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**Original Research Article**

# Anaemia in pregnancy: prevalence and treatment response to various modalities: a prospective study

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## ABSTRACT

**Background:** Anaemia seen in pregnancy are largely preventable and easily treatable if detected in time, despite this, anaemia still continues to be a common cause of maternal and perinatal morbidity and mortality in India.
**Methods:** A prospective observational study of 200 pregnant women with anaemia was carried out from Jun 2017 to December 2018 at a Tertiary care hospital with pan India population. Patients underwent clinical examination and laboratory tests to find out the severity and type of anaemia and were treated accordingly. Iron deficiency anaemia was treated with oral or intravenous iron therapy depending upon the hemoglobin concentration. Patients were followed up after 28 days of treatment and hemoglobin estimation was done to monitor the treatment response.
**Results:** A total 36.49% pregnant women had hemoglobin less than 10 gm%. 151 out of 200 women had serum ferritin <12 ng/ml which indicates that iron deficiency anaemia is the commonest type of anaemia in pregnancy. Overall, out of 200 patients 5.5% patients were found to have hemoglobinopathies (β thalassemia trait). After 28 days of treatment mean increase in hemoglobin was 2.40 gm% and 4.24 gm% in patients receiving oral and intravenous iron therapy respectively.
**Conclusions:** A total 36.49% pregnant women were found to have anaemia during pregnancy and iron deficiency anaemia is the commonest type of anaemia. Therefore, there is still a need for dietary counselling and health education in the community. 5.5% patients were found to have beta thalassemia trait which was detected only after conducting hemoglobin electrophoresis. Both oral and intravenous iron therapy are effective in treatment of iron deficiency anaemia but intravenous iron therapy results in a more rapid resolution of anaemia.

**Keywords:** Anaemia, β thalassemia trait, Intravenous iron therapy, Oral iron therapy, Pregnancy

## INTRODUCTION

Anaemia is a major global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. Although the mean minimum by WHO criteria is taken to be 11 g/dL, in developing countries the limit of acceptance to 10 g/dL would not be wrong.[1] According to WHO it is estimated that 41.8% of pregnant women are anaemic worldwide. It affects about 18% of pregnant women in developed and 35-75% of pregnant women in developing countries.[2] However, according to the nutrition impact model study 2011 estimates, the worldwide prevalence of anaemia in pregnant women was 38% translating into 32 million pregnant women globally.[3]

In India, this prevalence has been reported to be in the range of 33.0%-89.0% and 16% of maternal mortality is attributed to anaemia.[4]

Particularly in India the prevalence is high because of low dietary intake, poor iron and folic acid intake, poor bioavailability of iron in phytate and fibre rich Indian diet

and chronic blood loss due to infection such as malaria and hookworm infestation. Other causes of anaemia include diarrhoea, HIV/AIDS and other infections, genetic disorders (e.g., sickle cell and thalassemia), blood loss during labour and delivery, heavy menstrual blood flow and closely spaced pregnancies.

The early stages of anaemia in pregnancy are often symptomless. However, as the hemoglobin concentration falls, oxygen supply to vital organs declines and the expectant mother begins to complain of general weakness, tiredness and headaches. Pallor of the skin and of the mucous membrane may not become noticeable until hemoglobin drops to about 7.0 g/dl. With a further fall in hemoglobin concentration to 4.0 g/dl, most tissues of the body become starved of oxygen and the effect is most marked on the heart muscles, which may fail altogether.[5]

There is usually a 2 to 3-fold increase in perinatal mortality rate when maternal hemoglobin levels fall below 8.0 g/d1 and 8 to 10-fold increase when maternal hemoglobin levels fall below 5.0 g/dl. A significant fall in birth weight due to increase in prematurity rate and intrauterine growth retardation has been reported when maternal hemoglobin levels were below 8.0 g/dl.[6,7]

### *Aim*

To study the prevalence of anaemia in pregnancy and response to treatment by various modes in a tertiary care hospital.

### *Objectives*

1. To study the prevalence of different types of anaemia in pregnancy
2. To determine the commonest type of anaemia in pregnancy.
3. To study the response to treatment for the commonest type of anaemia by various modes.

