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Original Article

# A study to find out the prevalence of iron deficiency among women of different age groups

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## Abstract

Iron deficiency can result from a low nutritional supply, increased demand, or blood loss. Worldwide, deficiency anemia (IDA) is a significant problem and the most neglected micronutrient deficiency among children, adolescent girls, and pregnant women. According to a recent study, 58.6% of children, 53.2% of non-pregnant women, and 50.4% of pregnant women are being affected. The aim is to find out the prevalence of iron deficits among women of different age groups. This is a cross-sectional study in which 300 women from all age groups were included. Women of the age group between 13 to 80 years were included in the study. Hemoglobin estimation will be done by Sahli' s method. Total serum iron and TIBC (Total Iron Binding Capacity) will be determined through ferrozine. Ferritin estimation will be done using the CLIA (Chemiluminescent Immunoassay) method. The IDA has the highest prevalence among the age group 36–50 years. This result could lead to higher bleeding levels and a lack of knowledge on deficiency. This study gives an idea about the prevalence of iron deficiency among women of different age groups, which can be observed, and preventive measures can be taken to prevent such deficiency.

**Keywords:** anemia, iron deficiency, prevalence, women groups

## Introduction

Iron deficiency is the most prevalent cause of anemia globally, affecting around 1 billion people. Among women, the prevalence of iron deficiency ranges from 15% to 18%, and approximately 45% of pregnant women are affected by low iron levels [1]. Globally, iron deficiency is recognized as the primary form of undernutrition. According to WHO guidelines for the control of iron deficiency anemia (IDA), nutritional anemia remains a critical public health concern in India, predominantly caused by iron deficiency. However, there has been a lack of consensus on the public health significance of this deficiency and the specific population groups it affects [2]. The Indian government has set a goal to reduce anemia among women by 50%.

Iron deficiency is a systemic condition that impacts organs and muscles involved in erythropoiesis, including skeletal muscles and vital organs. The production of myoglobin and the generation of energy in these tissues rely heavily on iron to sustain mechanical performance [3].

Common causes of iron deficiency include blood loss from donations or nosebleeds and intravascular hemolysis accompanied by hemoglobinuria, which can occur during malaria and result in iron loss through hemorrhage [4]. In women, frequent causes are menstrual bleeding, abnormal uterine bleeding, and gastrointestinal blood loss. Nearly 45% of women begin pregnancy with minimal or no iron reserves. During pregnancy, the iron requirement increases approximately tenfold—from 0.8 mg per day at the beginning

of the first trimester to 7.5 mg at the start of the third trimester—to support fetal and placental development and prepare for potential blood loss during childbirth. The typical daily absorption of iron is limited to just 1–5 mg. Multiple signals such as erythropoietic activity, transferrin saturation, hypoxia, and inflammation regulate the expression of hepcidin, which plays a vital role in iron homeostasis [5].

Ascorbic acid significantly enhances iron absorption. However, the intake of whole bread, nuts, and seeds was found to negatively correlate with serum ferritin levels among middle-aged women aged 35 to 69 years [6].

Common dietary sources of iron include liver, meat, egg yolk, leafy vegetables, whole grains, and cereals. The recommended dietary allowance (RDA) for iron is 10 mg per day for adult men and early-menopausal women, 15–20 mg per day for premenopausal women, and 30–60 mg per day for pregnant women. Women require more iron than men due to physiological losses during menstruation.

Iron is essential for the synthesis of heme-containing molecules such as peroxidase, catalase, cytochromes, and myoglobin, thereby playing a key role in oxygen utilization, storage, and transport. It also contributes to the formation of non-heme iron-dependent enzymes.

Anemia resulting from iron deficiency may arise due to a reduction in red blood cell production caused by inadequate iron levels. Low iron bioavailability due to high-fiber diets is one indication of poor dietary intake. Additionally, abdominal surgeries and malabsorption conditions can further impair iron absorption. Severe losses, such as gastric bleeding and menstrual blood loss, contribute to iron depletion. Iron deficiency results in hypochromic microcytic anemia, characterized by reduced hemoglobin levels and a decrease in red blood cell mass, ultimately lowering total hemoglobin content [7].

