Serum Level Of Iron And Transferrin In Normal And Anemic Pregnant Women

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Abstract: Background: Iron deficiency anemia is a major health problem in our country especially in pregnancy. For accurate diagnosis of iron deficiency anemia we require accurate indicators based on which treatment can be given. Purpose of this study is to prevent unnecessary iron overload by accurate diagnosis in pregnancy as excessive iron can lead to oxidative damage. Method: Serum level of Iron and transferrin and total iron binding capacity and % saturation of transferrin were estimated in 70 women in their I, II and III trimester of pregnancy. Only healthy subjects (without infective, metabolic, and degenerative disease) on clinical examination were selected. The women were divided into three groups according to their hemoglobin level in normal, mild anemic and moderate to severe anemia. Result: In normal group serum iron levels were within normal range in all trimester, whereas in anemic groups serum iron level were lower. Serum transferrin level was raised in III trimester in all the groups and also raised in I and II trimester in severe anemic group. TIBC was increased with decreased in serum iron level. % saturation of transferrin was lowered with lowered hemoglobin level. Conclusion: Our study shows iron level can be well correlated with haemoglobin level but transferrin level cannot be well correlated. But % of transferrin saturation can be a better indicator then transferrin.

Key Words: pregnancy, anemia, serum iron, transferrin, % saturation of transferring

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Introduction: Iron deficiency anemia is the most prevalent problem in developing countries. It accounts for 57.9% in pregnant women and 56.2% in women in reproductive age[1]. During pregnancy hemodynamic changes lead to expansion of blood volume up to 50% and increase in red cell mass up to20% which results in haemodilution. Because of haemodilution low concentration of hemoglobin often misdiagnosed as anemia[2]. As sequences it leads to useless administration of haemetinics. The study was designed to correlate other parameters with hemoglobin concentration and for finding the best indicator of iron deficiency anemia unaffected by haemodilution.

Material and Method: 70 women in their 1st, 2nd and 3rd trimester of pregnancy were selected from obstetrics and gynecology antenatal outpatient department irrespective of level of anemia and nutritional status. Any infective, metabolic or degenerative disease detected on clinical examination was exclusion criteria. Approval of ethical committee of medical college and informed consent was taken from participants in study. Patients were called at laboratory at 9:00 a.m. with empty stomach. A through clinical examination was done and body weight, height, period of gestation and nutritional status were noted. Venous samples were collected and analyzed for hemoglobin, serum iron, serum transferrin, and TIBC and % saturation of transferrin.

Women taken in study were between 18-36 years in age, weight between 40-60 kg, height ranged from 136-159 cms, body surface area between 1.23-1.67m2 and arm circumference between 22-25.6 cms. The parity was between 1-4. Women were divided into three groups.

Group A- Normal (Hb above 10 gm %)

Group B- Mild anemia (Hb between 8-10 gm %)

Group C- Moderate and severe anemia (Hb below 8 gm %)

Statistical analysis- Mean with standard deviation of different parameter was compared with level of haemoglobin in different trimester.

Result: In group A Hb> 10gm % s. iron, s. transferrin, TIBC, % saturation of transferrin were not significantly different in different trimesters of pregnancy as seen in table I,II,III,IV. In group A serum iron level was highest within normal average value as seen in healthy person about 120 µg/dl. In group B and C women with anemia serum iron level was significantly lower than group A being

lowest in group C. Serum iron level correlated well with Hb concentration.

Table 1: Serum iron level in during different trimesters of pregnancy and its relation with level of anemia.

Hb gm %	Serum Iron µg/dl mean ± SD		
Trimester	1st	2nd	3rd
>10	106 ±23.13	121.6 ±47.90	140.8 ±55
8-10	64.67 ±21.7	49.64 ±14.63	51.29 ±11
<8	24.66 ±2.3	29.66 ±10.44	28.33 ±9.9

