Study of Serum Ferritin Levels in Anemia of Pregnancy

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Research Article

Abstract: Anemia in pregnancy is a global problem and is associated with increased maternal morbidity and mortality (WHO, 1992). Iron deficiency anemia is defined as anemia accompanied by depleted iron stores and signs of a compromised supply of iron to the tissues. The objectives of this study were to determine the serum ferritin in anemic pregnant women and to compare them to that of normal healthy non-pregnant women. Materials and Methods: Present Cross sectional study was carried out in the Department of Biochemistry MGM Medical College, Aurangabad during March 2011 to March 2013. A total of 50 pregnant women of 15-35 yrs age with hemoglobin level < 10.5 g% were compared with 50 non-pregnant healthy women. Serum ferritin levels were done by Chemiluminescence assay (Immulite 1000).Mean and standard deviation were calculated for Hb%, Serum Ferritin. Statistical analysis was done using SPSS. In the present study mean hemoglobin level and serum ferritin level was low in test group as compared to control group. Low level of hemoglobin and serum ferritin was noted in 2nd trimester as compared to 1st and 3rd trimester of pregnancy which was statistically significant.

Key words: anemia, transferrin

Introduction

Anemia in pregnancy is a global problem and is associated with increased maternal morbidity and mortality (WHO, 1992).[1] Anemia in pregnancy is more common in developing countries than in developed countries. In the USA, less than 30% of pregnant women develop anemia, whereas the prevalence rates in Africa, Asia, and Latin America range from 35% to 75%.[2,3] In India prevalence of anemia at all ages remain very high e.g. pregnant women particularly rural.[4] Iron deficiency anemia is defined as anemia accompanied by depleted iron stores and signs of a compromised supply of iron to the tissues.[5] There is variation in hemoglobin levels during pregnancy; at the beginning of a pregnancy, there is a normal reduction in hemoglobin level followed by a slight rise towards the end of pregnancy.[6] The initial reduction has been explained to result from increased red cell mass and demands of the fetus which exceeds iron intake with consequent reduction in iron stores of the woman's body.[7] Thus, the World Health Organization has defined anemia in pregnancy as a hemoglobin value below 11 gm/dL.[5,7]The lowest normal hemoglobin in the healthy non-pregnant woman is defined as 12 g%. The World Health Organization (WHO, 1993) recommends that hemoglobin ideally should be maintained at or above 11.0 gm/dL, and should not be allowed to fall below 10.5 gm/dL in the second trimester.[8] The objectives of this study were to determine the serum transferring of the subjects and controls, to compare them to that of normal healthy non-pregnant women.

Materials and Methods

Present Cross sectional study was carried out in the Department of Biochemistry MGM Medical College, Aurangabad during March 2011 to March 2013. A total of 50 pregnant women of 15-35 yrs age with hemoglobin level < 10.5 g% were considered as test group and control group of 50 non-pregnant healthy women. The test group were also classified into three sub-groups according to stage of pregnancy, i.e., first, second and third trimester. serum ferritin were done and compared with control group of same age. Among the subjects, those having any acute or chronic generalized infection (respiratory or renal diseases), women using e contraceptive devices taking Anti-thyroid drugs, cortisol, NSAIDs, cases of dysfunctional uterine bleeding and taking iron supplements were excluded. Serum ferritin levels are done by Chemiluminescence assay (Immulite 1000).Mean and standard deviation were calculated for Hb%, Serum Ferritin,. Statistical analysis was done using SPSS. The differences between means of more than two groups were tested by performing ANOVA. Pearson correlation coefficients were calculated to determine correlation of serum ferritin. The methodology used in this study included, collection, preparation, and storage of the samples. The fresh blood samples collected in EDTA were used for complete blood count (CBC) by ADVIA 2120i 5 Part Cell Counter (SIEMENS), on the same day

of collection. The analysis included hemoglobin concentration (Hb), haematocrit values (Hct),).

