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Prevalence of iron deficiency anemia (IDA) among women of reproductive age group in a tertiary care hospital

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Abstract

Background: Worldwide, Iron Deficiency Anemia (IDA) is one of the most common types of nutritional anemia. About 30% of the world's populations are iron deficient (ID). Women seem to be more affected with Iron Deficiency Anemia (IDA) than men, which constitute an epidemic public health issue.

Aim: The aim of the study was to determine the current prevalence of Iron Deficiency Anemia (IDA) among women of reproductive age group in a tertiary care hospital.

Materials and Methods: A prospective study on 50 healthy females aged between 15-49 years was done in the biochemistry and hematology clinical laboratory of Parul Sevashram Hospital (PSH)-Vadodara, Gujarat, India for a period of three months (March 2022-May 2022). Participants were subjected to different tests including complete blood counts (CBC), serum iron (SI), serum ferritin (SF) and total iron binding capacity (TIBC). Moreover, a questionnaire was designed to collect dietary habits and menstrual history.

Results: The prevalence of IDA among study participants was 30%. Their different levels of severity of IDA were as follows: 16% with mild, 8% with moderate, and 6% with severe IDA. The questionnaire analysis of the dietary habits and clinical characteristics revealed that having breakfast regularly significantly reduced the development of IDA compared with irregularly having breakfast. Overall analysis showed that consumption of red meat, fish, eggs or peanut butter regularly and iron/iron rich food showed significant role in provoking IDA.

Conclusion: This study found an overall prevalence of IDA among reproductive age group women of 30%. This study revealed that the majority of participants, especially 21–30-year age group participants, have IDA that might become worse by malnutrition, lifestyle habits and lack of awareness.

Keywords: Iron deficiency anemia, women, prevalence, reproductive age

Introduction

Anaemia is one of the most important global health problems, impacting more than two billion people worldwide, with majority coming from the developing countries. Its adverse health consequences impact people of all ages and can be caused by non-nutritional and dietary variables. The World Health Organization (WHO) has classified it as one of the top ten most critical health issues.[1]

Anaemia is a condition in which the level of haemoglobin in the blood is low due to a lack of red blood cells and little haemoglobin in each cell. Iron deficiency anaemia is the most prevalent type of nutritional anaemia which results from long-term negative iron balance and is responsible for approximately 50% of all anaemia.[2]

It is a severe stage of iron deficiency in which haemoglobin level falls below the normal range. It affects women of reproductive age more frequently and severely, but it can affect people of any age group. Iron deficiency normally develops gradually and is not clinically noticeable until anaemia is severe. Accelerated development, hormonal changes, malnutrition and the onset of menstrual periods in girls are the major causes of iron deficiency anaemia during reproductive age, which can cause decreased perception and learning difficulties.[3]

If IDA is not detected and treated early, it can have long-term consequences for women, including negative maternal and neonatal outcomes as well as an increased risk of disability in later life.[4]

In India, prevalence of anaemia and its associated variables among reproductive age women has been largely ignored. These findings would help us in having in-depth understanding of the impact of disease on numerous aspects of health. This study was conducted to find the current prevalence of IDA and its associated factors among women of reproductive age group in a tertiary care hospital.[5]

Materials and methods

Study Design

This prospective study designed to determine the prevalence among reproductive age women's by analyzing blood samples to measure serum iron (SI), serum ferritin (SF), total iron binding capacity (TIBC) and complete blood count (CBC). In addition, a questionnaire survey was administered to participants to classify their health condition and lifestyle.

Study Subjects

The present study included 50 participants randomly selected between the ages of 15 and 49 years and excluded participants below 15 years of age group and no other physiological disease co-related. Questionnaires were administered randomly to each participant to survey dietary habits and menstrual history. The study's goals and experiment protocol were explained to the participants.

Data and Samples Collections

The questionnaire was designed to collect demographic information, dietary habits and menstrual history of the participants which includes regular or irregular breakfast intake.

The types of foods taken (vegetables, fruits, dry fruits, egg, red meat, fish, chicken or peanut butter) were classified into the following: no, infrequently (<2 servings / week), and frequently (> 3 servings / week); eating junk food defined as yes or no; multi vitamins taken classified as yes or no; regularly and

irregularly frequency of iron/iron-rich food intake; diet (fitness) defined as yes or no. menstruation frequency analyzed once per month or twice or more per month; menstruation duration allocated <7 days or >8 days; heavy flow of menstrual blood classified yes or no. Moreover, participants being aware of anemia were classified as yes or no.

5 ml of venous blood was drawn from each participant and divided into two tubes: 2 ml was drawn into EDTA tubes to measure haematological parameters/complete blood count (CBC), and 3 ml was drawn into a plain tube with no anticoagulant to measure serum iron (SI), serum ferritin (SF), and total iron binding capacity (TIBC); biochemical tests were performed on samples with low Hb based on WHO guidelines[6] to confirm the diagnosis of IDA.

