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A Comparative Study of Haemoglobin Levels in Primigravidas and Multigravidas after Oral Iron Supplementation in Gauhati Medical College and Hospital

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Dr. Heemanshu Shekhar Gogoi[1], Dr. (Mrs) Bonti Bora[2]

1. *Post Graduate Trainee, Department of Physiology, Gauhati Medical College and Hospital, Guwahati, Assam, India.*
2. *Professor and Head of Department, Department of Physiology, Gauhati Medical College and Hospital, Guwahati, Assam, India.*

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ABSTRACT

Objective: This study was done to evaluate and compare the rise of haemoglobin levels in between primigravidas and multigravidas after oral iron supplementation. This study was also done to compare the rise of haemoglobin levels of the subjects taking oral ferrous ascorbate and oral ferrous sulphate therapy. **Materials and methods:** A total of two hundred pregnant women (18–40 yrs) without any co-morbidities were selected and taken into two groups i.e. one hundred pregnant women who took ferrous ascorbate and another one hundred women who took ferrous sulphate. In this study for the comparison of the rise of haemoglobin levels, oral ferrous ascorbate and oral ferrous sulphate supplementation was selected out of the various available oral iron supplementations. Each group comprised of fifty primigravidas and fifty multigravidas. **Result:** There was rise in haemoglobin levels of both the groups, the rise in the group of primigravidas taking oral iron supplementation (mean rise=1.640 ± 0.7793) was more than that of the group of multigravidas taking oral supplementation (mean rise=1.404 ± 0.6432) and was statistically significant ($t=2.336$, $p=0.0205$, $p<0.05$, considered significant). Also the rise in haemoglobin levels was more for the ferrous ascorbate group containing both the primigravidas and the multigravidas (1.884 ± 0.6838) than that of the ferrous sulphate group containing both the primigravidas and multigravidas (1.160 ± 0.5628) and was statistically significant ($t=8.175$, $p<0.0001$). **Conclusion:** This study has shown that there occurs more rise in the haemoglobin levels in primigravidas as compared to the multigravidas after oral iron supplementation. Also, oral ferrous ascorbate has shown more mean rise in the haemoglobin levels than that of oral ferrous sulphate.

INTRODUCTION

Mothers are the God's most exquisite, most divine and celestial creation. Mothers define God. She is everything for her child who is the apple of her eye. She is her child's guardian angel, her child's best friend. Her child's silent protector. Her child's everything.

But she needs love, care and protection too. One such instance is the period during her pregnancy as in that case she is more prone to iron deficiency and hence to anaemias such as iron deficiency anaemia. In this regard an appropriate iron supplementation can be her saviour as iron supplementation has the power to prevent anaemia and to increase the levels of haemoglobin.

The prevalence of iron-deficiency anemia depends on the economic status of the population and on the methods used for evaluation. In developing countries, as many as 20% to 40% of infants and pregnant women may be affected (WHO Joint Meeting, 1975), while studies in the United States suggest that the prevalence of iron-deficiency anemia in adult men and women is as low as 0.2% to 3% (Cook et al., 1986). Better iron balance has been achieved by the practice of fortifying flour, the use of iron-fortified formulas for infants, and the prescription of medicinal iron supplements during pregnancy[1].

The body has an elaborate system for maintaining the supply of the iron required for hematopoiesis. It involves specialized transport and storage proteins whose concentrations are regulated by the body's demand for hemoglobin synthesis and adequate iron stores. The vast majority of the iron used to support hematopoiesisis reclaimed from catalysis of the hemoglobin in old erythrocytes. Normally, only a small amount of iron is lost from the body each day, so dietary requirements are small and easily fulfilled by the iron available in a wide variety of foods. However, in special populations with either increased iron requirements (e.g. growing children, pregnant women) or increased losses of iron (e.g. menstruating women), iron requirements can exceed normal dietary supplies and iron deficiency can develop[2].