## METHODS

This is a prospective observational study conducted in department of obstetrics and gynecology at a tertiary care hospital from Jun 2017 to Dec 2018. The patients were from pan India in origin.

Study population included all pregnant women who were booked in their first or second trimester at the antenatal clinic.

Hemoglobin estimation was done for all patients for the detection of anaemia and those with hemoglobin less than 10 gm% were registered as cases of anaemia and included in the study.

A total of 200 pregnant women who fulfilled the inclusion and exclusion criteria were selected for the study. All pregnant women with anaemia were selected till the stipulated sample size was achieved.

### *Inclusion criteria*

Pregnant women with singleton pregnancy with hemoglobin less than 10 gm% (booked cases), uncomplicated pregnancy by ruling out any medical/ surgical illness and bleeding disorders and willingness of the patient to participate in this study.

### *Exclusion criteria*

Patients with chronic medical diseases as chronic heart disease, diabetes mellitus, tuberculosis, chronic renal disorders. History of antepartum haemorrhage, multiple pregnancies. Patients with bleeding disorders, patients having history of blood transfusion during present pregnancy. Infections-malaria, HIV, kala azar were excluded from the study.

### *Socio-demographic data collection procedures*

Detailed history was taken from all patients regarding age, gravidity, parity, education status, occupation, family income, period of gestation, number of abortions, menstrual history, dietary habits, drug history, etc., by interviewing the patients using a predesigned proforma.

History was also taken regarding any chronic medical diseases, family history of hemoglobinopathies or bleeding disorders and infections.

### *Clinical examination*

All patients underwent a thorough clinical examination and height and weight of all patients was noted. Patient was also checked for signs of pallor, icterus, cyanosis and koilonychia. Any sign suggestive of malnutrition was noted and attention was given to thyroid and lymph nodes. Examination of respiratory system, cardiovascular system and obstetrical examination was also done.

### *Laboratory tests*

All selected patients underwent baseline hemoglobin estimation. RBC indices including PCV, MCV, MCH, MCHC, PBS (peripheral blood smear), Serum TIBC, serum iron and serum ferritin was also done for all patients. Stool and urine examination were done for all patients.

Hemoglobin, PCV, MCV, MCH, MCHC were measured by an autoanalyzer. PBS was done using Leishman stain. Serum TIBC and Serum Iron was done by Ferrozine method (spectrophotometry) and serum ferritin was done by chemiluminescent immunoassay.

All patients with serum ferritin <12 µg/L were classified as iron deficiency anaemia. Those with serum ferritin >12

µg/L underwent hemoglobin electrophoresis to rule out hemoglobinopathies.

The commonest type of anaemia was thus found and treatment was given accordingly.

***Treatment***

All pregnant patients attending antenatal clinic were supplemented with folic acid tablets 5mg daily and all patients detected with anaemia were given anthelminthic treatment in the form of tablet albendazole 400 mg stat and repeated after 2 weeks.

Patients with hemoglobinopathies were treated according to hemoglobin level. Blood transfusion was reserved for patient with hemoglobin less than 6 gm% and for those with hemoglobin more than 6 gm% no treatment was given but blood was kept available in the blood bank.

Patients with iron deficiency anaemia were treated with oral or intravenous iron therapy depending upon their hemoglobin concentration. Hemoglobin more than 8 gm% was treated with oral iron therapy- tablet ferrous sulphate 20 0mg twice daily (each tablet containing 60 mg of elemental iron) was initiated. Hemoglobin less than 8 gm% was treated with intravenous iron therapy in the form of iron sucrose

*The dose was calculated as follows*

Required iron dose (mg) = (2.4 × (target hemoglobin-actual hemoglobin) × pre-pregnancy weight (kg)) + 500 mg for replenishment of stores.[8]

Target hemoglobin was set as 12 gm%. Calculated dose was rounded off to nearest hundred and patients were given 200 mg elemental iron in the form of iron sucrose on alternate days.

