SERUM IRON AND SERUM IRON BINDING CAPACITY IN NORMAL NON-PREGNANT AND PREGNANT WOMEN

by

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It is well recognised that even normal pregnancy necessitates adjustments in the circulation and the haemopoietic system to meet the requirements of the growing foetus. During pregnancy the foetus requires large quantities of maternal iron and as a general rule obtains these supplies irrespective of the mother being anaemic or not. Severe anaemia in pregnancy, therefore, is usually hypochromic in type and is amenable to iron therapy.

The present communication deals with some aspects of ferrodynamics in pregnant women in Rajasthan.

Material & Methods

A total number of 30 adult healthy non-pregnant women and 160 pregnant women at different periods of gestation, selected at random, were included in the present study (Table 1). In pregnant women, the obstetric history and period of gestation were noted. Blood was collected for routine haematological investigations, including the absolute blood values. Cases showing haemoglobin less than 12 gms.% were selected for further study. For serum iron and total iron binding capacity (T.I.B.C.), blood was collected with iron free syringes into iron free test tubes. These estimations were carried out by the tripyridil method, as described by Wootton (1964).

Observations

Table II shows the various types of anaemia encountered in 160 patients studied. Out of these, 126 (76%) had a microcytic hypochromic type of anaemia. The incidence of this type of anaemia was highest in the third trimester. Normocytic hypochromic

TABLE I

Showing number of cases studied

	Healthy Non-pregnant	Months of pregnancy								Puerperium	Total
		2	3	4	5	6	7	8	9		
Nature of cases	30	2	5	10	12	20	24	30	40	17	190

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TABLE II

Showing type of anaemia in 160 cases in relation to the stage of pregnancy

Type of anaemia	Total cases		1st Trimester	2nd Trimester	3rd Trimester	Puerperium
	No.	%				
Microcytic hypochromic	126	76	2	32	80	12
Normocytic hypochromic	17	10	2	6	7	2
Macrocytic normochromic	11	7	2	3	5	1
Microcytic normochromic	6	4	1	1	2	2

and macrocytic normochromic types of anaemia were also observed, their incidence being 10% and 7% respectively.

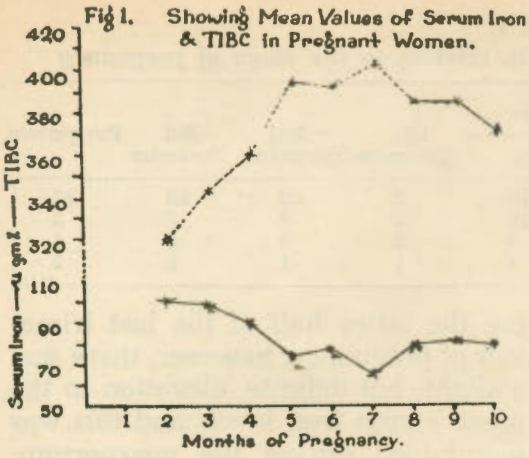
Table III depicts the mean values of serum iron and total iron binding capacity as observed in 30 non-pregnant healthy females and 160 cases of pregnancy at different intervals. In healthy females the range of serum iron values were found to be 95-125 μg%, with a mean of 115 μg%. The T.I.B.C. range was found to be 250-350 μg%, with a mean of 298 μg.% It is clear from the same table (Table III) that in the second and third month of pregnancy the mean serum iron values were only slightly lower than those observed in the control group of females. The lowest serum iron values were observed during the 5th to 7th months of pregnancy. During the latter half of the last trimester of pregnancy, however, there was a slight, but definite, elevation in the mean serum iron levels and this was maintained during the puerperium. Total iron binding capacity values followed, in general, an inversely proportional pattern to the values of serum iron. The highest values were obtained in the 5th to 7th months of gestation (Fig. 1). The scatterogram (Fig. 2) shows the relationship between serum iron values and number of pregnancies In the primigravida and the second gravida 12 and 14 out of 40 and 30 cases respectively had serum values within normal range. In multigravida, in contrast, only three of the ninety cases had normal serum iron levels. More than 50% of these had values for serum iron less than 80 μgms%.

TABLE III

Showing serum iron and T.I.B.C. values at different periods of gestation and puerperium

	No. of cases	Serum iron (μg %)		T.I.B.C. (μg %)	
		Range	Mean	Range	Mean
Normal	30	95–125	115	250–350	298
Pregnancy 2nd month	2	90–110	100	260–350	320
Pregnancy 3rd month	5	87–112	99	255–380	343
Pregnancy 4th month	10	82–98	90	292–394	360
Pregnancy 5th month	12	76–97	74	291–399	394
Pregnancy 6th month	20	70–85	78	307–406	392
Pregnancy 7th month	24	60–90	65	387–430	404
Pregnancy 8th month	30	62–87	80	373–428	386
Pregnancy 9th month	40	71–88	82	387–402	386
Puerperium	17	76–92	80	343–397	372

Fig 1. Showing Mean Values of Serum Iron & TIBC in Pregnant Women.