Haematological and Biochemical Parameters

Haemoglobin (Hb), haematocrit (Hct), red blood cell count (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), red cell width distribution (RWD), white blood cell count (WBC) and platelets were determined and measured using hematology analyzer Mindray 6 part BC-6200 fully automated. Serum Iron and Total Iron Binding Capacity (TIBC) estimation was done by Ferrozine method on fully automated chemistry analyzer Olympus AU400 with the reagent kit available in the market. Serum Ferritin estimation was done by Chemi luminescence immunoassay method, using Access 2 (Beckman Coulter).

Participants with Hb levels lower than cut-off values were considered to be anemic if Hb < 12.0 g/dl. Participants who had Hb < 12 g/dl, SI < 50 μg/L, SF < 10 ng/ml and TIBC ≥ 350 μg/dl were defined as IDA.

Ethical Approval

The ethical committee of Parul sevashram hospital - Vadodara, granted permission to perform the study. The goal of the study was described to the family's head and then to each respondent individually during the actual experiment, and the consent was acquired.

Statistical Analysis

The collected data were stored and analyzed using the Microsoft excel 2007. All reliable data had been presented as numbers and percentages, whereas continuous data had been summarized as mean ± standard deviation (SD).

Results and discussion

Status of IDA in Women (15-49 years)

An overview of the status of IDA in 50 randomly selected women of reproductive age (15-49 years) in tertiary care hospital is shown in Table-1. Overall, 70% were nonanemic and 30% of the study participants were anemic, whilst 6% were severe, 8% were moderately, and 16% were mildly anemic.

Table 1: Overview of the status of IDA in women (15-49 years)

Anemia	N (%)
Non	35 (70%)
Mild	8 (16%)
Moderate	4 (8%)
Severe	3 (6%)
Total	50 (100%)

Haematological and Biochemical Data (mean ± SD) for IDA-Positive Women/Age

Table-2 shows the mean haemoglobin, serum iron (SI), serum ferritin (SF) and total iron binding capacity (TIBC) values of IDA-positive women in

different age groups. The numerically lowest mean Hb (8.7±1.6), SI (26.4±13.1), SF (7.9±1.2) values, and the highest TIBC (497.3±34.6) was observed in the age group 21 to 30 years.

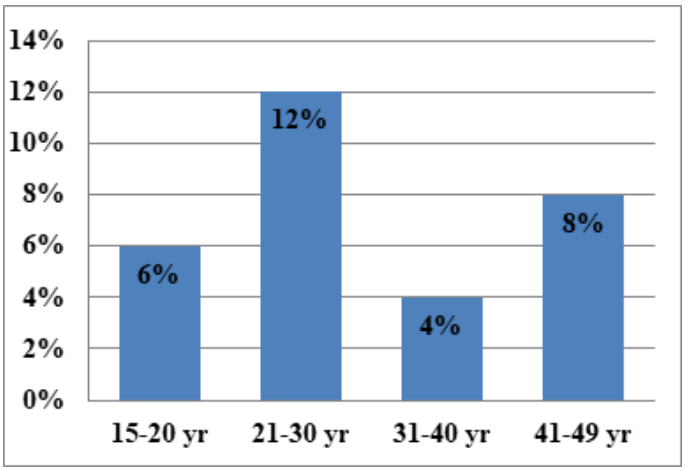
Table 2: Hematological and Biochemical Data (mean ± SD) for IDA-Positive Women/Age.

Age Group (Years)	Haemoglobin (gm/dL) Normal Range (>12 gm/dL)	Serum Iron (µg/L) Normal Range (50-170 µg/L)	Serum Ferritin (ng/ml) Normal Range (10-120 ng/ml)	Total Iron Binding Capacity (µg/dL) Normal Range (250-450 µg/dL)
15-20 yr	10.1±1.0	35.0±4.1	8.1±1.0	463.6±9.0
21-30 yr	8.7±1.6	26.4±13.1	7.9±1.2	497.3±34.6
31-40 yr	10.8±0.2	33.7±5.3	8.3±0.7	475±33.9
41-49 yr	9.4±1.9	26.5±10.6	8.0±2.0	477±8.9

Frequency (%) Distribution of IDA- Positive Women by Age

An overall assessment of IDA-positive women based on the age group is presented in Graph-1. Based on total observations of a particular age group, the highest number (12%) of IDA- positive women were recorded in the age group 21-30 years, whilst the lowest (4%) was in the age group 31-40 years.

Chart 1: Frequency (%) Distribution of IDA-Positive Women by Age.