REVIEW OF LITERATURE

The World Health Organisation has uniform definition of anaemia during pregnancy haemoglobin levels below 11.0 g/dl [3,4,5,6,7,8,9]. Iron deficiency is the most common nutritional deficiency of the world [10]. Iron supplementation is almost universally recommended during

pregnancy to correct or prevent iron deficiency [10,11,12] because dietary consumption of iron is unlikely to meet the daily dietary recommendation of 30mg [13]. Iron supplements of different kinds cause a rise in the haemoglobin levels.

Iron deficiency is the most common cause of chronic anaemia – anaemia that develops over time. Like other forms of chronic anaemia, iron deficiency anaemia leads to pallor, fatigue, dizziness, exertional dyspnoea, and other generalized symptoms of tissue ischaemia[14].

The response of iron-deficiency anemia to iron therapy is influenced by several factors, including the severity of anemia, the ability of the patient to tolerate and absorb medicinal iron, and the presence of other complicating illnesses. Therapeutic effectiveness can be best measured from the resulting increase in the production of red cells. The magnitude of the marrow response to iron therapy is proportional to the severity of the anemia (level of erythropoietin stimulation) and the amount of iron delivered to the marrow precursors. Studies by Hillman and Henderson (1969) demonstrated the importance of iron supply in governing erythropoiesis[15].

Iron deficiency anaemia is the most important indication for medicinal iron. Iron deficiency is the commonest cause of anaemia, especially in developing countries where a sizable population of the country is anaemic. The RBC are microcytic and hypochromic due to deficient haemoglobin (Hb) synthesis. Other metabolic manifestations are seen when iron deficiency is severe. Apart from nutritional deficiency, chronic bleeding from g. i. tract (ulcers, hookworm infestation) is a common cause. Iron deficiency also accompanies repeated attacks of malaria and chronic inflammatory diseases. Several studies on intra-household food allocation shows that women get less food than men relative to their nutritional needs[16,17].

Unequal access to food, heavy work demands, nutritional deficiencies including iron, makes Indian women susceptible to illness, and anaemia. Low intake of ascorbic acid and meat, due to low income reduces the absorption of iron [18]. Iron deficiency can be diagnosed by measuring serum iron levels directly. However, serum ferritin and serum transferrin receptors can help to stratify individuals who are at risk of developing this deficiency even before it gets manifested[19]. The cause of iron deficiency should be identified and treated. Iron should be normally administered orally; parenteral therapy is to be reserved for special circumstances. A rise in haemoglobin level by 0.5 – 1 g/dl per week is an optimum response to iron therapy. It is faster in

the beginning and when anaemia is severe. Later the increase in Hb% declines. However, therapy should be continued till normal haemoglobin level is attained (generally takes 1 -3 months depending on the severity) and 2 – 4 months thereafter to replenish stores because after correction of anaemia, iron absorption is slow[20]. Common adverse effects of oral iron therapy include nausea, epigastric discomfort, abdominal cramps, constipation and diarrhoea[21].

Elemental iron 100mg is used for the treatment of iron deficiency anaemia in pregnancy and 30-60 mg is used as prophylaxis for iron deficiency anaemia in pregnancy, and also for treatment of iron deficiency anaemia in children. Folic acid being a very essential vitamin in process of erythropoiesis has significant role in keeping the cell morphology intact. It is observed that low serum folate levels are associated with the iron deficiency and thus are related to the vicious cycle of deficiencies of iron and folate[22].

What Kind of Iron Increases Haemoglobin Level?

There are oral as well as parenteral iron supplementation available for the patients.

Oral iron supplementation will be used for this study. Dissociable ferrous salts are inexpensive, have high iron content and are better absorbed than ferric salts, especially at higher doses. Some simple oral preparations are ferrous ascorbate, ferrous sulphate, ferrous gluconate, ferrous fumarate and colloidal ferric hydroxide. Also other forms of oral iron formulations such as ferrous succinate, iron choline citrate, iron calcium complex, ferric ammonium citrate, ferrous aminoate, ferrous glycerophosphate and iron hydroxyl polymaltose[23] .

