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Efficacyof Iron Supplementationin Rural Anemic Pregnant Womenand Its Influenceon Oxidative Stress

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Abstract:*Iron deficiency anemia (IDA) is a common affliction in women in the reproductive age group across ourcountry particularly in rural women and this assumes more significance when these anemic women become pregnant. IDA affects both mother and fetus in the form of weakness, fatigue,breathlessness, palpitation, cardiac failure, preterm labor, preeclampsia, postpartum hemorrhage,abruptio placentae and sepsis in mother and prematurity, low birth weight, intrauterine growth retardation and perinatal mortality in fetus.Iron supplementation resulted in significant improvement in iron status in all these women while at the same time there was statistically significant reduction in oxidative stress that was evaluated by Parameters like TBARS and FRAP.Iron supplementation is absolutely essential in all ruralanemic pregnant women particularly primi to prevent complications arising out of IDA.*

Keywords:*Iron deficiency anemia, antioxidant status, primi pregnant women, oxidative stress.*

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I. Introduction

Anemia during pregnancy is a major public health problem especially in pregnancy(1). According to World Health Organization (WHO), anemia is defined as a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet the physiologic needs, which may vary by age, sex, smoking, and pregnancy status.

TABLE: 1. Severity of anemia is classified based on Hb concentration as follows:

Severity of anemia	ICMR (Hb in g/dl)	WHO (Hb in g/dl)
Mild	10 - 10.9	9 -11
Moderate	7 – 9.9	7.1 – 9
Severe	4 – 6.9	≤ 7
Very severe	< 4	--

The World Health Organization (WHO, 2011) reports that roughly 43% of children, 38% of pregnant women and 29% of non- pregnant women and 29% of women in reproductive age group have anemia globally, and it corresponds to 273 million children, 496 million non-pregnant women and 32 million pregnant women. According to the recent data of National Family Health Survey (NFHS‑4), the prevalence of anemia in India is estimated to be 50.3%. Although there has been a reduction in the prevalence of anemia from 58.3 % in NFHS‑3 to 50.3% in NFHS‑4, it is not yet better than then the prevalence rate reported in NFHS‑2 (49.7%).

Statistics show that every second Indian women is anemic and one in every five maternal deaths is due to complications arising out of anemia. The prevalence of anemia is estimated to be higher in India when compared to all other developing countries and it is the second leading cause of maternal deaths in our country(2).Prevalence of anemia in pregnancy is 50 -70%.Iron deficiency anemia (IDA) is the most common type of anemia in pregnancy(3) . Iron requirement is more during pregnancy (4), and this explains why anemia is more common in pregnant women. Iron requirement during pregnancy increases by 1g over usual body iron stores of 2 to 2.5g in adult women (5).Usually only 10% of ingested iron is absorbed and since average diet contains inadequate iron, pregnancy creates a state of negative iron balance. Other causes of maternal anemia are malnutrition, folate , vitamin B12 and vitamin A deficiencies, unhealthy lifestyle, hemoglobinopathies, twin or multiple pregnancies, chronic inflammation, smoking or alcohol abuse, history of menstrual disorders

andparasitic infections(6).

Pregnancy itself is a condition with increased oxidative stress(7) and in addition Iron deficiency affects not only hemoglobin, but also iron containing proteins- cytochrome, catalase, peroxidase, myoglobin and so on. Since in iron deficiency, enzymes of antioxidant defence system are functionally defective, the balance tends to get tilted towards free radicals –triggering oxidative damage(8)

II. Materials and methods

This prospective study was conducted in Rajah Muthiah Medical college and hospital between February 2018- February 2019 in the Dept. of Obstetrics. &Gynaecology. Thirty(30) primi pregnant women with iron deficiency anemia in the beginning of second trimester(13 – 14 weeks) were selected for this study.**Inclusion criteria:** Primi with IDA with Hb 7 to 9 gm/dl.**Exclusion criteria:** Pregnant women with hemoglobin <7 gm/dl and >9 gm /dl, with chronic disease, multiple pregnancy and multiparity. IHEC clearance from our institution and Informed written consent from patients wereobtained.Oral iron tablets containing 100mg elemental iron were supplemented for 10 weeks OD in selected anemic patients. Blood samples(5ml of venous blood) were collected before and after iron supplementation. Blood samples were stored at -80°c in clinical chemistry laboratory till analysis.Complete hemogram, Fasting plasma glucose, urea,creatinine,LFT, routine urine investigations were measured.Serum iron and TIBC were estimated by Ferrozine method (9). Transferrin saturation was calculated by using the formula iron/TIBC ×100 (10,11). Serum ferritin was measured by Elisa method (12,13,14). Serum TBARS (15)and plasma FRAP (16) weremeasured by spectrophotometric methods.

