



ORIGINAL RESEARCH PAPER

Obstetrics & Gynaecology

CORRELATION OF IRON STATUS BETWEEN BOOKED PREGNANT WOMEN AND THEIR NEWBORNS AT ESIC MEDICAL COLLEGE, BANGALORE.

KEY WORDS: Iron Profile, Pregnancy, cord blood

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ABSTRACT

INTRODUCTION: In pregnant women, iron deficiency anemia can lead to increased maternal and fetal morbidity, mortality and increased risk of low- birth weight babies.

AIMS AND OBJECTIVES: To correlate the iron profile between women and cord blood of their newborns at delivery.

MATERIALS AND METHODS: 100 term booked pregnant women attending the OBG OPD at ESICMC- PGIMSR, Bengaluru and the cord blood of their corresponding newborns, during the period from April 2014 to August 2014.

RESULTS: 12% mothers and 7% babies were found to be Iron deficient. 26% mothers and 1% babies were found to be Ferritin deficient in the group studied.

CONCLUSION: Pregnancy is associated with a steady and physiologic fall in serum iron and ferritin due to transfer to the fetus, hemodilution and an up-regulation of iron transport proteins in the placenta in the iron-deficiency state.

INTRODUCTION

Nutritional iron deficiency is the most common deficiency disorder in the world with pregnant women at particular risk. World Health Organization (WHO) data show that iron deficiency anaemia (IDA) in pregnancy is a significant problem throughout the world with a prevalence ranging from an average of 18% of pregnant women in industrialized countries to an average of 56% (range 35–75%) in developing countries.¹

In pregnant women, iron deficiency anemia can lead to increased maternal morbidity and mortality, increased fetal morbidity and mortality and increased risk of low- birth weight babies.² Mild to moderate iron deficiency, even without anemia, has adverse functional consequences, although the effects are less obvious. It adversely affects the cognitive performance, behavior and growth of infants, preschool, and school- aged children and cell mediated immunity³

Increasing evidence demonstrates that fetal iron supply through gestation is limited in the presence of maternal iron deficiency⁵. Cord serum ferritin decreases after maternal serum ferritin has fallen below 12 g/L.⁶ Storage iron decreases progressively after birth⁷ due to the need to maintain a near constant mean hemoglobin concentration of 125 g/L within a rapidly expanding blood volume, particularly between the ages of 4 and 12 months⁸, when infants depend on the iron acquired from the mother before birth. Such a demand leaves the infant susceptible to iron deficiency.

Iron deficiency often develops during the later stages of pregnancy even in women who enter pregnancy with relatively adequate iron stores.⁹ Young children and pregnant women are the most affected, with an estimated global prevalence of 43% and 51%, respectively. The condition is considerably more prevalent in the developing world (36%) than in the industrialized world (8%). Africa and Asia have the highest overall regional prevalence rates.¹⁰

Infants born with serum ferritin concentrations <5th percentile continue to have significantly lower ferritin concentrations at 9 months of age compared with infants born with normal iron status, potentially conferring a greater risk of later onset iron deficiency in the second postnatal year.⁸ In a study by ICMR, about 53% of children were found to be suffering from anemia.¹¹ The prevalence of anemia decreases as age progressed in male children after 6 years of age, however this decline does not occur in

females. 25- 50% of girls become anemic by the time they reach menarche and both rural and urban girls are similarly affected.¹² This anemia progresses as the girl continues into adulthood and enters pregnancy as an iron- deficient mother.

The effects of anaemia are varied and numerous. In pregnant women, this causes increased maternal morbidity and mortality when compared to women who are not anaemic. In Neonates, there is-

- Increased fetal morbidity, mortality and risk of low- birth weight babies.⁹
- Mild to moderate iron deficiency, even without anemia, has adverse functional consequences.
- It adversely affects the cognitive performance, behavior and growth of infants, preschool, and school- aged children and cell mediated immunity.¹⁰

Ferritin levels indicate the iron stores that the individual has while Transferrin is the iron transport protein in the body. The Total Iron Binding Capacity (TIBC) and the Unsaturated Iron Binding Capacity (UIBC) indicate the capacity of the body to bind to iron. Therefore, higher Ferritin and Transferrin levels indicate higher stores while the lower the value of the TIBC and the UIBC, the more iron deficient is the individual.