Fig 1: Serum Level Of Iron In Different Groups

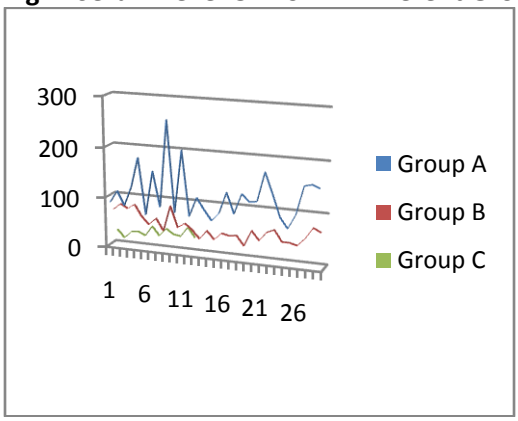

Chart show clear relation with haemoglobin being highest in normal group and lowest in severe anemic group.

Serum transferrin: Serum transferrin level was increased in third trimester of pregnancy in all groups. Serum transferrin level was also raised in 1st and 2nd trimester in group C with severe anemia.

Table 2: Serum transferrin level during different trimesterof pregnancy and its relation with level of anemia.

Hb gm %	Serum transferrin g/dl mean ± SD		
Trimester	1st	2nd	3rd
>10	2.51±0.43	2.72±0.99	3.57±0.72
8-10	2.95±0.95	2.87±0.20	3.48±0.50
<8	3.40±0.18	3.81±0.62	3.58±0.64

Fig 2: Showing serum level of transferrin in different groups.

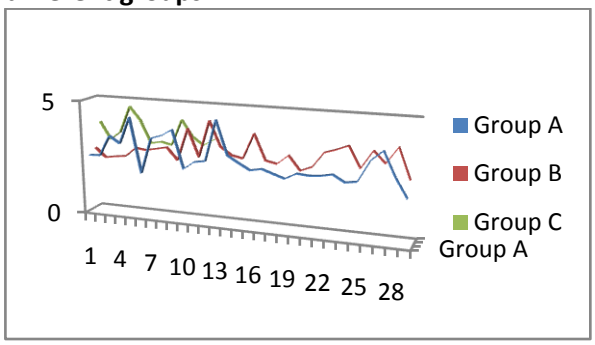

Chart does not show clear relation with haemoglobin in different groups like serum iron level.

Total iron binding capacity: Total iron binding capacity was increased with decreased serum iron level. Although they do not always show linear relationship to iron store.

Table 3: serum TIBC level during different trimester of pregnancy and its relation with level of anemia.

Hb (gm %)	Serum TIBC µg/dl mean ± SD		
Trimester	1st	2nd	3rd
>10	435.11±81.15	481.68±48.5	511±85.8
8-10	483.75±61.26	524.7±62.05	615.27±85
<8	581±111.94	538±64.71	717±309.9

% saturation of transferrin: % saturation of transferrin is normally 30%. In group A Hb> 10gm%, % saturation ranges from 25 to 28.47. Lower level 13.81 was observed in 1st trimester in women of group B Hb between 8-10 gm% and in same group % saturation fell significantly in 2nd and 3rd trimester. In severe anemia % saturation was very law being only 4.3, 5.3, and 5.32 respectively during 1st, 2nd and 3rd trimester of pregnancy thus leaving a vast unsaturated or latent iron binding capacity. It can also be well correlated with Hb as serum iron. % saturation of transferrin can be the better index of anemia with iron then transferrin.

Table 4: % saturation of transferrin in different trimester of pregnancy and its relation with level of anemia

Hb gm%	% saturation of transferrin mean ± SD		
Trimester	**1st**	**2nd**	**3rd**
>10	25±8.83	24.76±8	28.47±12.5
8-10	13.81±5.31	9.77±3.78	8.64±2.78
<8	4.3±0.48	5.30±1.32	5.32±4.6

Thus results shows better correlation of hemoglobin with serum iron and % saturation of transferrin then that of serum level of transferrin.

Discussion: From the observation table of the study it may be seen that in group of pregnant women included in study, % saturation of transferrin with serum iron was lower than normal, indicating a deficiency of Iron even when Hb level was>10gm%.

According to WHO expert group anemia is considered to exist when serum iron level is < 50 µg/dl. According to Bengaminet al.[3], iron deficiency anemia was considered to exist during pregnancy when serum iron level was < 50 µg/dl.