STATISTICAL ANALYSIS

Data was analyzed by SPSS 25.0. Paired student t – testand Pearson correlation coefficient were done.p-value less than 0.05 was considered statistically significant.

TABLE: 2.Physiological Parameters

Age (years)	23.8 ± 1.51
Height (cm)	155.77 ± 2.87
Weight (kg)	55.1 ± 3.08
Blood pressure (mm Hg)	112/73 ± 7/4
Gestational age (weeks)	13 – 14

(mean ± SD) in anemic primi patients (n=30)

TABLE: 3.Biochemical Parameters

Parameters	Before supplementation n=30	After supplementation n=30	P value
Fasting plasma glucose (mg /dl)	80.67 ± 2.97	79.27 ± 3.37	0.009*
Urea (mg / dl)	19.03 ± 2.31	15.7 ± 2.29	<0.001**
Creatinine (mg/dl)	0.527 ± 0.09	0.463 ± 0.06	<0.001**
Cholesterol (mg/dl)	151.17 ± 10.21	169.27 ± 10.94	<0.001**
AST (U / L)	22.6 ± 6.3	18.8 ± 4.8	<0.001**
ALT(U/L)	15.9 ± 3.46	12.63 ± 2.96	<0.001**

***** - statisticallysignificant, (mean ± SD) in anemic primi (n=30) before and after iron supplementation
Iron supplementation -100 mg elemental iron OD given for 10 weeks.

TABLE: 4.Hematological Indices

Parameters	Before supplementation n=30	After supplementation n=30	P value
Hemoglobin (g/dl)	8.4 ± 0.26	9.7 ± 0.57	< 0.001**
RBC (million cells /µl)	3.47 ± 0.17	3.9 ± 0.16	< 0.001**
PCV (%)	27.19 ± 0.98	30.7 ± 2.49	< 0.001**
MCV (fl)	69 ± 1.9	73 ± 1.7	0.07
MCH (pg)	23 ± 2.1	26.9 ±0.84	< 0.001**
MCHC (%)	29.55 ± 2.1	31.27 ± 3.8	0.006*

***** -statisticallysignificant, (mean ± SD))in anemic primi(n=30) before and after iron supplementation
Iron supplementation -100 mg elemental iron OD given for 10 weeks.

TABLE: 5.Special Parameters

Parameters	Before supplementation n = 30	After supplementation n=30	P value
Iron (µg /dl)	52.9 ± 3.3	67.4 ± 5.3	< 0.001**
TIBC(µg / dl)	406.0 ± 14.3	351.1 ±19.8	< 0.001**
Transferrin saturation (%)	13 .0 ± 1.1	19.2 ± 1.7	< 0.001**
Ferritin (ng / ml)	13.7 ± 1.2	56.6 ± 13.4	< 0.001**
TBARS (mmol / L)	4.2±0.4	3.1 ± 0.5	< 0.001**
FRAP (µmol / L)	173.7 ± 28.7	228.0 ± 31.5	< 0.001**

***** - statisticallysignificant, (mean ± SD)) in anemic primi (n=30) before and after iron supplementation
Iron supplementation -100 mg elemental iron OD given for 10 weeks.

