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Comparative Study of Different Oral Iron Preparations in Females of Reproductive Age Group

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Anemia (anemia) is a decrease in the total amount of red blood cells (RBCs) or hemoglobin in the blood, or a lowered ability of the blood to carry oxygen. The commonness of iron inadequacy is high in all age bunch females. Around 32.4% of ladies have mellow iron deficiency, 14.19% ladies have direct sickliness, 2.2% have serious weakness.
Objective: The aim of the study is to compare the efficacy and safety profile of oral iron formulations in iron deficiency anemia.
Methods: A cross sectional study in patients with anemia receiving oral ferric ammonium citrate, folic acid, vitamin B12and iron hydroxide respectively was included. The patients were followed up once in 0 day, end of week, 1 month, for 3 months and observed for hematological improvement and adverse drug reactions (ADRs). Total 350 anemic patient were included in the study.
Results: The data analyzed in 185 patients received ferric ammonium citrate, folic acid, 165 received, iron hydroxide,folic acid, vitamin B12 have significantly improved mean hemoglobin and anemia indices at the end of study, however, there was no significant differences between the groups when compared. "All four formulations showed similar ADR profile, there was no significant difference in adverse reactions.''
Conclusion: Ferric ammonium citrate can be considered as best cost-effective choice for treatment of irons deficiency anemia.

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Keywords: Anemia; iron formulations; efficacy; safety; cross sectional study; female age group.

1. INTRODUCTION

Anemia (also written anemia) is a condition in which the overall number of red blood cells (RBCs) or hemoglobin in the blood is reduced, or the blood's capacity to contain oxygen is reduced. Paleness is the most well-known hematological problem in blood. Iron deficiency is very widespread in females of all ages. About 32.4 percent of women suffer from mild iron deficiency, 14.19 percent from direct sickness, and 2.2 percent from severe fatigue. In non-pregnant females of reproductive age, the WHO's hemoglobin limit for iron deficiency is 12g/dl, and in breastfeeding, it's 11g/dl. According to the WHO, 35 percent to 75 percent of pregnant women in developing countries suffer from fatigue. In India, 65 percent of the population lives in towns, while 35 percent lives in rural areas. According to recent WHO data, India is among the countries with a high prevalence of iron deficiency in pregnant women (>40 percent) [1]. Iron deficiency starts in infancy, continues through puberty, and becomes exasperated through pregnancy. Because of the hormonal modifications that occur during breastfeeding, the Centers for Disease Control (CDC) recommends that hemoglobin levels in pregnant women not dip below 10.5 g/dl in the second trimester [2]. Unfavorable obstetric outcomes such as cardiac failure, pre-eclampsia, antepartum drain, infant blues discharge, puerperal sepsis, lactation disappointment, and delayed wound healing are both caused by anemia [3]. Anemia is a significant cause of maternal death. During the baby blues time, anemia increases the risk of blood transfusion. The most widely used iron preparation in the world is ferrous sulfate [4]. There are several oral iron descriptions available. Iron deficiency is described as a subjective or quantitative inadequacy of flowing hemoglobin, resulting in a reduction in the red platelets' oxygen transporting capacity to the tissues [5]. Gentle (10.9-9.0 gm percent), direct (8.9-7.0 gm percent), and serious (7.0 gm percent) are the three degrees [6]. An in-depth investigation was performed to evaluate the right oral iron substitute for improving iron deficiency sickliness in pregnant women, as well as to assess their averageness, as this has an effect on patient quality and the beneficial outcome. The normal iron requirement during pregnancy is 4 mg/day; this varies from 2.5 mg/day in early pregnancy to 6-8 mg/day from 32 weeks onwards. Since press assimilation of food is less than 10%, it takes at least 40-60 mg of iron in the diet to achieve 4-6 mg of ingestion, and if pre-pregnancy iron reserves are poor, the amount of iron needed during the last half of the pregnancy can't be reached by consuming less calories alone [7]. Preterm delivery, perinatal death, maternal postpartum distress, and hampered social development and psychological potential of the offspring have all been linked to iron deficiency during pregnancy [8]. As a result, iron supplementation is deemed mandatory to improve the mother's iron condition during pregnancy [9]. Oral iron arrangements come in a number of shapes and sizes. Ferrous salts such as ferrous sulfate, ferrous fumarate, and ferrous gluconate are often utilized since ferrous iron is best preserved. Our study is the key investigation in which two popular iron supplements (ferrous sulfate and ferrous fumarate) are compared. Supplementation therapy may also be prescribed as a preventative measure in some situations, such as for pregnant women, hemodialysis patients, and newborns of low birth weight. Intravenous iron administration is provided in extreme situations, such as significant blood loss or a severe shortage of healthy substance [10]. Oral iron supplementation is available in two forms: as a prescription-only option or as a prescription-only option that requires a restorative specialist's prescription.