The aim and objective of this study are to determine the prevalence of iron deficiency among women of different age groups, identify the age group most affected by iron deficiency, and explore whether aging contributes to changes in iron deficiency prevalence.

## Material and methods

This cross-sectional study involved a total of 300 women spanning various age groups, specifically between 13 and 80 years. The study excluded males, girls under the age of 13, and women diagnosed with diabetes mellitus, hypertension, cardiac disease, hyperthyroidism, tuberculosis, or cancer, as well as those currently taking iron supplementation. The objective was to assess iron status using a range of hematological and biochemical parameters, including serum iron, ferritin, total iron-binding capacity (TIBC), transferrin saturation percentage, hemoglobin, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC).

Haemoglobin was estimated using Sahli's method, while total serum iron and TIBC were measured using the ferrozine method on an automated chemistry analyzer. Serum ferritin levels were determined using the chemiluminescent immunoassay (CLIA) method with the Beckman Coulter Unicell DXI automated analyzer.

All study procedures were initiated following approval from the Institutional Human Ethics Committee under the proposal ID IHEC-I/1399/22. Informed consent was obtained from each participant prior to inclusion in the study.

Data analysis was performed using IBM SPSS software, version 29.0. Descriptive statistics were used to summarize categorical variables, and frequency analysis was carried out for individual parameters. One-way ANOVA was employed to determine the overall prevalence and statistical significance among the different age groups. Mean values and standard deviations were calculated for all measured parameters.

## Results

There were 300 women in this study group. 80 women are 19–35 yrs of age, 103 women are 36–50 yrs. Of age 116, women were above 50 years of age, and only one girl was below 18 years old. Descriptive statistics were done for all parameters. ANOVA frequency test was done to find the statistical significance difference among the three groups and the prevalence of iron deficiency among the groups. Since the iron level is considered an anemic, the IDA has the highest prevalence among the age group of 36–50 years. Higher bleeding levels could explain this result, as well as a lack of knowledge about iron-rich meals and improper hygiene (Tables 1–3).

## Discussion

Anaemia due to iron deficiency is common everywhere. Iron is crucial for our bodies to operate properly. Based on earlier research, iron is necessary for several processes, including the movement of oxygen,

Table 1: Descriptive statistics.

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| **Age** | 300 | 14.00 | 83.00 | 46.1167 | 15.85774 |
| **Ferritin** | 300 | .70 | 880.50 | 54.1973 | 118.90295 |
| **Iron** | 300 | 1.40 | 475.00 | 41.4947 | 54.24481 |
| **TIBC** | 300 | 58.00 | 672.00 | 359.8067 | 112.35513 |
| **HB** | 300 | 2.40 | 81.00 | 8.9437 | 4.77646 |
| **MCV** | 300 | 50.20 | 114.20 | 71.9560 | 11.77091 |
| **MCHC** | 300 | 25.00 | 36.90 | 30.9713 | 1.89678 |
| **MCH** | 300 | 13.70 | 37.50 | 22.6983 | 4.74056 |
| **Transferrin** | 300 | .31 | 558.82 | 15.3856 | 36.00822 |
| **Valid N (listwise)** | 300 | | | | |

the production of DNA, the transport of electrons, and a lot more. According to numerous research by the WHO, iron deficiency is 2.5 times more common than iron deficient anemia. Multiple investigations have already been conducted to determine the frequency of anemia among females in various regions of the nation and overseas. Anaemia occurrence varies significantly between regions of the globe, within a nation, and between districts. Due to their higher need for iron, women are mostly prone to anemia and iron deficit. The Indian government has implemented numerous policies to address this issue. The UNICEF and the World Health Organization have recently launched many programs to combat malnutrition in this population. That, if left untreated, might impact future generations of children, increasing morbidity and mortality and reducing efficiency. Many studies have been conducted to determine the commonness of serum Fe insufficiency between females in various regions of India and overseas. Sandra *et al*. conducted a study on the perinatal iron deficit while examining the available data from mothers and infants regarding the epidemiology and consequences of iron deficiency and recent treatment strategies and identified that in the presence or absence of anemia, iron deficiency is most commonly present in pregnant women. Globally, the prevalence of anemia in pregnancy is identified as 38%, and it was also found that 30% of the world population with anemia is of reproductive age. Recommendations for mothers and infants are also made regarding the screening and treatment of iron deficiency anemia [8].

