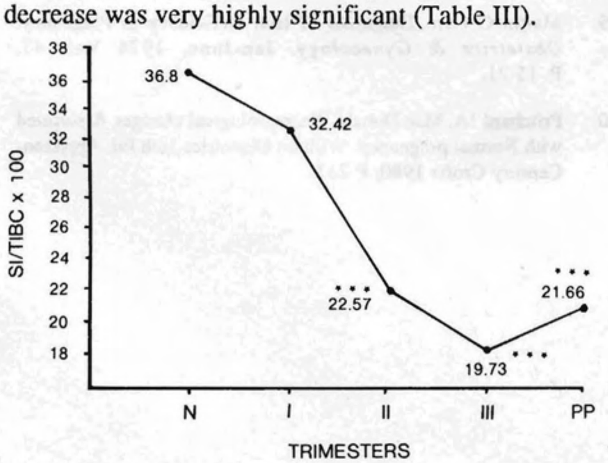

Fig. 4 : Mean levels of percent iron saturation of transferrin at different periods of gestation.

***Very highly significant.

DISCUSSION

The decline in mean levels of haemoglobin throughout pregnancy have been reported (5,6,7,8,). The majority of women in our country enter pregnancy with already decreased levels of haemoglobin. Legacy of poor iron stores at birth from an iron deficient mother, demands of growth, onset of menses and inadequate diet may be important causes. The haemoglobin levels do not rise during pregnancy, not only because newly formed haemoglobin is added to comparatively large volume of plasma, but also due either to inability to take iron supplement or irregular intake of the same. In postpartum period, due to blood loss, haemoglobin levels are further lowered. Same factors contribute to decrease in haemoglobin with age and parity (9,10).

The serum iron levels also decrease throughout pregnancy. During Ist trimester maternal iron stores are mobilised to compensate the demand by the fetus. These fetal demands further increase during II trimester. Increase in erythrocyte mass is a feature of midpregnancy (11,12). In the presence of increased erythropoietin (13) placental lactogen stimulates erythropoietin directly and maximally (14). Slight rise in SI level in postpartal period may be due to shrinkage of plasma volume, absence of fetal demand and supplementation of iron to the mother. The greater rise of plasma volume in multigravidae as compared with primigravidae (15) also contributes to low SI in multigravidae. Also in multigravid women each following pregnancy further draws upon already negative iron stores of the mother.

Total iron binding capacity of the serum rise significantly during pregnancy, against the gradient of dilution, which is an expression of the vastly increased turnover of iron in late pregnancy (16). TIBC is influenced by subject's iron and endocrine status. TIBC increases during pregnancy to the extent of 15% above nonpregnant level. This is apparently secondary to sex hormonal influence; there is no change in its degradation rate also (17). All these factors contribute to a sort of iron hunger. The transferrin not bound to iron, is readily available resulting in increased TIBC. These findings are consistent with those reported by other authors (18,19,20).

Percent iron saturation of transferrin is significantly decreased, due to decrease in SI levels and increase in TIBC levels in various trimesters of the pregnancy.

Haemoglobin, erythrocyte morphology may take longer to suggest hypochromic microcytic anaemia, fall in SI preceeds them. This associated with TIBC and percent iron saturation of transferrin would form a group of more sensitive tests. Hence these investigations help in precise diagnosis of subjects with latent iron deficiency. The work conducts an evaluation of iron deficiency anaemia in pregnancy. The results are analysed to identify the extent and gravity of problem.

The study suggests that although situation is improving, there is a long way to go to achieve WHO's goal of Health for All/2000.

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