Serum Ferritin

Serum samples were allowed to thaw at room temperature before they were utilized for quantitative determination of ferritin in serum by using an Immunoassay method. The Chemiluminescence Immunoassay CLIA is intended for use on the IMMULITE – 1000 (SIEMENS, UK) Analysis of variance and t-student test were used to compare means. Means, standard deviations (SD), and percentages were calculated for each hematological parameter.

Anemia in pregnancy has been defined by criteria from the Centers for Disease Control and Prevention (CDC) as a hemoglobin level of less than 11 gm/dL during the first and third trimesters and less than 10.5 gm/dL during the second trimester. They found significant decrease in Hb, Serum ferritin, in 2nd Trimester compared to 1st trimester in iron deficient pregnant women.

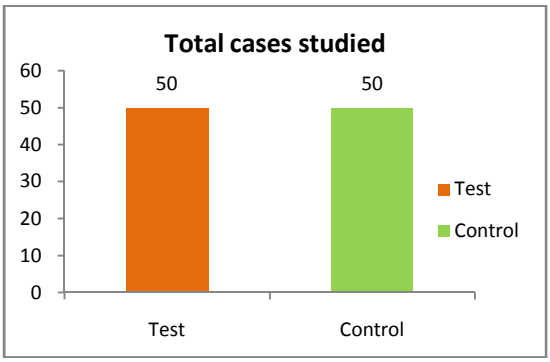
Observation and Results

The mean age of control group was 25.3 years, and that of the pregnant group 25.3 irrespective of the trimester of pregnancy was comparable to that of the control group.

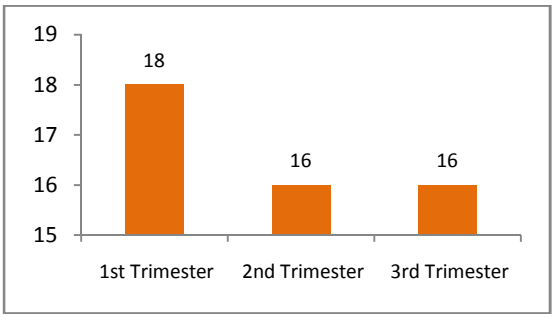
Table 1: Distribution of Cases between Test Group (according to their Trimester) and control

Group	Trimester	No of Cases	Percentage
Test (n=50)	1st Trimester	18	36.0%
	2nd Trimester	16	32.0%
	3rd Trimester	16	32.0%
Control (n=50)		50	100.0%

Present study included total 100 cases of test group and control group (50% each). In test group maximum cases i.e. 18 (36%) were observed in 1st trimester of pregnancy.



Bar diagram 1A



Bar diagram 1B

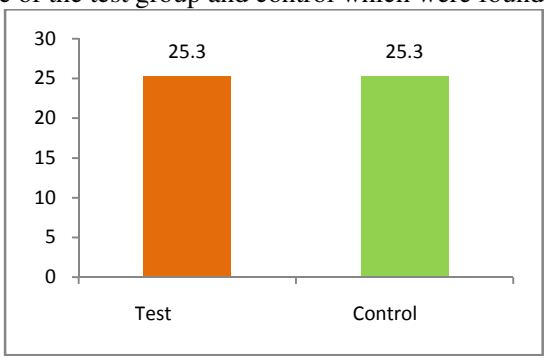
Bar diagram: 1A Total cases studied in test and control group. 1B) Trimester wise cases in test group

Table 2: Comparison of mean age between Test and Control Group.