Our study population is of the working class and belong to the lower socio-economic strata. Due to previously experienced high rates of anaemia in this population, we routinely supplement all of our pregnant women with iron as this has been proven to increase neonatal stores of iron as well as those in the mother.¹¹ We hypothesized that both our women and newborns would have lower incidences of anaemia due to this. Limited literature states that there is a correlation between the stores.¹²

The aim of this analysis is to describe the mean values of serum Iron, Ferritin, Transferrin, Total Iron Binding Capacity, Unsaturated Iron Binding Capacity in a pregnant population in India and their newborn children, percentage of women and their babies who are deficient in Iron and if a correlation between levels of the mother and baby exist. Data from this study could help plan strategies and policies focused on the control and reduction of Iron Deficiency.

AIMS AND OBJECTIVES

1. To find the levels of serum Iron, Ferritin, Transferrin, Unsaturated Iron Binding Capacity (UIBC) and Total Iron Binding Capacity

(TIBC) in women between 38 to 40 weeks of gestation at ESIC MC PGIMSR, Bangalore.

2. To study the same values in cord blood of newborns at delivery to the corresponding mothers studied at ESIC MCGIMSR, Bangalore.
3. To find if any relation exists between these values in the mother and the neonate studied.

METHODS

A prospective comparative study of 100 term pregnant women attending the Obstetrics Outpatient and Labour Division at ESIC MC Model Hospital, Rajajinagar, Bengaluru, Karnataka, India during the period of April 2014 to August 2014 irrespective of place and frequency of prior antenatal checkup. We obtained permission from the Hospital and Departmental Clinical Research Committee before starting this study.

CLINICAL MANAGEMENT AND DATA COLLECTION

Participants who fulfilled the inclusion and exclusion criteria were included in the study. Hospital staff and participants were all aware of the study being conducted and an informed consent was taken from the patient.

Ethical Approval

We obtained approval from the Hospital and Departmental Clinical Research Committee on 18th May 2013 before starting this study.

Study Population And Setting

Women between 21 and 35 years of age willing to give written informed consent were included in the study with a single live intrauterine pregnancy and with a pregnancy of more than or equal to 37 weeks of gestation. The exclusion criteria were- Multiple pregnancy, Preterm delivery, Women on treatment for detected Iron, Vitamin B12 or Folate Deficiency.

100 pregnant attending the Outpatient Antenatal Clinic at ESIC MC Model Hospital- either for the first time or who are booked in the institution were examined, investigated and if fulfilled the inclusion and exclusion criteria, were registered into the study. Informed consent was obtained for the procedure. Venous Blood of 3 ml was drawn into a plain vacutainer and maternal serum Iron, Ferritin, Transferrin, Total Iron Binding Capacity, Unsaturated Iron Binding Capacity was estimated using the International Federation of Clinical Chemistry (IFCC) Method. A separate card was maintained by the patient to show her inclusion in this study and her id number was noted in her investigation chart for our future reference.

When the patient came in labour or was admitted for obstetric indications and delivery was planned, the inclusion criteria was again checked, procedure explained and consent sought. Cord Blood of 3 ml was drawn into a plain vacutainer within 90 seconds of birth and 30 seconds of clamping the cord. Serum Iron, Ferritin, Transferrin, Total Iron Binding Capacity, Unsaturated Iron Binding Capacity were estimated using the International Federation of Clinical Chemistry (IFCC) Method.

Patient was informed about her and her baby's results before discharge and suitable treatment was given.

Statistical Analysis

The data obtained was fed into Microsoft Excel and proportions estimated. It will be further analyzed using SPSS- Correlation statistics.

Results

Study Group

Demographic characteristics (Table 1) were analyzed with respect to age, weight, haemoglobin status and parity.

Serum Iron in Women and their Neonates

Out of the 100 term antenatal women tested, 12 women and 7 neonates were Iron deficient and the mean values were 77.27ng/ml and 123.35ng/ml respectively.

Serum Ferritin in Women and their Neonates

26 women and 1 neonate was Ferritin deficient and the mean values were 38.35ng/ml and 91.36ng/ml respectively.