Thus in present study in the group C subjects the decrease in Hb was not due to hydration but was due to anemia. Decrease in serum iron could be correlated well Hb level in the results also as shown in the graph above; with mild and severe anemia in group B and C decrease in serum iron was greater.

Pregnancy is a major drain on the limited iron reserve of young women. Each pregnancy results in average loss to the mother of 680mg of iron, equivalent of 1300 ml of blood. An additional iron must be available to support the expanded blood volume during pregnancy.

Prorated over the full term pregnancy, the iron requirement amounts to approximately 2.5 mg/day. In IIIrd trimester it rises as much as 3.0 to 7.5 mg/day. These amounts are greater than those that can be absorbed from even the best diets; stores may be insufficient to meet them. For this reason early diagnosis of anemia and iron supplementations is frequently as a component of prenatal care[4].

Other finding in present study was increased level of serum transferrin concentration in late pregnancy, IIIrd trimester. The increase in transferrin concentration in serum is not produced by administration of estrogen to normal women[5], so it is likely that the elevated steroid level in pregnancy accounts for this elevation. It may represent an increased rate of production for its functional capacities along with no change in its degradation rate[6].

The turnover (half-clearance time) of transferrin bound iron is very rapid-typically 60 to 90 minutes. Because the overwhelming majority of iron transported by transferrin is delivered to the erythroid marrow, the clearance time of transferrin-bound iron from circulation is affected most by plasma iron level and activity of erythroid marrow. When erythropoesis is markedly stimulated, pool of erythroid cells requiring iron increase and clearance time of iron from circulation decrease[7].

InI IIrd trimester erythropoesis markedly, so the pool of erythroid cells requiring iron increases considerably in third trimester which leads to clearance time from the circulation to decrease. This may be the probable reason for this raised concentration of serum transferrin in late pregnancy.

Serum transferrin concentration was raise in early pregnancy also in severe anemic subjects group C in the study but no explanation is found about and contrary explanation is there, it seems that in severe anemic state rate of synthesis of transferrin is less in liver[8]. The half clearance time of iron in presence of iron deficiency is as short as 10 to 15 min; this value reflects the limit of iron delivery as function of cardiac output going to the bone marrow [6].

Apte and lyenger[11] demonstrated that during pregnancy iron absorption increased from a mean of 7 to 30 and further to 33 percent at gestation

weeks 8-16, 27-32, respectively, using the chemical balance method, the absorption of iron was better among those with low percent transferrin saturation than in women with high percent transferrin saturation. As much as 58 percent of 30 mg of dietary iron ingested per day could be absorbed by an iron deficient full term pregnant woman. However, the magnitude of the difference in iron absorption between non pregnant and pregnant Indian women in striking even when the same balance method is used. This study shows the greatly increased demands of iron in pregnancy and increased absorption according to need in iron deficient women[9].

In study to evaluate liver iron stores in different countries it was observed that Indian values ranked amongst the lowest in females due to the stress of pregnancy and lactation. The anemia of pregnancy is most likely manifestation of latent iron deficiency[10].

Deficiency of dietary iron exaggerated in late pregnancy by rise in requirement up to 3.0 to 7.5 mg/day. These amounts are greater than those that can be absorbed from even the best of diets, and stores may be insufficient with daily Indian diet to meet them. For these reason iron supplementation is the major components of prenatal care[4].

Conclusion: Serum iron level can be well correlated with haemoglobin concentration with decrease in haemoglobin concentration in accordance there is also decrease in serum iron level. But serum transferrin level is not showing any parallel or dependent result as iron with haemoglobin concentration. Its level increased in late pregnancy in all groups irrespective of anemic status. So it cannot be taken as a better index of anemia. However % saturation of transferrin shows decrease with decrease in haemoglobin concentration and serum iron level. So it can be a better index then transferrin. Thus serum iron and % saturation along with haemoglobin concentration can be used to diagnose iron deficiency anemia in early stages. And with early accurate diagnosis we can prevent its consequences by administration of haematinics. We can also prevent faulty administration of haematinics by excluding physiological haemodilution which is misdiagnosed as anemia which can cause oxidative damage.

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