Sr No	Group	Number	Mean±SD (Years)	Z -Value	*p* value
1.	Test	n=50	25.3±3.6	0.563	P=0.542 NS
	Control	n=50	25.3±3.8		

(p=0.542, statistically not significant)

Above table shows, mean age of the test group and control which were found to be same i.e. 25.3 years**.**

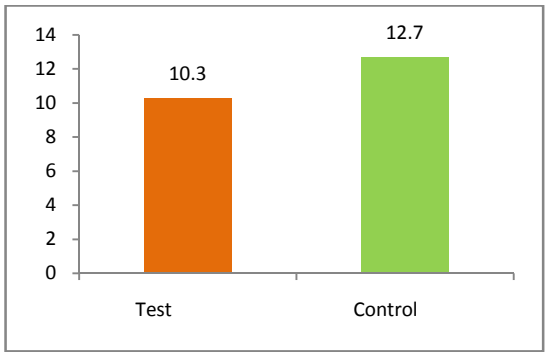


Bar diagram 2: showing comparison of mean age between Test and Control Group

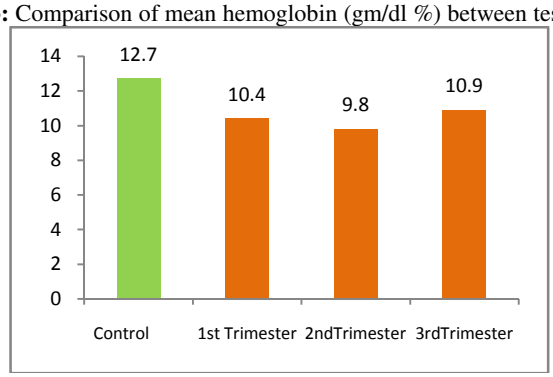
Table 3: Comparison Of Trimester Wise Mean Hemoglobin (gm/dl %) Between Test And Control Group

Sr No	Group	Number	Mean±SD (Hemoglobin gm/dl)	Z-Value	*p* value
			Mean±SD (Hemoglobin gm/dl)	Z-Value	*p* value
1.	Test	n=50	10.3±1.5	10.50	P=0.000 S
	Control	n=50	12.7±0.6		
2.	1st Trimester	n=18	10.4±1.6	1.09	P=0.275 NS
	2ndTrimester	n=16	9.8±1.6		
3.	1st Trimester	n=18	10.4±1.6	1.17	P=0.241 NS
	3rdTrimester	n=16	10.9±0.8		
4.	2ndTrimester	n=16	9.8±1.6	2.45	P=0.013 S
	3rdTrimester	n=16	10.9±0.8		

In the present study mean hemoglobin level was low (10.3 gm/dl) in test group as compared to control group (12.7 gm/dl). As per trimester wise distribution low level of hemoglobin were noted in 2nd trimester as compared to 1st and 3rd trimester of pregnancy i.e. 9.8 gm/dl) which was statistically significant



Bar diagram 3: Comparison of mean hemoglobin (gm/dl %) between test and control group

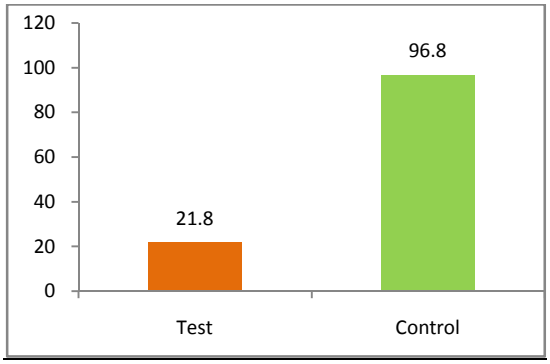


Bar diagram 4: Showing comparison of trimester wise mean hemoglobin (gm/dl %) in test & control group

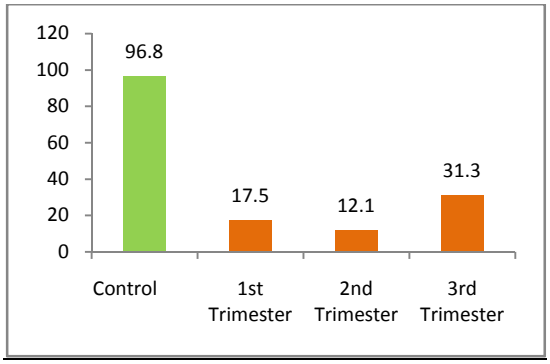
Table 4: Comparison of Mean Serum Ferritin (ng/ml) between Test and Control Group