Serum Transferrin in Women and their Neonates

2 women and 47 neonates were Transferrin deficient and the mean values were 398.56ng/ml and 204.95ng/ml respectively.

Serum TIBC in Women and their Neonates

4 women and 51 neonates had TIBC that was lower than the normal range and the mean values were 484.85ng/ml and 260.96ng/ml respectively.

Serum UIBC in Women and their Neonates

1 woman and 37 neonates had UIBC that was lower than the normal range and the mean values were 474.3ng/ml and 179.02ng/ml respectively.

Relation Between Serum Iron Profile In Women and Neonates

There was a correlation between maternal and neonatal serum Iron and Ferritin levels with a Pearson's coefficient of 0.42 and 0.34 respectively and a p value of <0.001 and <0.001. There was no correlation between maternal and neonatal serum Transferrin, TIBC and UIBC levels with a Pearson's coefficient of 0.06, 0.08 and 0.12 and a p value of 0.54, 0.41 and 0.21 respectively.

Discussion

Main findings

A smaller percentage of women and babies were iron deficient when compared to the national average. This could be because of routine supplementation of iron in our population. There was a correlation between iron and ferritin levels in the mother and neonate which indicates a benefit of iron supplementation to both the mother and her baby. As the higher the TIBC and UIBC values are, the lower the iron status is, the neonates had higher iron stores than their mothers.

Strengths and weaknesses of the study

The major strength of this trial was that the trial population was homogeneous with strict inclusion and exclusion criteria.

Some limitations to this study may apply as this was a small study conducted in a unit of a teaching hospital. Large multi-centric studies with a mixed ethnic population would be of value in this field. Another limitation to the current study may be that the outcomes evaluated were all short-term with no long term follow up of deficient women and babies.

Interpretation

Before applying the results to other populations and settings, several factors have to be considered. Overall, the study population had a low body mass index and was very homogeneous, and the study aimed to only include healthy women with no a priori risks.

Conclusions

Pregnancy is associated with a steady and physiologic fall in serum iron and ferritin due to transfer to the fetus, hemodilution and an up-regulation of iron transport proteins in the placenta in the iron-deficiency state. Cord blood values are more, due to avid binding to its transporter and due to the placental active transport system. Lower incidence of Iron and Ferritin deficiency is seen in our population due regular antepartum supplementation of Iron to booked cases. Another approach to improve the iron status of a neonate could be by delayed cord clamping. Neonates should be followed up and treated if found to be Iron or Ferritin deficient.

The control of anemia seems a distant but achievable goal and requires strengthening of health services, supplementation programmes, nutritional education and maternal education. The entire medical community should therefore be actively involved in combating anemia as this can cause long standing effects in not

only that generation but also the subsequent ones.

Disclosure of interests

The authors have no conflicts of interest.

Contribution to authorship

All authors had full access to the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors reviewed and approved the final version of the paper.

Details of ethics approval

The study was approved by ESI Hospital Ethical Committee.

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Tables- Table 1- Demographics of the study population

Demographic Characteristics	Group (Range)
Age (Years)	25.7 (18- 35.5)
Weight (kg)	55.9 (38- 82)
Hemoglobin (gm/dl)	11.5 (10.5- 13.2)
Parity	No of women (%) [n=51]
Primigravida	20 (39.2%)
Parous	31 (60.8%)

Table 2- Mean, Standard Deviation and Range of Vitamin B12 and Folate values in the mother and baby.

Micronutrient Studied	Mean ± (Standard Deviation)	Range
Maternal B12 (ng/ml)	189.25 ± 94.2	2.78- 375.72
Maternal Folate (ng/ml)	13.13 ± 5.15	2.93- 23.32
Baby B12 (ng/ml)	321.86 ± 143.68	37.44- 606.28
Baby Folate (ng/ml)	15.68 ± 4.61	6.56- 24.81

Table 3- Number of Mothers and babies with normal and deficient values of serum vitamin B12 and Folate

Micronutrient Studied	Number with normal values (Percentage %)	Number with deficient values (Percentage %)
Maternal B12	36 (70.58)	15 (29.4)
Baby B12	37 (72.55)	14 (27.45)
Maternal Folate	50 (98.03)	1 (1.96)
Baby Folate	50 (98.03)	1 (1.96)

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