In this study for the comparison of the rise of haemoglobin levels, oral ferrous ascorbate and oral ferrous sulphate supplementation was selected out of the various available oral iron supplementations. Ferrous sulphate and ferrous ascorbate were taken into consideration because ferrous sulphate is available free of cost in the hospital dispensary of Gauhati Medical College and Hospital and in other Government Medical Centres. So, people generally prefer the oral ferrous sulphate tablets. Orally administered ferrous sulphate, the least expensive of iron preparations, is the treatment of choice for iron deficiency (Callender, 1974; Bothwell et al., 1979)[24].

Oral ferrous ascorbate tablets on the other hand, have shown a great promise in the treatment of

iron deficiency states as they also show an increased rise in the haemoglobin levels. It is also expensive than oral ferrous sulphate preparations. Ferrous ascorbate is a synthetic molecule of ascorbic acid and iron. Ascorbic acid enhances absorption of iron. Ascorbic acid reduces ferric iron to ferrous iron, which remains soluble even at neutral pH. Ferrous form is absorbed thrice as much as ferric form of iron, the discrepancy becomes even more, when treated with higher dosage of ferric salts[25].

AIMS AND OBJECTIVES OF THE STUDY:

1. To evaluate and compare the rise of haemoglobin levels in primigravidas and multigravidas after oral iron therapy.
2. To compare the rise of haemoglobin levels of the subjects taking oral ferrous ascorbate and oral ferrous sulphate therapy.

MATERIALS AND METHODS

This study was carried out in the Department of Obstetrics and Gynaecology in Gauhati Medical College and Hospital, Guwahati in 2014-2015 after getting Institutional Ethics Clearance certificate to perform the study.

- ✓ It was a cross-sectional study.
- ✓ A simple random sampling was done.
- ✓ Subjects within 18 to 40 years both vegetarian and non-vegetarian were included.
- ✓ The written consent of pregnant women was obtained prior to collection of blood sample.
- ✓ Data is collected through general information and standardized questionnaire. Pretested questionnaire was including education, trimester, gravida etc.
- ✓ Venous blood samples were drawn from the mothers for the assessment of haemoglobin levels. EDTA (ethylene diamine tetraacetic acid) tubes were used for blood sample collection. Analysis was done on the same day of blood collection.

Inclusion criteria:

1. No history of any gynaecological abnormalities or any haematological abnormalities.
2. No history of malaria, congenital haemoglobinopathies or gastro-intestinal bleeding.
3. Subjects in between the age group of 18 – 40 years were taken for the study.

4. Persons not suffering from chronic anaemia.
5. Persons who came for regular routine check-up and took iron supplements daily as prescribed.
6. Persons not taking any medications that can interfere with iron absorption.
7. Persons who donate have any history of parasitic infections such as hookworm anaemia.
8. Subjects who were not hypersensitive to iron or any of the components or ferrous ascorbate or ferrous sulphate were included in the study.
9. Well balanced diet with proper nutrition.

Exclusion criteria:

1. Persons with gynaecological abnormalities or any haematological abnormalities.
2. History of malaria, congenital haemoglobinopathies or gastro-intestinal bleeding.
3. Subjects who were less than 18 years and above 40 years of age.
4. Persons having obesity, diabetes mellitus and any complication related to pregnancy as well as suffering from chronic anaemia are excluded.
5. Persons who were irregular in their routine check-ups and did not take iron supplements daily as prescribed.
6. Persons with medications that can interfere with iron absorption.
7. Persons having history of parasitic infections such as hookworm anaemia.
8. Subjects suspected of hypersensitivity to iron or any of the components or ferrous ascorbate or ferrous sulphate were also excluded from the study.
9. Diet not balanced and without proper nutrition.