Jing *et al*. conducted a study to identify the frequency of anemia and IDA in Chinese pregnant women. Twelve thousand four hundred three pregnant women

Table 2: Frequency table.

| Age group | | Iron | Ferritin | TIBC | HB | MCV | MCH | MCHC |
|---|---|---|---|---|---|---|---|---|
| **<18** | Normal | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | Deficiency | 67.5 | 67.5 | 7.5 | 50 | 52.5 | 77.5 | 60 |
| **19–35** | Normal | 27.5 | 32.5 | 57.5 | 47.5 | 47.5 | 22.5 | 40 |
| | High | 5.0 | - | 35.0 | 1.3 | - | - | - |
| | Deficiency | 70 | 56.3 | 7.8 | 60 | 46.6 | 86.4 | 67 |
| **36–50** | Normal | 28 | 41.7 | 68.9 | 38 | 53.4 | 13.6 | 31.1 |
| | High | - | 1.9 | 23.3 | - | - | - | 1.9 |
| | Deficiency | 60 | 31 | 30.2 | 64.7 | 33.6 | 73.3 | 50 |
| **Above 50** | Normal | 30 | 60.3 | 56.0 | 35.3 | 63.8 | 23.3 | 44 |
| | High | 6.0 | 8.6 | 13.8 | - | 2.6 | 3.4 | 5.2 |


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Table 3: ANOVA table.

| | | Sum of squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| **Ferritin** | Between groups | 272321.995 | 3 | 90773.998 | 6.794 | <.001 |
| | Within groups | 3954913.623 | 296 | 13361.195 | | |
| | Total | 4227235.618 | 299 | | | |
| **Iron** | Between groups | 21227.434 | 3 | 7075.811 | 2.439 | .065 |
| | Within groups | 858579.857 | 296 | 2900.608 | | |
| | Total | 879807.291 | 299 | | | |
| **TIBC** | Between groups | 418934.746 | 3 | 139644.915 | 12.318 | <.001 |
| | Within groups | 3355544.041 | 296 | 11336.297 | | |
| | Total | 3774478.787 | 299 | | | |
| **HB** | Between groups | 119.238 | 3 | 39.746 | 1.755 | .156 |
| | Within groups | 6702.320 | 296 | 22.643 | | |
| | Total | 6821.558 | 299 | | | |
| **MCV** | Between groups | 1941.892 | 3 | 647.297 | 4.852 | .003 |
| | Within groups | 39485.848 | 296 | 133.398 | | |
| | Total | 41427.739 | 299 | | | |
| **MCHC** | Between groups | 39.283 | 3 | 13.094 | 3.740 | .012 |
| | Within groups | 1036.451 | 296 | 3.502 | | |
| | Total | 1075.733 | 299 | | | |
| **MCH** | Between groups | 280.257 | 3 | 93.419 | 4.294 | .006 |
| | Within groups | 6439.133 | 296 | 21.754 | | |
| | Total | 6719.389 | 299 | | | |
| **Transferrin** | Between groups | 8164.921 | 3 | 2721.640 | 2.123 | .097 |
| | Within groups | 379516.163 | 296 | 1282.149 | | |
| | Total | 387681.084 | 299 | | | |

signed up, of whom 1018 (8.2%) were in their first trimester, 3487 (28.1%) in their 2nd trimester and 7898 (63.7%) in their third. In total, 19.8% of females had anemia diagnoses, and 13.9% had IDA diagnoses. They finally concluded that the commonness of anemia and IDA during pregnancy ranged across regions in China and was comparable to that of wealthy nations [9]. Raetjendra *et al*. investigated the frequency of IDA in type 2 diabetes – insights from tertiary diabetes care centers across India. Out of the 1137 participants in the study, 117 (10.3%) were classified as not having an iron deficit (ID) (normal hemoglobin: male 13 g/dl, female 12 g/dl, and normal serum ferritin 70 g/L), and 123 (10.8%) as having an ID (normal hemoglobin and low serum ferritin 70 g/L), In the IDA group, 447 people (39.3%) had low hemoglobin (male 13 g/dl, female 12 g/dl, and low serum ferritin), while 450 people (39.6%) were in the ACD group (low hemoglobin and normal serum ferritin). Women were substantially more likely to have ID (57.7%) and IDA (65.3%) than men. Whereas ACD was more common (50.5%) in those with long-standing diabetes (>10 years), ID was more common (61.7%) in people with diabetes duration of 5 years [10]. Female gender, diabetes duration, and FPG were independent risk factors for IDA [11]. A study done by Kumari *et al*. conducted a study on the frequency of ID and IDA in teenage girls. This study estimated total iron, TIBC, hemoglobin and ferritin. This is a cross-sectional study. Teenage girls are determined to be 50% anemic out of 200 girls. 43.3% of the population had mild anemia,