In India, the first initiative for the prevention and management of frailty was launched in 1970. From that point on, the industry has been flooded with a vast variety of oral (capsules, pills, and syrup frames) and injectable arrangements promising superiority over one another in terms of adequacy, consistency, greater passability, less reactions, and faster renewal of iron reserves in the body, yet with no genuine writing to back up their claims. Both pregnant women are issued 100 iron folic corrosive tablets as part of the paleness management scheme. The most well-known iron salt used in oral iron supplements is ferrous sulfate, although it has been known to trigger intestinal reactions in certain people. Compared to ferrous sulfate, ferrous fumerate has less stomach responses and is absorbed more quickly. Absorption and adequacy are stronger for ferrous salt structures. The amount of elemental iron in hemoglobin and the degree of iron absorption from the gut determine the actual increase of hemoglobin. In

general, preparations with a higher elemental iron content have fewer side effects. More iron formulations contain more iron, cause fewer side effects, and are more tolerable.

Mechanism and Site of Absorption of Iron with Factors Facilitating and Retarding ItsAbsorption
Iron deficiency remains the most prevalent source of anemia globally, notwithstanding the reality that iron is the second most plentiful element in the earth's crust. The body hoards iron so successfully that it has evolved little method for iron excretion over thousands of years of evolution. The only way to regulate iron reserves physiologically is by absorption. The majority of absorption takes place in the duodenum, with the remainder occurring in the small intestine's distal portion. Because of the lower pH caused by gastric acid processing, ferrous iron is quickly transformed to ferric form in the duodenum at physiological pH. Iron may be consumed as a heme protein or in its ferrous shape as part of a protein. Phytates, tannates, lead, calcium, zinc, manganese, and widespread use of PPIs reduce ferric to ferrous form, which is easily absorbed into the lining mucosa by divalent metal transporter and then either deposited in intestinal cells as ferritin or released in the blood via iron exporter ferroport in Phytates, tannates, lead, calcium, zinc, manganese, and widespread use of PPIs (e.g omeprazole). Slow-release formulations release iron in the distal small intestine when the medium is alkaline, while iron is maximally consumed in the proximal intestine/duodenum in comparatively acidic media, according to studies. Different iron preparations in tablet shape, such as ferrous ascorbate, ferric ammonium citrate, ferrous bisglycinate, and ferrous fumarate, as well as syrup preparations, such as ferrous ascorbate, ferric glycine, colloidal iron, and ferric ammonium citrate, tend to have different pharmacodynamics and pharmacokinetics, altering their net impact on medicinal. The study's aim is to identify the iron preparation with the most desirable results and the fewest side effects. This research was carried out on anemic females of reproductive age. The study's ultimate goal is to develop an iron preparation with high elemental iron content, better enforcement, less side effects, and significant improvements in hematological parameters.

2. MATERIALS AND METHODS

2.1 Materials

All females of 18 to 54 years of age were incorporated into the investigation. Syrup Forms: Ferric ammonium citrate, Folic acid, Vit.B12, Ferric hydroxide. Drugs: Dexorange –Pregnant, Tonoferon-Non-Pregnant.

2.2 Methodology

The present examination is a cross sectional investigation. The study period was 6 months and study place were GSVM Medical College Kanpur.

Incorporation Criteria: All females of conceptive age with direct pallor (7-9.9 gm %).

2.3 Avoidance Criteria

- Females <15 years age and females with >54 years age.
- Females with Hb<7gm%
- Intolerance to oral iron arrangements as intemperate sickness and regurgitating, gastrointestinal narrow mindedness and soforth.
- Patients with uncontrolled hypertension, diabetes, hepatic and renal infections, tuberculosis, hypothyroidism and fundamental sicknesses might beavoided.

The selected ladies were haphazardly divided into different groups based on the medication (oral iron arrangements) that had been assigned to them. Patients were given different oral Iron plans after enlistment that were followed up with after 1 week (7 days), 1 month (30 days), and 3

Table 1. Distribution of hemoglobin mean (SD) non-pregnant women, and pregnant women stratified by age

Age group (years)	Non-pregnant women	Pregnant women
18–24	55	30
25–34	35	55
35–44	45	40
45–54	30	60

months (90 days). They were asked about any changes in their health side effects during each subsequent appointment, and they were exposed to general and obstetric tests, as well as hematological examinations. It's possible that consistency would be assured more than once. A sufficient follow-up on the chosen patients was conducted, which included an update on the planned appointment dates and dosage consistency.