Sr No	Group	Number	Mean±SD Sr. Ferritin (ng/ml)	Z-Value	*p* value
1.	Test	n=50	21.8±17.4	11.04	P=0.000 S
	Control	n=50	96.8±44.7		
2.	1st Trimester	n=18	17.5±13.4	2.22	P=0.026 S
	2ndTrimester	n=16	12.1±10.8		
3.	1st Trimester	n=18	17.5±13.4	2.40	P=0.016 S
	3rdTrimester	n=16	31.3±19.2		
4.	2ndTrimester	n=16	12.1±10.8	3.49	P=0.000 S
	3rdTrimester	n=16	31.3±19.2		

Above table shows, mean serum ferritin level were found to be low i.e. 21.8 ng/ml in test group as compared to control group (96.8 ng/ml). Trimester wise distribution, low level was found in 2nd trimester of pregnancy as compared to 1st and 3rd trimester i.e. 12.1 ng/ml. (Graph 8A and 8B)



Bar diagram 5: Showing comparison of Mean Serum Ferritin (ng/ml) between test and control group



Bar diagram 6: Showing comparison of trimester wise Mean Serum Ferritin (ng/ml) in test group with control

Discussion

Hemoglobin concentration and haematocrit, because of their low cost and quick assessment, are most commonly used to screen for iron deficiency; these measures reflect the amount of functional iron in the body. But limitation is that changes in hemoglobin concentration and haematocrit occur only at the late. Serum ferritin concentration is an early indicator of the status of iron stores and is the most specific indicator available of depleted iron stores especially when used in conjunction with other tests to asses iron status. Iron deficiency anemia in pregnancy is an important preventable cause of maternal and perinatal morbidity and mortality. Iron deficiency is the most prevalent specific single micro-nutrient deficiency affecting approximately 50% of the world population. Ferritin is a water soluble protein-iron complex of molecular weight 465000. Ferritin is found in nearly all cells of the body. In hepatocytes and in the macrophage system of the bone marrow and other organs, ferritin provides a reserve of iron readily available for formation of hemoglobin and other haem proteins Ferritin levels are considered the gold standard for the diagnosis of iron-deficiency anemia in pregnancy.[9] In our study the serum ferritin showed significant changes in different trimesters. Serum ferritin levels were lowest in second trimester as compare to first trimester in all groups and

then there was stability or slight improvement in ferritin levels found during third trimester

Ferritin is the key to this important control of the amount of iron available to the body. **Ferritin is a protein that stores iron and releases it in a controlled fashion.** Hence, the body has a "buffer" against iron deficiency (if the blood has too little iron, ferritin can release more) and, to a lesser extent, iron overload (if the blood and tissues of the body have too much iron, ferritin can help to store the excess iron). Anemia of pregnancy has a significant impact on the health of foetus as well as mother, especially if severe, may impair the oxygen delivery to placenta and foetus interfering with intrauterine growth. Placental weight, volume and surface area are reduced if expecting mother is moderately anemic. It results in 12–28% of foetal loss, 30% prenatal deaths and 7–10% of neonatal deaths. During the second trimester anemia is associated with preterm birth, incidence of which is increased five-fold for iron deficiency anemia and double for other anemia. The risk of iron deficiency is particularly high in women with high parity and short intervals between pregnancies.16 Average hemoglobin levels decrease to 11.6 g/dL at 20 to 24 weeks' gestation, with the fifth percentile at 10.5 g/dL (Hematocrit = 32%). Anemia in pregnancy has been defined by criteria from the Centers for Disease Control and Prevention (CDC) as a hemoglobin level of less than 11 g/dL during the first and third trimesters and less than 10.5 g/dL during the second trimester. In the present study mean hemoglobin level was low (10.3 gm/dl) in test group as compared to control group (12.7 gm/dl). As per trimester wise distribution low level of hemoglobin were noted in 2nd trimester as compared to 1st and 3rd trimester of pregnancy i.e. 9.8 gm/dl) which was statistically significant. Serum ferritin usually falls markedly between 12 and 25 weeks of gestation, probably as a result of iron utilization for expansion of the maternal red blood cell mass.[1,2] Iron transfer from mother to fetus occurs against the concentration gradient. Most iron transfer to the fetus occurs after 30 weeks of gestation which correspond to the time of peak efficiency of maternal iron absorption.[18] They found significant decrease in Hb, Serum ferritin, in 2nd Trimester compared to 1st trimester in iron deficient pregnant women. Ferritin levels are considered the gold standard for the diagnosis of iron-deficiency anemia in pregnancy.[20] In our study the serum ferritin showed significant changes in different trimesters. Serum ferritin levels were lowest in second trimester as compare to first trimester in all groups and then there was stability or slight improvement in ferritin levels found during third trimester. The prevalence of low hemoglobin or hematocrit is reduced;