Patients on oral iron therapy were treated on outpatient department (OPD) basis and were asked to take Iron tablets 2 hours before or after meals and preferably with citrus juice. Patients were followed up in the OPD and adverse effects if any told by the patient were noted.

Patients on intravenous iron therapy were admitted to the hospital and were given the calculated dose in fractions of 200 mg elemental iron on alternate days. In each infusion 200 mg of elemental iron was diluted in 100 ml of 0.9% normal saline. Initially the infusion was given @ 8-10 drops/min for 10-15 min and patient was monitored for signs of intolerance such as anaphylactic reactions or hypotension. Later the remaining dose was given @100-120 ml/hour. Blood pressure was measured before, during and after each infusion.

Patients were followed up after 28 days of treatment. Detailed history, general and obstetric examination and adverse effects if any were noted. Hemoglobin estimation was repeated after 28 days of treatment to monitor the treatment response.

The study was approved by the ethical review committee of the hospital.

***Statistical analysis***

The collected data was compiled tabulated and analysed using Microsoft excel 2007 and statistical package for social sciences (SPSS) software version 11.

## RESULTS

Total of 2359 were booked in the antenatal clinic out of which 861 patients i.e., 36.49% were found to have hemoglobin less than 10 gm%.

**Table 1: Distribution of cases according to age.**

| Age in years | Number of patients (N=200) | Percentage |
|---|---|---|
| **<20** | 3 | 1.5 |
| **20-25** | 124 | 62 |
| **26-30** | 68 | 34 |
| **>30** | 5 | 2.5 |
| **Total** | 200 | 100 |

**Table 2: Distribution of cases according to the gravidity.**

| Gravidity | Number of cases (N=200) | Percentage |
|---|---|---|
| **1** | 102 | 51 |
| **2** | 56 | 28 |
| **3** | 36 | 18 |
| **4** | 6 | 3 |
| **Total** | 200 | 100 |

Women between 20-25 years age group constituted the largest (62%) number of cases. The mean age of the patient in the study was 24.51±2.758 years with 19 years as minimum age and 33 years as maximum age.

Table 2 shows that 51% patients were primigravida's and of the remaining (49%) 28%, 18% and 6% were second, third and fourth gravida respectively.

**Table 3: Distribution of cases according to education status.**

| Education status | Number of cases (N=200) | Percentage |
|---|---|---|
| **Matric** | 14 | 7 |
| **Post metric diploma** | 10 | 5 |
| **Graduate** | 143 | 71.5 |
| **Post graduate** | 33 | 16.5 |
| **Total** | 200 | 100 |

Table 3 shows that 71.5% patients were graduates and minimum qualification was matric (7%) and maximum qualification was post-graduation (16.50%).

Table 4 shows that majority of patients i.e., 55.5% had haemoglobin levels between 7-8.9 gm%, 7% of the cases had haemoglobin between 4-6.9% and 37.5% had haemoglobin between 9-9.9 gm%. Mean baseline hemoglobin level was 8.596±2.13 gm% and no patient had haemoglobin less than 4 gm%.

**Table 4: Distribution of cases according to baseline hemoglobin.**

| Baseline Hb (gm%) | Number of cases (n=200) | Percentage |
|---|---|---|
| **<4** | Nil | 0 |
| **4-6.9** | 14 | 7 |
| **7-8.9** | 111 | 55.5 |
| **9-9.9** | 75 | 37.5 |
| **Total** | 200 | 100 |

**Table 5: Distribution of cases according to serum ferritin levels.**

| Serum ferritin | Number of cases (n=200) | Percentage |
|---|---|---|
| **<12** | 151 | 75.5 |
| **≥12** | 49 | 24.5 |
| **Total** | 200 | 100 |

Table 5 shows that 75.5% of patients had Serum Ferritin levels below 12 and the remaining 24.5% had levels more than 12. Mean Serum Ferritin was 10.57. Standard deviation was 3.774.