2.4 Study Procedure

The study was conducted in the Kanpur District of Uttar Pradesh. The data was collected from the Obstetrics & Gynecology Department which is a government tertiary care Hospital in Kanpur. 350 patients from Obstetrics & Gynecology ward were included in the study, regardless of clinical presentation and diagnosis. Information about patient's age, gender, and different investigations was gathered. Data on Anemic patient was collected by reviewing medical charts of all patients hospitalized during the study period. After getting the required data, the average age of patients, average number of anemic per patient and frequently used iron preparation in medicine wascalculated.

3. RESULTS

Out of 350 patients, 185 pregnant females were included, and 165 non pregnant females were included in the study. The mean age of the patients treated with iron supplements with a minimum age of 18 years and maximum of 54 years.

3.1 Iron Preparations Therapy Outcome

All patients were followed up every visit for hematological improvement for 3 months. As compared to baseline, significant improvement was seen in red cell indices (MCV, MCH and MCHC), and mean hemoglobin in patients treated with ferric ammonium citrate, folic acid, Vit B12 and cynocobalamine at 1 weeks, 1 month and end of 3 month. There was no significant difference in mean hemoglobin, anemia indices (MCV, MCH and MCHC) and ferritin in patients treated with ferric ammonium citrate, folic acid, Vit B12, and cynocobalamine at the end of the treatment.

3.2 Examinations Andinvestigations

Tests for blood examinations would gathered on day 0 (preceding beginning prescription), day 7(end of 1 week), day 30 (end of one month), day 90 (end of thirdmonth).

The parameters surveyed were:

- Hemoglobin
- MCV (Mean Corpuscular Volume)
- MCH (Mean Corpuscular Hemoglobin)
- MCHC (Mean Corpuscular Hemoglobin Concentration)
- Reticulocyte check (evaluated on Day 0 and end of firstweek)
- GBP (General BloodPicture)
- Serum Ferritin (surveyed on day 0, and after that toward the finish of third month)

3.3 Hemoglobin

- Hemoglobin is a protein in red platelets that conveys oxygen all through thebody.
- Normal extend for ladies 12 to 15g/dl.
- Normal run for men 13 to 17 g/dl.

3.4 MCV

- MCV is the normal volume of redcells.
- It can be specifically estimated via robotized hematology analyzer or it can be ascertained from hematocrit and the red platelet check.
- Normal scope of MCV is 80 to 100 fl/redcell.

3.5 MCH

- MCH is the convergence of hemoglobin in a given volume of pressed redplatelets.
- MCH is utilized to help analyze the sort, cause, and seriousness of irondeficiency.
- Normal scope of MCH is 27 to 33 picogram/cell ingrown-ups.

Table 2. Hemoglobinof Pregnant andNon-pregnant Women

	Visit at 0 day	Visit at 7 day	Visit at 30 day	Visit at 90 day
Pregnant	6.2	7.9	9.9	13.9
Non -pregnant	7.4	8.1	9.6	13.1

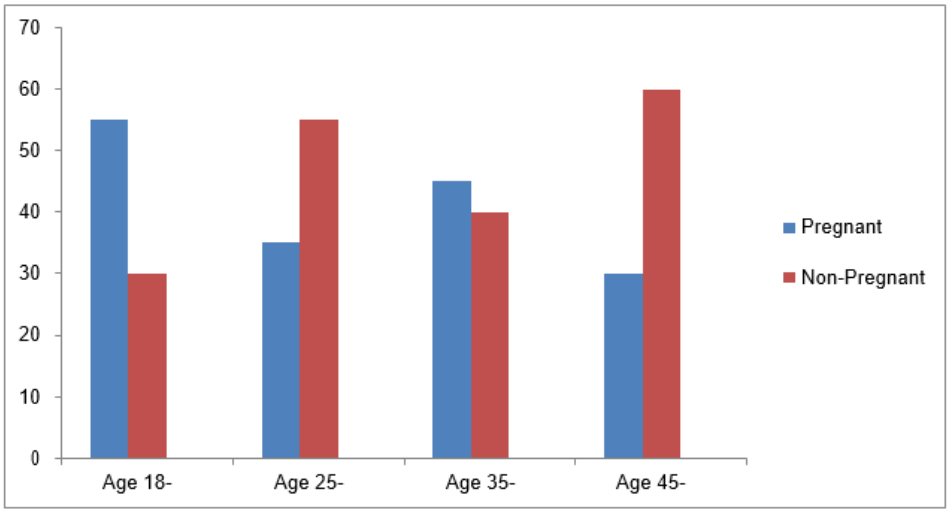

Fig. 1. Distribution of hemoglobin in non-pregnant women, and pregnant women stratified by age as graphs