The salient feature of our study is a statistically significant decrease in Hb, serum ferritin level, in pregnant women compared to non pregnant controls. The proportion of iron deficient pregnant women was 50–60% of cases, and iron deficient anemic was about 26%, while 20% of controls were also iron deficient but none of them was iron deficient anemic. These findings are not unexpected since the diet of the population in the region (especially rural areas) is heavily reliant on grains such as maize, which contains large amounts of phytates which are known to interfere with the intestinal uptake of iron and other trace minerals, such as Zinc and Calcium. The data indicates significant differences in hemoglobin, serum ferritin, significantly lower hemoglobin and serum ferritin were observed in 2nd and 3rd trimester of pregnancy than in the 1st trimester. Hemoglobin level in all the three trimesters of pregnancy were lower than in the control subjects and the decrease was especially pronounced in the 2nd and 3rd trimesters. Their study revealed that iron deficiency was the most frequent cause of anemia. The study conducted by Bondevik *et al*[18] in Nepal, about 76.6% of pregnant women were found anemic. Approximately 81.3% of anemia was due to iron deficiency. Low birth weight was especially associated with low hemoglobin level in pregnancy. Serum ferritin levels in our subjects decreased significantly in all the three trimesters as compared to controls. This is in agreement with the results reported by above studies.22–25.Van den Broek and Letsky[19] opined that a ferritin value of 30 ηg/ml or less was the best indicator of iron deficiency in pregnant women. Applying a cutoff value of 30 ηg/ml for iron-deficiency in that study 23% of anemic pregnant women were deficient in iron, one third of anemic subjects in that study were also deficient in Vitamin-B while another one third were deficient in folate. Our results match with above study.

Summary and Conclusions

1. The mean age of control group was 25.3 years, and that of the pregnant group 25.3 irrespective of the trimester of pregnancy was comparable to that of the control group. (Table no.1)
2. In test group maximum cases i.e. 18 (36%) were observed in 1st trimester of pregnancy and mean age of the test group and control which were found to be same i.e. 25.3 years.(Table No.2)
3. In the present study mean hemoglobin level was low (10.3 gm/dl) in test group as compared to control group (12.7 gm/dl). As per trimester wise distribution low level of hemoglobin were noted in 2nd trimester as compared to 1st and 3rd trimester of pregnancy i.e.(9.8 gm/dl) which was statistically significant. (Table No. 3)

4. Mean serum ferritin level were found to be low i.e. 21.8 ng/ml in test group as compared to control group (96.8 ng/ml).Trimester wise distribution, low level was found in 2nd trimester of pregnancy as compared to 1st and 3rd trimester i.e. 12.1 ng/ml. (Table No. 4)

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