**Table 6: Distribution of cases according to hemoglobin electrophoresis results.**

| Hemoglobin electrophoresis | Number of patients (n=49) | Percentage |
|---|---|---|
| **Normal** | 38 | 77.55 |
| **Haemoglobinopathies** | 11 | 22.45 |
| **Total** | 49 | 100 |

**Table 7: Distribution of cases according to the treatment given.**

| Treatment given | Number of cases (n=189) | Percentage |
|---|---|---|
| **Oral iron therapy** | 143 | 75.7 |
| **Intravenous iron therapy** | 46 | 24.3 |
| **Total** | 189 | 100 |

Table 6 shows that out of 49 patients who underwent hemoglobin electrophoresis 22.45% were detected to have haemoglobinopathies (β thalassemia trait) and 77.55% were found to have normal hemoglobin electrophoresis. Overall, out of 200 patients 5.5% patients were found to have haemoglobinopathies (β thalassemia trait).

Table 7 shows that out of 189 patients who received treatment 75.7% received oral iron therapy and 24.3% received intravenous iron therapy. The remaining 11 patients were found to have haemoglobinopathies (β thalassemia trait) with adequate iron stores therefore were not given iron therapy.

**Table 8: Distribution of cases according to adverse effects.**

| Adverse effects | Oral iron (n=143) number (%) | Intravenous iron (n=46) number (%) |
|---|---|---|
| **Nausea/vomiting** | 8 (5.59) | 2 (4.34) |
| **Constipation/ diarrhoea** | 11 (7.69) | Nil |
| **Dizziness** | Nil | 1 (2.17) |
| **Thrombophlebitis** | Nil | 2 (4.34) |
| **Fever** | Nil | Nil |
| **Rash** | Nil | Nil |
| **Hypotension** | Nil | Nil |
| **Myalgia** | Nil | Nil |

Table 8 shows that of the 143 patients who received oral iron 19 (13.29%) had adverse effects in the form of nausea/vomiting (5.59%) and constipation/ diarrhoea (7.69%).

**Table 9: Treatment response after 28 days of treatment.**

| Mean hemoglobin | After oral iron (gm%) | After intravenous iron (gm%) |
|---|---|---|
| **Baseline** | 9.04 | 7.19 |
| **After 28 days** | 11.44 | 11.34 |
| **Increase** | 2.40 | 4.25 |
| **Standard deviation** | 0.20962 | 0.25100 |
| **P value** | <0.0001 | <0.0001 |

Table 9 shows that mean hemoglobin was 11.44±0.20 gm% and increase in haemoglobin was 2.40 gm% in patients receiving oral iron therapy after 28 days of treatment whereas mean hemoglobin was 11.34±0.25 gm% and increase in hemoglobin was 4.24 gm% in patients receiving intravenous iron therapy after 28 days of treatment. P value was significant in both.

## DISCUSSION

The overall prevalence of anaemia was found to be 36.49% which is almost similar to Stevens et al which was (38%, 33-43) for pregnant women, Kochhar et al who found that approximately one third of pregnant

women are anemic with hemoglobin levels below 10 g/dL.[3,9] The prevalence was low as compared to WHO worldwide prevalence of anaemia which was 48.2% (43.9-52.5). The reason for which may be the different cut-off levels of hemoglobin which was taken as 10 gm% in this study whereas 11 gm% by WHO.

In this study majority of the patients were primigravida (51%) and nullipara (56%) which indicates that most women begin their pregnancy with partially or completely depleted iron reserves. Thus, the severity of the anaemia is inversely related to the amount of iron reserves. Similar results were described by Gupta et al and Breymann.[10,11]

The education status of the patient is an important factor as it makes the patient receptive to the advice of the health staff. In this study 71.5% patients were graduates. Other studies Ahmad et al also found significant association between the education status, prevalence of anaemia and treatment response.

In this study the mean baseline hemoglobin was 8.596±2.13 gm%. 55% patients had moderate grade of anaemia and 7% patients were found to have severe anaemia. According to a study conducted in 16 districts of India 56.7% pregnant women were found to have moderate degree of anaemia.[12] In studies by Vijaynath et al, Kriplani et al and Saraswathi et al the proportion of pregnant women having moderate degree of anaemia was 61.83%, 68% and 50.9% respectively.[13-15]

World Health Organization (WHO) and centres for disease control (CDC) technical consultation on the assessment of Iron status at the population level concluded that hemoglobin and ferritin were the most efficient combination of indicators for monitoring the iron status of a population. When anaemia is accompanied by an indicator of iron deficiency (e.g., hypoferritinaemia) it is referred as iron-deficiency anaemia (WHO 2011).