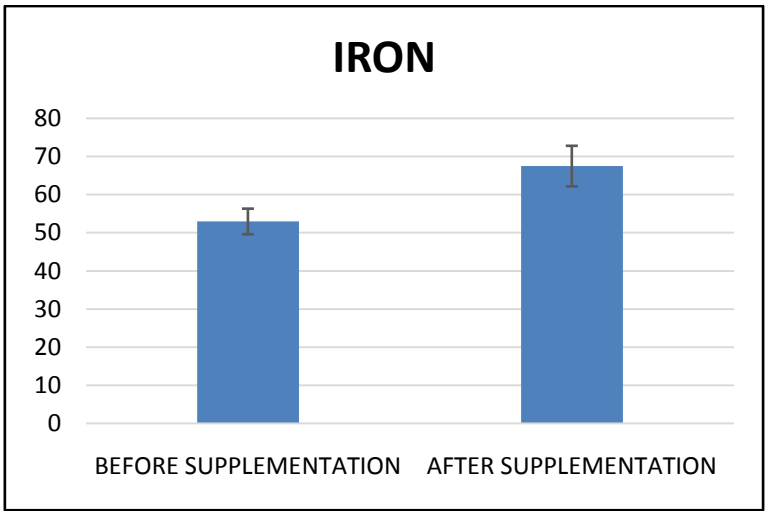

Fig:1. Serum iron level in anemic primi was significantly increased after iron supplementation.

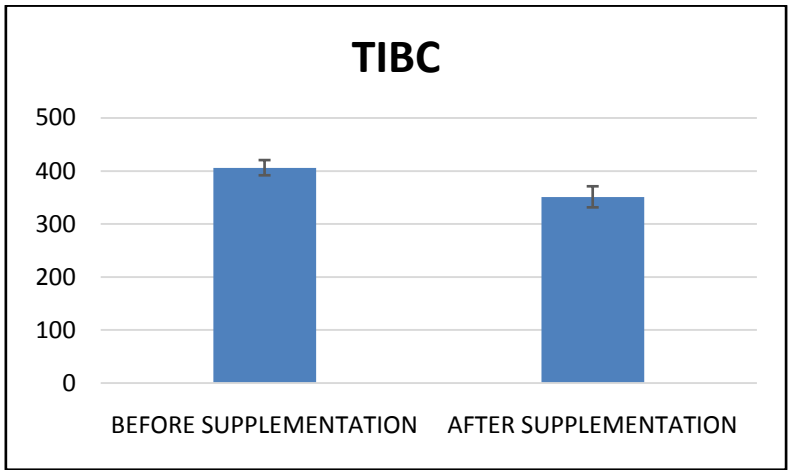

Fig:2. Serum TIBC level in anemic primi was significantly decreased after iron supplementation

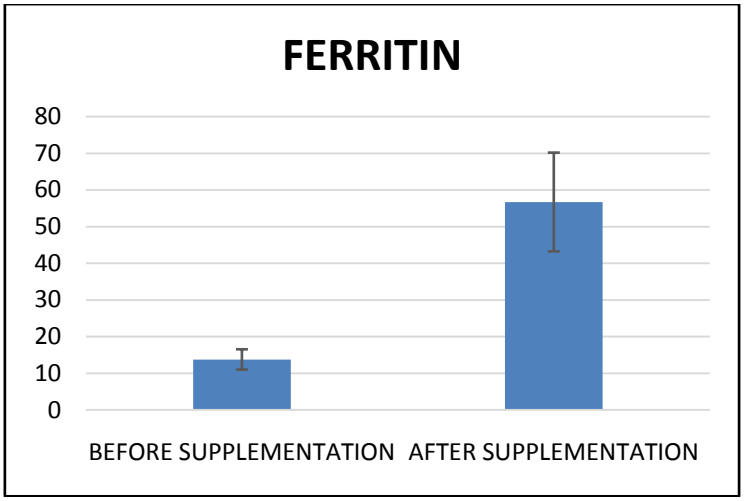

Fig:3. Serum ferritin level in anemic primi was increased3-foldafter iron supplementation