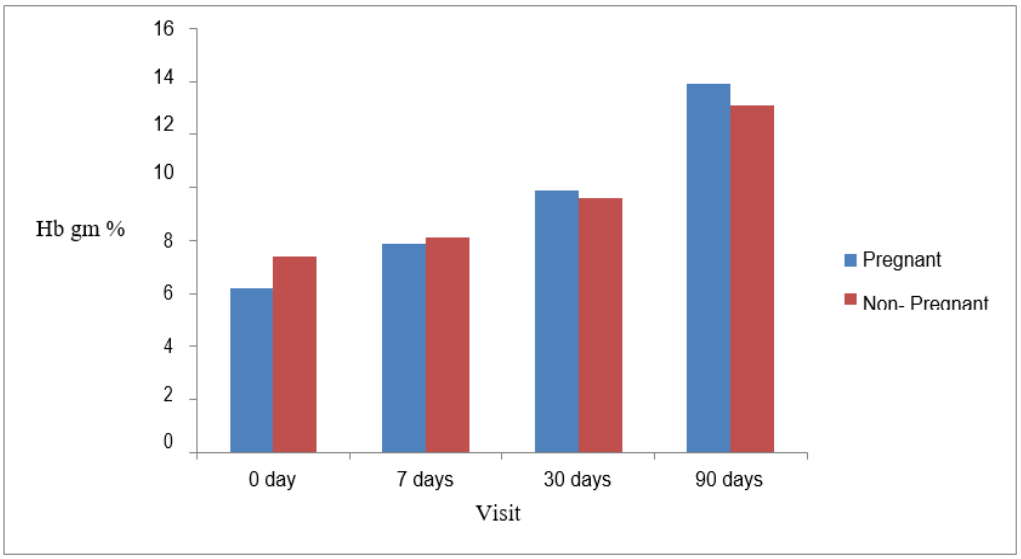

Fig. 2. Hemoglobin content of pregnant and non-pregnant women according to days of visit

3.6 MCHC

- MCHC measures the normal grouping of hemoglobin per unit volume of redplatelets.
- Normal scope of MCHC is 33 to 36 g/dl.
- MCHC ascertained by separating the Hb by thehematocrit.

3.7 Reticulocytecount

- Reticulocytes are juvenile redplatelets
- It measures the quantity of reticulocytes in theblood.
- Reticulocytes are made by the bone marrow and discharged in to theblood.
- Normal scope of retic include is 0.5 to 2.5% grown-ups and 2 to 6 % inbabies.

3.8 GBP

GBP to recognize morphological sort of sickliness, sufficiency of platelet tallies and blood parasites. It is the most widely recognized

routine trial of blood. Determination criteria we investigated impact of various oral iron planning in pregnant and non-pregnant women's-
We utilized syrups-

1. Tonoferon
2. Dexorange

3.9 Serum Ferritin

- Serum ferritin measures the measure of put away iron in your body.
- The ferritin test measures the level of ferritin and the significant iron stockpiling protein in thebody.
- High level of ferritin can demonstrate an iron stockpiling issue, for example,hemochromatosis.
- Low level of ferritin shows press inadequacy, for example, irondeficiency.
- Normal scope of ferritin is 12 to 150 ng/ml in females and 12 to 300 ng/ml inguys.

Particular examinations, wherever demonstrated according to history and examination of the patient would did as serum TSH, Montoux, ESR, Hb electrophoresis, serum creatinine, and stool examination for ova and pimple to preclude a few other foundationalissue.

Add up to cost brought about, immediate and aberrant will be noted.

3.10 Statistical Measures

A working Proforma were done and following side effects related with press insufficiency sickle cell anemia, for example, exhaustion, and discomfort, loss of craving, and shortness of breath, palpitation, happiness and touchiness were noted. Any unfriendly occasion like-metallic taste, epigastric trouble, stomach torment, sickness, regurgitating, loose bowels and obstruction were noted.

