

IRON STATUS IN THE THIRD TRIMESTER OF NORMAL PREGNANCY*

by

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Iron deficiency anaemia occurs frequently during vulnerable periods such as infancy and pregnancy since the extra demands cannot be met with because of poor reserves. Repeated pregnancies and episodes of excessive menstrual loss tend to deplete the iron stores in the majority of women. During the treatment of iron deficiency it is important to consider not only the restoration of the haemoglobin levels but also of the depleted iron stores so that a positive balance is achieved.

The present study was aimed at assessing the iron status particularly the marrow iron stores of normal healthy pregnant women attending the antenatal clinic at the Postgraduate Institute of Medical Education and Research, Chandigarh.

Material and Methods

Fifty healthy pregnant women in the third trimester of normal pregnancy with haemoglobin levels 10 gm% or above were included in the study. Majority of the women belonged to the lower and upper middle socio-economic status. The ages ranged from 15 to 40 years. Thirty-one women were nulliparae and the rest were multiparae. A group of 20 non-pregnant women with haemoglobin 12

gm% or above of similar age, socio-economic status and parity served as controls. The women included in this study did not show hookworm infestation on stool examination and or evidence of bleeding from any site.

Haematological investigations were done on each subject on her first visit and the techniques employed were those described by Dacie and Lewis (1963). Haemoglobin was estimated by oxyhaemoglobin method using a photoelectric colorimeter. Blood films were stained with Leishman stain. The reticulocyte counts were done by the tube method on dry films. Serum iron and iron binding capacity were done by the modified technique of Hamilton *et al* (1950). Marrow aspiration was performed on iliac crest using salah needle and the aspirate was drawn on the slide into a smear. The smears containing at least 2-3 marrow particles were selected for staining for iron by the Prussian blue stain. Two smears each were stained with Leishman stain. The grading of the stainable marrow iron was done by the method of Gale *et al* (1963).

Observations

1. Haemoglobin, Packed Cell Volume and MCHC

The various haematological values observed are shown in Table 1.

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TABLE I
Haematological values in 50 pregnant and 20 non-pregnant women

	Pregnant women				Non-pregnant women			
	Max.	Min.	Mean	+ SD	Max	Min.	Mean	L SD
Hb gm%	13.0	10.0	1.2	1.0	14.2	12.0	13.1	0.7
PVC	40.0	29.0	34.4	3.4	42.0	32.0	38.4	3.0
MCHC %	36.0	29.0	36.6	1.6	35.0	32.0	33.6	0.8

1. Red Cell Morphology in the Blood Smear

In the control group red cells were normocytic normochromic in 18 and mildly hypochromic in 2 patients. In the pregnant group the red cell morphology was normocytic normochromic in 30, normocytic and mildly hypochromic in 16, normocytic and fairly hypochromic in one and dimorphic in three patients.

2. Serum Iron and Iron Binding Capacity

The serum iron and iron binding capacity in the two groups is given in Table II. The mean serum iron in the pregnant group was 80.3 ug% while in the non-pregnant group it was 106.9 ug%. The serum iron below 55 ug% was found in

8 pregnant women and in only one non-pregnant woman.

4. Nature of Erythropoiesis in the Bone Marrow

The erythropoiesis was normoblastic in all controls. In the pregnant group the marrow was normoblastic in 31, micronormoblastic in 10, and dimorphic in 9 women.

5. Stainable iron in the Bone Marrow

The analysis of patients in the two groups is given in Table III. According to the grading system used the grades of 0, 1 and 2 indicate deficiency of storage iron. Thus 35% women in the control group and 64% of pregnant women showed deficient iron stores.

TABLE II
Serum Iron and Iron Binding Capacity

	50 Pregnant women				20 Non-pregnant women			
	Max.	Min.	Mean	± SD	Max.	Min.	Mean	± SD
Serum Iron (ug/100 ml.)	120	40	80.3	8.9	150	60	106.94	290.7
TIBC (Ug/100 ml.)	430	260	325	23.6	300	180	262.6	45.08

TABLE III
Grades of Stainable Iron in the Bone Marrow in 50 Pregnant and 20 Non-Pregnant Women

No. of patients	Grades of Marrow Iron						
	0	1	2	3	4	5	6
Pregnant Group	4	13	15	14	3	1	—
Non-pregnant group	1	0	6	7	3	3	—

6. Stainable Marrow Iron in Relation to Age & Parity and Oral Iron

There was no correlation between the grade of stainable iron in the marrow on one hand and age or parity of women on the other, either in the pregnant or non-pregnant group. A correlation between the intake of oral iron and the grades of marrow iron in the pregnant group showed that three patients who were on regular oral medicinal iron had adequate grades of 4 or 5 of marrow iron.