A cross-sectional study was done among two hundred pregnant women of age group 18 to 40 years who were randomly selected and were without any co-morbidities in Gauhati Medical College and Hospital. Then two groups were created. One group comprised of one hundred pregnant women who took oral ferrous ascorbate in tablet form and another group comprised of one hundred pregnant women who similarly took oral ferrous sulphate in tablet form. In case of the oral ferrous ascorbate group, all the subjects belonging to that group who were involved in the study were dispensed with fixed-dose combination (FDC) of ferrous ascorbate (equivalent to elemental iron 100mg) and folic acid 1.5mg oral tablets, one tablet once a day after meal. Similarly in the case of oral ferrous sulphate group also all the subjects belonging to that group

who were involved in the study were dispensed with fixed-dose combination (FDC) of ferrous sulphate (equivalent to elemental iron 100mg) and folic acid 0.5mg oral tablets, one tablet once a day after meal. Each of the group was again comprised of fifty primigravidas and fifty multigravidas respectively. Haemoglobin levels in the first trimester before the initiation of iron supplementation as well as the haemoglobin levels towards the end of third trimester near her expected date of delivery after intake of iron supplementation were evaluated.

Spectrophotometric methods were used for the determination of haemoglobin levels.

Statistical analysis was done using IBM SPSS Ver. 21.0. Student's t test was performed considering $P < 0.05$ to be significant.

Spectrophotometric method for estimation of haemoglobin concentration:

These methods are rapid and give accurate results. They are oxyhaemoglobin method and cyanmethaemoglobin method. Here, cyanmethaemoglobin method was used for the estimation of the haemoglobin levels.

Cyanmethemoglobin method:

When blood is diluted by a solution containing potassium ferrocyanide and potassium cyanide the haemoglobin is converted into cyanmet haemoglobin. The haemoglobin content of the blood is estimated by photo-electric colorimeter. All forms of haemoglobin are converted into cyanmet haemoglobin, hence the method is very accurate for haemoglobin estimation.

RESULTS

For evaluation, the following steps were done.

The group of fifty primigravidas under oral ferrous ascorbate supplementation and the group of fifty primigravidas under the oral ferrous sulphate supplementation were taken as a single group now. So, the new group thus formed contained one hundred primigravidas.

Similarly, another group of one hundred multigravidas was created which contained the fifty multigravidas who were under the ferrous ascorbate supplementation as well as the fifty multigravidas who were under the ferrous sulphate supplementation respectively. So this group also now contained one hundred multigravidas.

The statistical analysis after performing paired t test shows that the group of primigravidas showed a mean haemoglobin level of 12.092 ± 1.007 towards the end of the third trimester, which in the first trimester was 10.452 ± 0.9050. It shows that there was a mean rise of haemoglobin levels and the mean rise is found to be 1.640 ± 0.7793 (t=21.045, p<0.0001, considered extremely significant).

Similarly, statistical analysis after performing paired t test shows that the group of multigravidas showed a mean haemoglobin level of 11.668 ± 0.9476 towards the end of the third trimester, which in the first trimester was 10.264 ± 0.7714. It shows that there was a mean rise of haemoglobin levels and the mean rise is found to be 1.404 ± 0.6432 (t=21.828, p<0.0001, considered extremely significant).

The result showed a mean difference in the rise of haemoglobin levels in between the two groups and the mean rise was more in the case of the group of primigravidas than that of the group of the multigravidas and independent unpaired t test showed that it was statistically significant (t=2.336, p=0.0205, considered significant as p<0.05) (see Table 1 and Figure 1).

After performing independent unpaired t test, the results were:

Table 1:

S. No.	GROUP	n	MEAN	t = 2.336
1.	Primigravidas	100	1.64	p = 0.0205.
2.	Multigravidas	100	1.404	Significant.

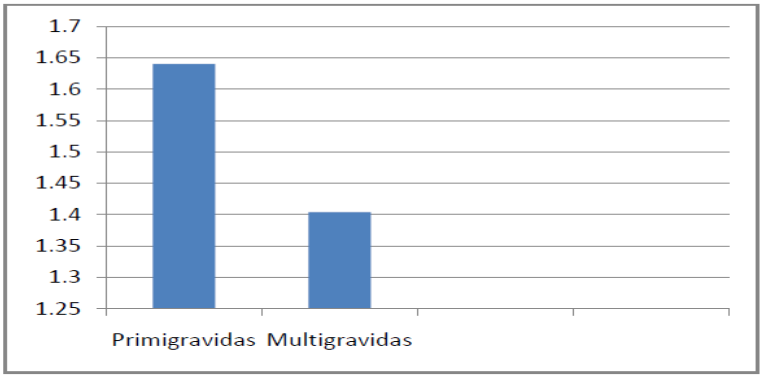

Figure 1: This figure shows that the mean rise of haemoglobin levels in case of the group of primigravidas is more than that of the respective group of multigravidas.

Now, to compare the rise of haemoglobin levels in between oral ferrous ascorbate and oral ferrous sulphate supplementation, at first a single group of oral ferrous ascorbate was created which consisted of one hundred pregnant women out of whom fifty women were primigravidas under oral ferrous ascorbate supplementation and the other fifty women were the multigravidas who were under the oral ferrous ascorbate supplementation. Similarly, another group of one hundred pregnant women who took ferrous sulphate was formed which consisted of the fifty primigravidas who took oral ferrous sulphate supplementation and the fifty multigravidas who took oral ferrous sulphate supplementation respectively.

The statistical analysis after performing paired t test shows that the oral ferrous ascorbate group showed a mean haemoglobin level of 12.29 ± 1.002 towards the end of the third trimester, which in the first trimester was 10.406 ± 0.7874. It shows that there was a mean rise of haemoglobin levels and the mean rise is found to be 1.884 ± 0.6838 ($t=27.551$, $p<0.0001$, considered extremely significant).

Similarly, the statistical analysis after performing paired t test shows that the oral ferrous sulphate group showed a mean haemoglobin level of 11.47 ± 0.8118 towards the end of the third trimester, which in the first trimester was 10.31 ± 0.9006. It shows that there was a mean rise of haemoglobin levels and the mean rise is found to be 1.160 ± 0.5628 ($t=20.610$, $p<0.0001$, considered extremely significant).

The result showed a mean difference in the rise of haemoglobin levels in between the two groups and the mean rise was more in the case of the group of oral ferrous ascorbate supplementation than that of the group of the oral ferrous sulphate supplementation and independent unpaired t test showed that it was statistically significant ($t=8.175$, $p<0.0001$, considered extremely significant) (see Table 2 and Figure 2).

After performing independent unpaired t test, the results were:

Table 2:

S. No.	GROUP	n	MEAN	t = 8.175 p < 0.0001 Extremely significant.
1.	Ferrous ascorbate group containing both primigravidas and multigravidas	100	1.884	
2.	Ferrous sulphate group containing both primigravidas and multigravidas	100	1.160	

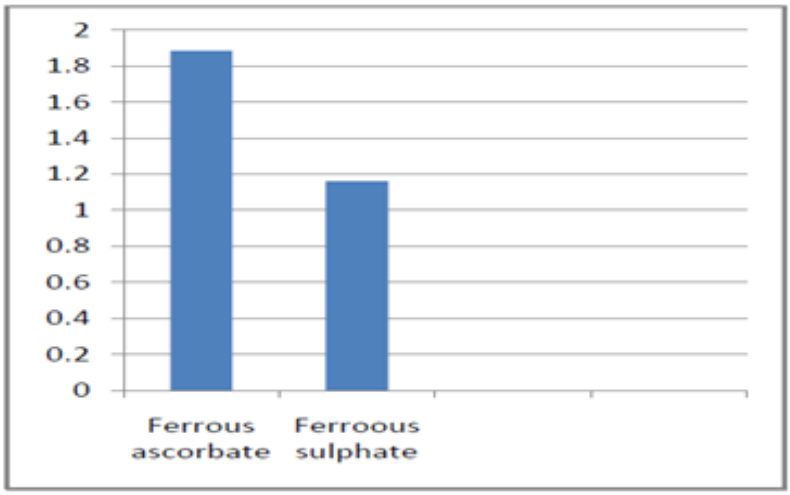

Figure 2: This figure shows that the mean rise of haemoglobin levels of the oral ferrous ascorbate group containing both the primigravidas and the multigravidas is more than that of the respective oral ferrous sulphate group containing both the primigravidas and the multigravidas.