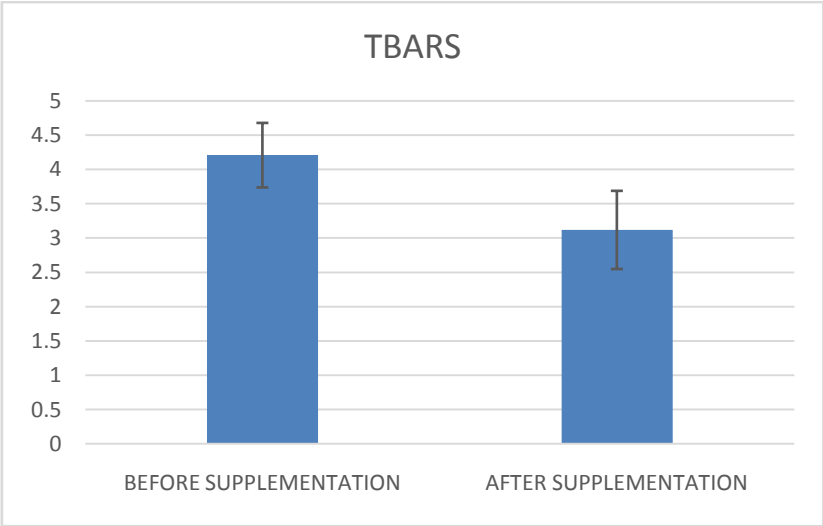

Fig:4. Serum TBARS level in anemic primi was significantly decreased after iron supplementation.

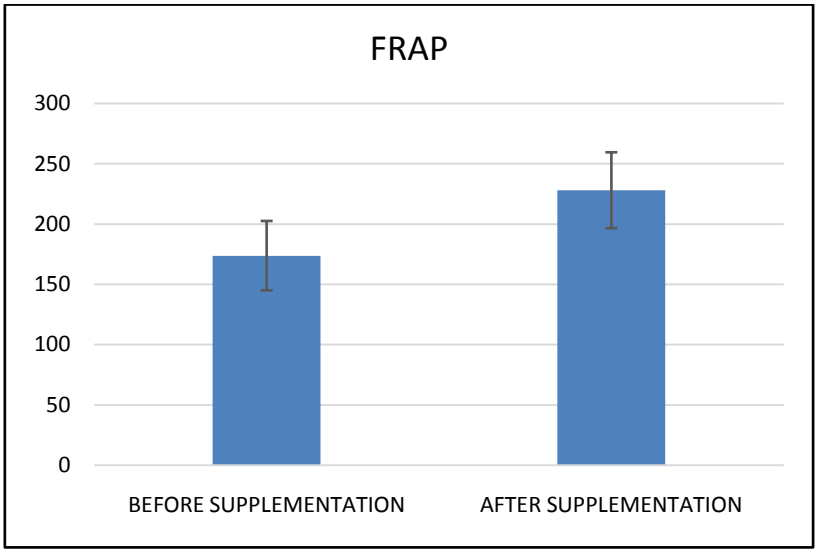

Fig:6. Plasma FRAP level in anemic primi was significantly increased after iron supplementation.

III. Results

- Anthropological Parameters in anemic primi women did not show any significant deviation from the normal. (Table 2)
- Routine biochemical Parameters as given in Table 3 shows appreciable difference in their levels but both values are within normal physiological range.
- Among the hematological indices (Table 4) Hb,RBC,PCV,MCH,MCHC shows significant increase.
- Special Parameters seen in Table 5 showstatistically significant increase in iron status (Serum Ferritin level increased 3-fold)and significant improvement inantioxidant levels.

IV. Discussion

Iron deficiency anemia in pregnancy can lead to potentially serious complications for both mother and fetus. It is essential to grade the level of iron deficiency and supplement accordingly. Care should be taken to avoid excess dosage and its attendant complications. In India, most of the rural women are chronically anemic and pregnancy particularly primi in young age groups adversely affects its outcome.

In our study,Iron supplementation resulted in significant increase in serum iron, hemoglobin and RBC indices and 3 fold increase in serum ferritin levels(12).TIBC is usually found to be increased in iron deficiency anemia. Iron supplementation resulted in improvement in anemic status and consequently TIBC decreasedand transferrin saturation level improved.

In our study, IDA augments the oxidative stress of pregnancy and the supplementation of iron reverses the increased oxidative stress and restores the much-neededhemodynamic balance and facilitates thesmooth

progress of pregnancy.Our results revealed improved hematological indicators after iron supplementation.Our results are in agreement with findings of zeebazaka-ur-rab et al,Han XX et al and Aly SSet al. (17,18,19).

V. Conclusion

All the pregnant women in India particularly in rural areas should be screened for IDA similar to IGT and iron deficiency if diagnosed should be treated immediately and appropriately till the end of pregnancy.

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