Distribution of the severity of IDA in affected women/age under WHO criteria

Table-3 shows the severity of IDA-positive women of different age groups according to the criteria of the World Health Organization. Based on haemoglobin values, the highest prevalence of mildly and moderately affected IDA-positive women was observed in the age groups 31 to 40 years and 15 to 20 years, respectively, whereas severely affected IDA-positive women were evenly distributed in the age groups 21 to 30 years, 41 to 49 years.

Table 3: Distribution of the severity of IDA in affected women/age under WHO criteria

Age Group (Years)	Percentage on the basis of total IDA positive women	Percentage on the basis of severity of IDA positive women		
		Mild	Moderate	Severe
15-20 yr	6%	4.00%	2.00%	-
21-30 yr	12%	6.00%	2.00%	4.00%
31-40 yr	4%	2.00%	2.00%	-
41-49 yr	8%	4.00%	2.00%	2.00%

Risk factors enhance the prevalence of IDA women's

Table 4 shows the association between IDA and different parameters regular and irregular breakfast intake; dietary habits which include food (frequency intake of fruits, vegetables, meat, and fish); Depending on the analysis in the present study, an important relationship between IDA and breakfast, weekly intake of meat, vegetables, and fruits in IDA positive women's at tertiary care hospital. It was found that students who had a regular breakfast intake or frequently consume fruits and vegetables and red meat per week had a better iron status than women's who had irregular breakfast intake or insufficient portions of fruits and meat.

Regarding awareness and unawareness of anemia among the IDA positive women's, it was found that high proportions of women's were unaware and low proportions of women's were aware about anemia.

Table 4: Prevalence of the iron deficiency anemia by dietary habit among the study subjects.

Variables	Answers	15-20 yr	21-30 yr	31-40 yr	41-49 yr
		Total (%)	Total (%)	Total (%)	Total (%)
Breakfast intake	Regular	3 (100%)	2 (33.3%)	2 (100%)	2 (50%)
		Irregular	4 (66.7%)	0 (0%)	2 (50%)
Eating fruits and dry fruits / week	No	1 (33.3%)	2 (33.3%)	1 (50%)	3 (75%)
	< 2 times/week	2 (66.7%)	3 (50%)	1 (50%)	1 (25%)
	> 3 times/week	0 (0%)	1 (16.7%)	0 (0%)	0 (0%)
Eating red meat, fish, eggs or peanut butter / week	No	1 (33.3%)	4 (66.7%)	0 (0%)	2 (50%)
	< 2 times/week	2 (66.7%)	2 (33.3%)	1 (50%)	2 (50%)
	< 2 times/week	0 (0%)	0 (0%)	1 (50%)	0 (0%)
Eat junk food	Yes	2 (66.7%)	5 (83.3%)	0 (0%)	1 (25%)
	No	1 (33.3%)	1 (16.7%)	2 (100%)	3 (75%)

Take multivitamins	Yes	0 (0%)	1 (16.7%)	1 (50%)	0 (0%)
	No	3 (100%)	5 (83.3%)	1 (50%)	4 (100%)
Intake frequency of iron/iron-rich food	Regular	2 (66.7%)	5 (83.3%)	2 (100%)	2 (50%)
	Irregularly	1 (33.3%)	1 (16.7%)	0 (0%)	2 (50%)
Diet (fitness)	Yes	0 (0%)	2 (33.3%)	0 (0%)	0 (0%)
	No	3 (100%)	4 (66.7%)	2 (100%)	4 (100%)
Menstruation frequency	Once/month	3 (100%)	4 (66.7%)	2 (100%)	4 (100%)
	Twice or more/month	0 (0%)	2 (33.3%)	0 (0%)	0 (0%)
Menstruation duration	< 7 days	2 (66.7%)	4 (66.7%)	2 (100%)	3 (75%)
	> 7 days	1 (33.3%)	2 (33.3%)	0 (0%)	1 (25%)
Heavy flow of menstrual blood	Yes	0 (0%)	5 (83.3%)	0 (0%)	1 (25%)
	No	3 (100%)	1 (16.7%)	2 (100%)	3 (75%)
Being aware of anemia	Yes	1 (33.3%)	3 (50%)	0 (0%)	0 (0%)
	No	2 (66.7%)	3 (50%)	2 (100%)	4 (100%)

Iron Deficiency Anemia (IDA) is becoming more common among women of reproductive age around the world, particularly in underdeveloped nations. According to the findings of this study, 30% of women are impacted by IDA. IDA has been linked to poor cognitive performance and decreased work productivity in adults in numerous studies. [7, 8] The prevalence of iron deficiency anaemia (34.2%) among Yemeni children aged 15 years in rural regions has been documented in previous studies.[9] The current study is the first to show the prevalence of IDA among women of reproductive age. Our findings revealed a prevalence of IDA among women of reproductive age (30%), which is consistent with a previous WHO research that estimated the prevalence of anaemia among females of reproductive age to be more than 50%.[10]