3.3% had moderate anemia, and 3.3% had serious anemia. Since anemia is 50% prevalent, action is necessary to avoid and manage it. The formulation and execution of the policy for IDA and lack of iron prevention will be aided by the findings of their investigation [12]. Also, another study by Bellizzi *et al*. conducted a study on IDA and lower BMI among teenage girls in India: the changeover from 2005–2015. They used the nationally representative Indian DHS from 2005 to 2015. Anaemia and BMI were evaluated using the DHS approach in accordance with WHO criteria and indications. The ten-year period from 2005 to 2015 revealed variations across the poorest and wealthiest segments of the community, with the latter experiencing the largest increases in anemia over time (from 50% to 40%). In 2005 and 2015, the probability of anemia was considerably greater in the teenage group compared to women who were adults (OR=12). Although the frequency of each BMI of 18.5 and anemia within teenagers has generally decreased, the modified hazard of anemia in the former group is much greater than that of their adult counterparts [13]. Ponnambily *et al*. examined the prevalence of anemia among adolescent girls in a selected college in Kanchipuram. Adolescent girls between the ages of 17 and 19 were chosen as the study's sample population. Thirty-two people made up the sample. The findings indicated that 16 (50.0%) of the participants were evenly split between the ages of 17 and 18, that 27 (84.0%) of the individuals are members of nuclear families, while 05 (16.0%) of the general population are members of shared families, along with 8 (25%) of the subjects in the research are vegetarians while 24 (75.0%) are not. The hemoglobin level revealed that 22 study individuals (56.0%) have poor hemoglobin levels [14]. Our study level of iron, serum ferritin, TIBC, hemoglobin, MCV, MCH, MCHC, and transferrin among women of different age groups was estimated. Each parameter level differed in each age group. The deficiency of each parameter was compared with different age groups of 19–35, 36–50, and above 50 years. Table 2 shows the frequency of all parameters, which shows that the age group of 36–50 years has the highest iron deficiency level compared to other age groups. Since the iron level is considered an anemic, the IDA has the highest prevalence among the age group of 36–50 years. This result could be explained by higher levels of bleeding, a lack of knowledge about iron-rich meals, improper hygiene etc. Table 3 shows a one-way ANOVA frequency test done to find the statistical significance difference among the three groups in order to find the prevalence of iron deficiency among the groups. The statistical significance difference was found in ferritin (P=0.01) TIBC (P=<0.01) MCH (P=.006) MCV (P=.003), and MCHC (P=.012). According to the WHO's overall database analysis of the world's overall incidence of anemia from 1993 to 2005, a higher than 40% frequency of anemia is an important health difficulty that has to be addressed. About 120 million adolescent girls nationwide began receiving monthly iron and folic acid supplements in 2013, according to the Indian government. There was no significant difference in iron and hemoglobin due to limited sample size sources, which can be considered a limitation of this study.

## Conclusion

There were 300 women in this study group. Eighty women were 19–35 years of age, 103 women were 36–50 years of age, 116 women were above 50 years of age, and only one girl was below 18 years old. Descriptive statistics were done for all parameters. Since the iron level is considered anemic, iron deficiency anemia has the highest prevalence, 70%, between 36–50 years old. This result could be explained by higher levels of bleeding, a lack of knowledge about iron-rich meals, improper hygiene etc. At the end of this study, an idea about the prevalence of iron deficiency among women of different age groups can be observed, and preventive measures and guidelines to prevent such deficiency can be given.

## Conflict of interest

The authors declare no conflict of interest.

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