This study showed that 76% women had serum ferritin <12. Mean serum ferritin was 10.57±3.77. Similar observations were found in studies by Kriplani et al and Sharma et al, which indicate that iron deficiency anaemia is the commonest type of anaemia in pregnancy.[14.16] Gupta et al found that iron deficiency is responsible for 95% of anaemia during pregnancy.[10]

A total 49 patients who were found to have serum ferritin levels >12 underwent hemoglobin electrophoresis. Of these 11 patients were found to have β thalassemia trait. Overall, out of 200 patients 5.5% patients were detected to have β thalassemia trait which is an important finding. Varawalla et al found that beta thalassemia is the most prevalent disorder in India with an overall frequency of 7.0%.[17] It is estimated that more than 25 million people in India, are carriers of the beta thalassemia gene and 8000 children are born every year with thalassemia major.[18] Madan et al found that the overall carrier frequency of beta thalassemia trait was 4.05%.[19]

In this study a total of 189 (94.5%) patients who were found to have iron deficiency anaemia of which 143 (75.7%) received oral iron therapy and 26 (24.3%) received intravenous iron therapy depending on the severity of anaemia. Gupta et al also found that Iron deficiency is responsible for 95% of anaemia during pregnancy.[10]

This study shows that out of 143 patients who received oral iron 19 (13.29%) had adverse effects in the form of nausea/ vomiting (5.59%) and constipation (4.19%) and of the 46 patients who received intravenous iron 6 (10.8%) had adverse effects in the form of nausea/vomiting (4.34%), dizziness (2.17%) and thrombophlebitis (4.34%). No serious side effects or anaphylactic reactions were observed. Similar results were found by Perewusnyk and Breymann.[21] Sharma et al also found that gastrointestinal side effects were observed more frequently in the oral iron group than in the parenteral iron group.[16] Dyspepsia, constipation, diarrhea and vomiting were seen in 10%, 5%, 3%, and 2% of the women in the oral iron group, respectively.

Post treatment hemoglobin after 28 days of treatment was 11.44±0.20 gm% and average increase in hemoglobin was 2.4 gm% in patients receiving oral iron therapy which was statistically significant (p value <0.0001). Patients who received intravenous iron therapy had a mean hemoglobin was 11.34±0.25gm% and average increase in hemoglobin was 4.2 gm% which was also statistically significant (p value <0.0001). The results were similar to studies conducted by Suharno.[20] Al et al found a significant rise in hemoglobin in patients receiving intravenous iron on day 28 (p value <0.001).[21] Perewusnyk et al and Kriplani et al also found significant rise in hemoglobin after 28 days of treatment with intravenous iron sucrose.[14,22] Similar results were found in studies conducted by Kochhar et al who found that increase in haemoglobin was 3.1 gm% and 5.1 gm% after 4 weeks of treatment.[9]

According to this study both oral iron and intravenous iron are effective in increasing the hemoglobin levels but intravenous iron sucrose results in much more rapid resolution of iron deficiency anaemia and has lesser side effects.

## CONCLUSION

This study concluded that 36.49% pregnant women were found to have anaemia in pregnancy. The age distribution was statistically significant as majority of women were in the age group of 20-25 years and majority of patients were primigravida and nullipara which indicates that most ladies enter pregnancy with poor iron reserves. Therefore, there is still a need for dietary counselling and health education in the community to tackle the issue of

anaemia in pregnancy. Another important finding was that 5.5% patients were detected to have beta thalassemia trait. The study concludes that both oral iron therapy and intravenous iron therapy are effective in treatment of anaemia but intravenous iron therapy results in a more rapid resolution of anaemia with minimal side effects and circumvents the problem of compliance.

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