Discussion

The range of MCHC in non-pregnant women given by Dacie and Lewis (1963) is 32-36 per cent and that by Wintrobe (1962) as 34-36 per cent. In the present series the normal non-pregnant women had a range of 32-35 per cent with a mean of 32.6 per cent (SD \pm 0.80). In the pregnant group, the MCHC ranged between 32-36%. The average MCHC of 32.6 per cent in the pregnant women of the present series is close to that of Sokhey *et al* (1938) reported from Bombay. Out of 50 healthy, normal pregnant women examined, ten showed MCHC below 32 per cent (range 29-31). These figures are slightly lower when it is considered that MCHC is said to remain constant during normal pregnancy.

In severe iron deficiency serum iron is low and total iron binding capacity is high, whereas in pregnancy even in the absence of iron deficiency there is a definite fall in serum iron and increase in total iron binding capacity of serum. These changes become statistically significant from the twentieth week onwards and are most marked at term. The average serum iron of 80.3 μ g/100 ml. in the present series is very close to the values reported by most workers abroad and Menon (1965) from India.

In the present series, examination of

the marrow for stainable iron content was done in all patients. This test has been considered to be the most direct method of assessing the iron stores (Rath and Finch, 1948, Davidson and Jennison, 1952, Stevens *et al.*, 1953, Pratt and Johnson, 1954). The method of grading used in the present work on the amount of iron present in marrow specimen is by Gale *et al* (1963). According to this grading iron upto grade 2 was considered as indicative of deficient iron stores, from 3-5 as adequate and grade 6 as massive iron stores.

With these criteria, four out of 50 pregnant women examined had complete absence of stainable iron and twenty-eight out of fifty had deficient marrow iron stores. Thus the marrow iron stores were inadequate in 32 out of 50 pregnant women (64%) and adequate in 18 pregnant patients (36%) in contrast to the non-pregnant group where seven out of twenty (35%) showed inadequate iron stores while in the rest thirteen the stores were adequate.

Reports on marrow iron in pregnancy especially in the third trimester of normal pregnancy are scanty. The only other comparable report found is that of Allaire and Campagna (1961). They used a grading from 'no trace' to 'normal' and found that out of 47 antepartum bone marrow specimen of patients from California, 43 showed less than normal iron stores (91.4%). Holly and Grund (1959) examined 5 patients in late pregnancy and found deficient iron stores in all of them. Menon (1965) in his studies of 175 biopsies in normal pregnant women has made no comment on marrow haemosiderin.

An attempt was made to find out the relationship between haemoglobin, MCHC and serum iron and stainable iron in the bone marrow, as an indicator of iron stores.

Majority of pregnant women in the third trimester with haemoglobin 10-11 gm% had a stainable iron upto grade 3 whereas iron of grade 4 to 5 was found only in four pregnant women with haemoglobin of 12 gm% or above. Four pregnant women had no stainable iron at all although their haemoglobin levels were between 10-11 gm%. Pratt and Johnson (1954) have also reported absent stainable marrow iron in pregnant women with haemoglobin 12 gm%. Allaire and Compagna (1961) in their study on pregnant women concluded that the haemoglobin values are often misleading as far as the iron stores are concerned. On the other hand the haemoglobin level may fall to 10 gm% due to hydraemia without any depletion of iron stores (Lawrence, 1962). However, it has to be borne in mind that in some women the finding of little or no iron deposits in the bone marrow may be due to early mobilization rather than exhaustion of iron stores at the time of examination (Hancock *et al.*, 1968).

Mean corpuscular haemoglobin concentration as well as hypochromia did not correlate well with the amount of stainable iron in the marrow. Twenty-one out of fifty pregnant women who had MCHC 32% or above had a deficient grade of marrow iron (upto grade 2), and two women who had no stainable iron in the marrow showed normal MCHC.

Ordinarily the level of the serum iron varies with the amount of tissue iron. When the marrow iron stores are on the verge of depletion, it may still be consistent with normal serum iron. Thus in the present series 24 of 50 patients had normal serum iron (above 65 ug/100 ml) although the stainable iron in the bone marrow was deficient.

Although stainable marrow iron was the most reliable method in assessing the iron deficiency at its earliest stage, the

bone marrow puncture cannot be performed routinely on every pregnant woman with slightly low haemoglobin in order to assess the iron status. It is advisable that prophylactic iron should be continued regularly even in women who have a normal haemoglobin level.

Summary

Fifty healthy pregnant women in the third trimester of normal pregnancy and 20 non-pregnant controls were investigated to assess their iron status by a study of haemoglobin concentration, hypochromia of red cells, MCHC, serum iron, iron binding capacity and stainable marrow iron stores. The data and interrelationship of these findings are discussed. Despite a normal haemoglobin level, 64% women showed inadequate iron reserves in the bone marrow.

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