DISCUSSION

Low haemoglobin in the blood is widely identified as the commonest haematological abnormality and it is associated with adverse pregnancy outcome as haemoglobin levels continue to fall as pregnancy advances[26,27]. During pregnancy the physical adjustments vary depending upon the health status of pregnant female, genetic determinants of fetal size and maternal lifestyle. Multigravida women showed a significant lowering of their serum iron status as compared to the primigravida subjects as quoted in other studies[28-29]. The most important cause of haemoglobin lowering in pregnant females is relative hemodilution due to plasma expansion by 30-50%[30]. In multigravida females in addition to this plasma expansion, iron deficiency can play a major role in lowering the haemoglobin concentration and therefore making them more prone to develop anemias as compared to the primigravidas[31]. The risk of developing iron deficiency is higher in multigravidas as compared to primigravidas[32].

It is an established fact that maternal iron stores become depleted in second and third trimesters of pregnancy. Most of the iron transfer from mothers to fetus occurs during this period which corresponds to the time of peak efficiency of maternal iron absorption[30]. Also, analysis of data of multigravida subjects in order to determine the effects of spacing and number of children on their iron status revealed that the women who had a spacing period of upto one year between the

subsequent pregnancies had lower iron levels as compared to those having spacing of upto two years. This data further strengthens the fact that minimum spacing recommended should be two years in between subsequent pregnancies as recommended by WHO[33]. Haider et al and Elhassan et al concluded that both spacing and number of children affects the iron status of the female[34-35]. In addition, in developing countries, anaemia is common even among non-pregnant women, and anaemia develops rapidly because in most cases iron stores were depleted even before a pregnancy starts[36]. Subsequent pregnancies in a shorter period can have ominous effect on the mother and baby and can also affect the health of already born children. Repeated pregnancies with narrow spacing should best be avoided by adopting appropriate family planning measures.

CONCLUSION

This study has shown that there occurs more rise in the haemoglobin levels in primigravidas as compared to the multigravidas after oral iron supplementation. Also, oral ferrous ascorbate has shown more mean rise in the haemoglobin levels than that of oral ferrous sulphate. So, in during pregnancy iron supplementation is a must as practised worldwide as it gives rise to positive health effects and in this way we can protect the mothers from the grasps of iron-deficient anaemic conditions. Appropriate recommendations for large scale, public health oral iron supplementation programs as a means of reducing global maternal anaemia should be instituted. Illiteracy was a set back here as even though the benefits of iron supplementation were explained to them, many of them still hesitated to take. So, the sample size could not be a very large one. Also, the comparison of rise of haemoglobin levels could have been done in between primigravidas and multigravidas and/or in between primigravidas and primigravidas and/or in between multigravidas and multigravidas according to their age groups. But due to deficiency of large sample size it could not be done. There is also a prospect of doing a large sample study in this regard.

Methodologically rigorous evaluation is needed to determine the physiological benefits of iron supplementation and the effectiveness of other approaches such as prevention of hookworm infestation, food fortification etc. in reducing maternal anaemia. The health care system also needs to improve to offer treatment and facilities of maternal health in even the remote areas of the country. Providing of good iron supplements free of cost in every set ups. Also, a rigorous

system of the follow up of the patients is needed, so that utmost care can be given to them, both moral and medical support along with educational awareness. Family planning plays a vital role both in the health of the mother as well as her child. This will improve not only the maternal health but the entire health care infrastructure as a whole. This will improve our lives itself. Lastly, there is a famous saying that GOD could not be everywhere and so he created MOTHERS. So, we must take care and protect our mothers by any means necessary.

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