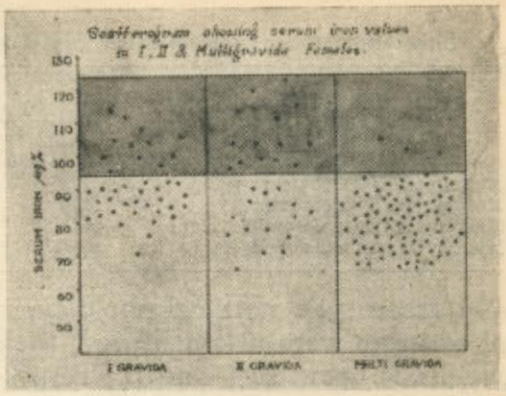


Fig. 2

Discussion

The clinical interpretation of iron metabolism in pregnancy is a vexed problem and is regarded by many tc be closely linked to the problem of the so called "physiological anaemia" of pregnancy. The development of iron deficiency state during pregnancy can be understood by considering the factors that affect the iron balance in pregnancy. The total foetal demand for iron has been estimated to be 300-350 mgm, a quantity which no woman can afford to loose. The foetus, however, has to be supplied its iron needs. To this is added the blood loss at delivery containing approximately 100 mg. of iron. If the intake of iron by the mother is small the maternal stores may become easily depleted and it is notorious that the capricious appetite found commonly in pregnancy will often not relish iron containing foods. Additional factors leading to iron deficiency in pregnancy may be a temporary derangement of gastric function and unmasking or exaggeration of anaemia which existed before the pregnancy set in.

In the present study only 29 out of 160 pregnant women presented normal serum iron values. As already mentioned the serum iron levels were slightly to moderately low during the first four months of pregnancy. From 5th month onwards up to the 7th month, the serum iron level was the lowest. This finding is in agreement with the majority of the workers in this field (Lundstorm, 1950; Ventura & Klopper, 1951; Menon & Ramaswami, 1955; Mukherjee & Mukherjee, 1953 and Benjamin *et al* 1966). Some workers in the past (Albers, 1941; Hammeler, 1946 and Rath & Finch, 1949), however, reported increased serum iron values in pregnancy but their findings have not been supported by the majority of the later workers.

An attempt has been made to correlate the fall in serum iron with hydraemia of pregnancy. All workers agree that the increase in plasma volume commences early in pregnancy, certainly not later than the 10th week, and the significant fall in serum iron values occurs not before the second trimester of pregnancy.

This means that the decrease in serum iron is greater than can be expected from the effect of hydraemia of pregnancy.

In the latter half of the last trimester of pregnancy the values of serum iron showed some stability and the mean values at the 8th and 9th months showed some elevation as compared to those of the 5th to 7th months. Few workers (Wolff and Limarzi, 1945; Lundstorm, 1949; and Wintrobe, 1967) in the past have also reported such an elevation in serum iron values in the final stages of pregnancy and have attempted to correlate this with a temporary decrease in the blood volume during this phase. While this possibility cannot be completely ruled out, further work is required to substantiate this hypothesis. It may be possible that by this time of pregnancy the foetal demands for iron have considerably been reduced which may be a part of the process by which the mother prepares herself in advance for the impending loss of blood and iron during parturition. We may say that the factors responsible for the stabilization, slight elevation and maintainance of serum iron levels during the last phase of pregnancy are not properly known.

In the puerperium the blood picture and serum iron values showed a trend more or less similar to the second half of the last trimester of pregnancy. With the continuous foetal drain of iron no longer there, this can be expected. Other workers (Lundstorm loc. cit. and Wolff & Limarzi, loc. cit.) have also reported similar findings.

The total iron binding capacity showed an increase from the 5th month onwards, a finding which the majority of previous workers have also reported (Laurell, 1947; Fay *et al.*, 1949 and Rath *et al.* 1951). It has been reported by Jain *et al* (1968) that the beta-globulin fraction of plasma proteins is increased in the last trimester of pregnancy and the increase in total iron binding capacity can partly be explained on this basis.

Summary

1. Serum iron and total iron binding capacity (T.I.B.C.) of 30 adult, healthy, non-pregnant females and 160 randomly selected women at different stages of pregnancy and puerperium were determined.

2. 76% of the pregnant women presented a microcytic hypochromic type of anaemia.

3. The mean values for serum iron were found to be lowest during the 5th to 7th months of pregnancy (65-74 μg%).

4. In the second half of the last trimester the mean serum iron values showed some elevation and this was maintained during the puerperium (80-82 μ mg%).

5. The T.I.B.C. values followed an inversely proportional pattern with those of serum iron.

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