Table 3. Reticulocytes of pregnant and non-pregnant women

Visit	Visit at 0 day	Visit at 3
Pregnant	7.9	9.2
Non pregnant	8.2	8.9

Table 4. Serum Ferritin of pregnant and non-pregnant women

Visit	Visit at 0	Visit at 90
Pregnant	21.62	41.24
Non pregnant	23.9	38.92

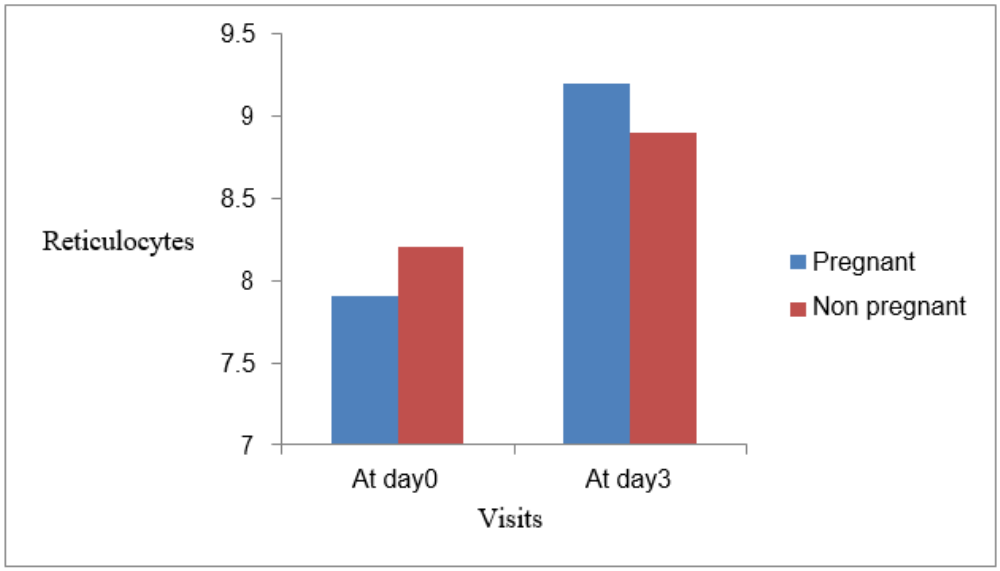

Fig. 3. Reticulocytes of pregnant and non-pregnant women

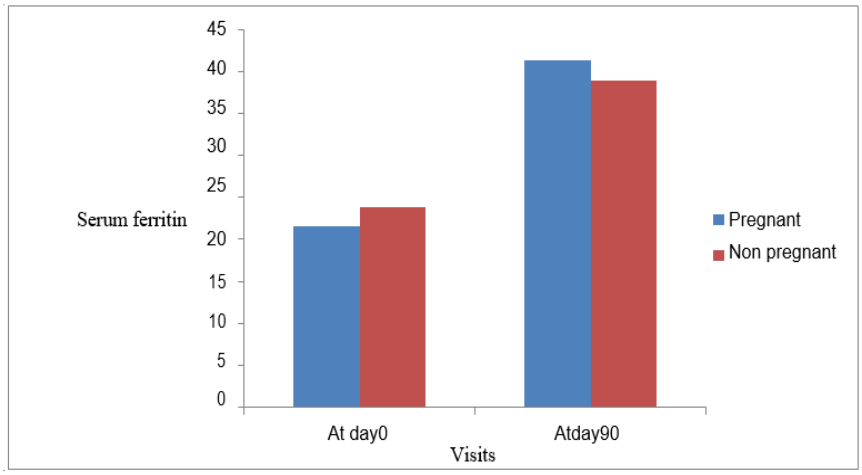

Fig. 4. Serum ferritin amount in pregnant and non-pregnant women according to days of visit

4. DISCUSSION

Anemia due to iron deficiency is a major issue that has a negative effect on behaviour, psychological health, and job efficiency. Iron deficiency is the 12th leading cause of death in the United States. Globally, and one of the world's most common dietary shortages. It may be avoided to some degree and managed with a healthy diet and various oral iron preparations. In a tertiary care hospital setting, 350 patients were handled for three months with ferric ammonium citrate, folic acid, iron hydroxide, and vitamin B12.

‘‘All patients demonstrated a substantial increase in hematological parameters in every follow-up after three months, demonstrating the effectiveness of all four preparations.” The most popular age group in our sample was 18-54 years old. Pregnant patients treated with iron preparations had a higher mean age than non-pregnant patients in our sample. In our sample, 70% of pregnant women demonstrated greater effectiveness than 30% of non-pregnant women, showing that females have a lower incidence of iron deficiency anemia.

5. CONCLUSION

The present study was aimed to select the best effective drug for the treatment of iron deficiency anemia from the four drugs currently available in the market, ferric ammonium citrate, iron hydroxide, vitamin b12and folic acid. Our results showed significant differences in the efficacy and safety among the treatment groups for treating iron deficiency anemia. Therefore, Ferric ammonium citrate can be considered as best cost effective choice for treatment of iron deficiency anemia.

CONSENT

As per international standard or university standard, patients’ written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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