Inadequate dietary iron intake, low bioavailability, a concurrent inadequate intake of dietary micronutrients, lack of awareness of iron insufficiency, and nutritional status are all possible causes of the high prevalence rate of IDA among women. Women are more likely to be anaemic than males at first, especially during reproductive age, due to menstruation and social norms; they eat a lower-quality diet than males. [11, 12] Furthermore, the higher frequency of anaemia among females in our population could be attributed to some families' traditional cultural norms, which tend to give males more importance and rights than females, particularly when it comes to food sharing.

Furthermore, the prevalence of IDA among university students was reported to be 23.9 percent in Saudi Arabia, 29.0 percent in the United Arab Emirates, and 3.8 percent in Iran [13, 14, 15], while the prevalence of IDA in this study was found to be 30%. This study looked into some possible risk factors for IDA among the women's, such as regular or irregular breakfast, red meat fish, chicken, vegetables and fruits, as well as unawareness about anaemia and its causes.

Breakfast consumption demonstrated a significant difference between IDA positive women in our current

investigation. Similarly, women's who eat irregular breakfast have a greater IDA. Breakfast foods rich in heme and non-heme iron, such as fat, meat, proteins, bread, fiber, cereals, pulses, legumes, fruits, vegetables, minerals and vitamins, particularly vitamin C, are essential for energy and improved iron absorption.[16] An earlier study of Bengali students found that 41.0% of anaemic students are breakfast regularly and 59.0% irregularly, compared to 68.7% of nonanemic students are breakfast regularly and 31.3% occasionally.[17] Breakfast meals may be missed by women's due to limited home money, getting up late, not being hungry in the morning, distaste of offered food, or calories are reducing to lose weight.

The study found poor consumption of foods including vegetables, fruits, dry fruits, eggs, fish, red meat or peanut butter has been reported to be linked with iron deficiency anaemia.[18] The traditional diet of Bangladesh has changed with the introduction of junk food and various studies have linked iron-deficiency anaemia to the change in dietary habits.[19]

The present study showed that the consumption of multivitamins was not significant in the case of anaemic subjects.

Other study showed that multi vitamin-mineral supplementation is not very efficacious in improving haemoglobin concentration.[20]

For the anaemic subjects, the frequency of iron/iron-rich diet consumption was minimal. In underdeveloped countries, iron deficiency is a major public-health concern. Red blood cell size and number are reduced, resulting in iron deficiency anaemia, which affects the function of various organic systems. To lower the prevalence of iron deficiency anaemia, appropriate iron supplementation is required. In recent years, a number of studies have suggested that weekly iron supplementation was equally efficient as daily iron supplementation in boosting haemoglobin levels in various groups at risk of iron deficiency anaemia. [21, 22]

Findings of other studies indicated that, despite the fact that all of the individuals were educated, almost half of them were anaemic. The findings of this study reveal a scenario of poor eating habits and nutritional understanding that contribute to IDA among women of reproductive age. According to our findings, only adequate nutrition and awareness can prevent IDA. The findings could be useful in doing more research among the students of other universities to estimate the prevalence of IDA and to raise awareness of the benefits of eating a balanced diet, especially iron-rich foods, and living a healthy lifestyle to avoid IDA.

Conclusions

This study found an overall prevalence of IDA among its sample of apparently healthy reproductive age women of 30%. The study also reported that the main risk factors in relation to contracting anemia were inadequate intakes of iron/iron rich food, infrequent red meat, eggs, fish or peanut butter consumption. The findings suggest the need for targeted awareness strategies aimed at improving nutritional habits by encouraging the consumption of high-iron foods (e.g., red meat) and increasing knowledge of which foods and beverages can improve (e.g., vegetables, fruits, and dry fruits) and hinder (e.g., junk food) iron bioavailability. The current research has established a baseline for future research in the form of randomized trials, which will aid in the development of a better knowledge of this health concern. Also, would encourage the formation of a

strong and appropriate public health policy that can effectively tackle IDA.

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Abbreviations

Abbreviation	Description
IDA	Iron Deficiency Anemia
ID	Iron Deficiency
CBC	Complete Blood Count
SI	Serum Iron
SF	Serum Ferritin
TIBC	Total Iron Binding Capacity
Hb	Hemoglobin
Hct	Hematocrit
RBCs	Red Blood Cells
MCV	Mean Corpuscular Volume
MCH	Mean Corpuscular Hemoglobin
MCHC	Mean Corpuscular Hemoglobin Concentration
RDW	Red cell Distribution Width
WBCs	White Blood Cells