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Prevalence of iron deficiency anemia among medical students in AL-Iraqia College of Medicine, correlation with socioeconomic and physiological conditions

Sarab Hesham Moulod1 *

Department of Pathology, AL-Iraqia University College of Medicine, Iraq.
*e-mail: sarab_moulod@aliraqia.edu.iq

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Abstract

Background: Particularly among women, iron deficiency can be defined as one of the most prevalent chronic diseases in humans. The purpose of the presented work is to ascertain the prevalence of iron deficiency among medical students at Al-Iraqi University College of Medicine and how it relates to socioeconomic status, nutrition, and education. **Methods:** Data was gathered via a questionnaire that assessed general information about the 100 randomly chosen medical students, such as their socioeconomic level, weight, the regularity of their menstrual cycle, and nutritional state. MCH, MCV, and red cell counts have been measured in blood samples at the Hb level. Serum ferritin levels were assessed as an IDA indicator. **Results:** This cross-sectional study involved 100 College of Medicine students. The patients had an average age of 20.34 ± 0.84 years; 66% of them were female; 78% of them had a healthy nutritional pattern; 78% of them had a normal weight; and 60% of the females had a regular menstrual cycle. Females with normal or underweight menstruation (48.5%, P=0.007), as well as those with irregular (heavy) menstruation (78.6%, P=0.012), had the highest prevalence of IDA.

Conclusion: The prevalence of IDA was found to be significantly higher in females with heavy (irregular) menstruation and underweight or normal weight. The results suggest that teaching medical students about healthy iron-containing diets, especially those that improve iron absorption, might help prevent IDA.

Keywords: IDA, medical student, Serum ferritin.

Introduction:

Anemia is a common issue in public health that is linked to a higher risk of mortality and morbidity (1). Anemia is described as a decrease in blood hemoglobin concentration below normal for sex and age. A hemoglobin level of less than 130 g/L for adult males, less than 120 g/L for adult non-pregnant females, and less than 110 g/L for children aged 6 to 59 months are considered anemia, according to the World Health Organization (WHO) (2). The major cause of anemia is changes in total circulating plasma volume and total circulating hemoglobin mass, which both affect the hemoglobin concentration in the two sexes. Even with a normal total circulating red cell as well as red cell mass, anemia can be caused by an increase in plasma volume, such as that seen in splenomegaly or pregnancy. Acute substantial blood loss causes a reduction in the overall blood volume, which delays the onset of anemia. The replacement of plasma volume and consequently the degree of anemia can take up to a day (2). Because of a combination of low iron intake and blood loss from hookworm, schistosomiasis infection, and other hemorrhage

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causes, iron deficiency continues to be the leading cause of anemia globally, particularly in underdeveloped nations (3,4).

Premenopausal women frequently suffer from iron deficiency anemia. Sections of the population with lower socioeconomic positions have a higher anemia prevalence, iron deficiency anemia is linked to certain dietary practices, such as having black tea with food and consuming less meat (3). Although IDA prevalence varies by nation, it is a significant public health issue in underdeveloped nations because of disparities in racial backgrounds, socioeconomic status, dietary preferences, access to healthcare, and the frequency of parasite infections (5). According to the World Health Report, iron deficiency was cited as the cause of anemia in 50% of cases (6). Iron deficiency is the cause of the majority of anemia cases in Iraq. The prevalence of IDA in adolescents, on the other hand, varies and is influenced by the family's socioeconomic standing (3). Adolescents and women are more susceptible to iron deficiency anemia. Globally, the gender disparity in iron deficiency anemia has grown recently, the most common cause of iron deficiency in women is menorrhagia (2). When an adult male follows a diet devoid of iron, it takes no less than 4 years for him to develop iron deficiency anemia, Iron might be insufficient or poorly supplied in the diet due to dietary fats, poverty, or religious beliefs. The majority of the world's population, who follow a predominantly vegetarian diet, are more susceptible to suffering iron deficiency since their physiological needs for iron are higher (2). Hookworm, as well as subsequent pregnancies, development, and lactation in women, might worsen iron deficiency, Gastrointestinal hemorrhage is the most frequent cause of iron deficiency in postmenopausal women and men (2,7).

One study conducted in Baghdad on 400 pregnant women discovered that 135 of them were anemic. Ninety-one percent of the 135 anemic women in the study had iron deficiency, and 87 of them (64%) were between the ages of 18 and 35 (8). Iron deficiency anemia was found in 25.5% of the total participants in research of 1400 Iraqi Kurdistan region residents, with pregnant women experiencing the greatest prevalence (32.6%) (9). Another study found that living in a rural area is one of the major risk factors for developing an IDA and that the nutritional status of children under 6 years old is rapidly declining as a result of the parents' ignorance of helpful and harmful food. The study included 150 preschool-aged children from various community groups in Al Madinah, Basra, Iraq. The prevalence of IDA was estimated to be 20% (10).

Materials and Methods:

Between April and December of 2023, a cross-sectional study was conducted at the Al-Noaman Teaching Hospital and Al-Iraqia University/College of Medicine. A total of 100 adolescents, with a mean age of 20.34 ± 0.84 years, representing various stages of general medical students, participated in the study (26 men and 74 females). The Department of Pathology and the Deanship of Graduate Studies and Scientific Research formally approved the current study. The Department of Hematology at the Al An-Noaman Learning Hospital also gave its clearance. The study was implicit and optional. No personal information was disclosed or shared. The study questionnaire collected information about the student's medical and nutritional status, socioeconomic status, family history, parents' diet, education, nutritional deficiencies, and questions about risk factors for iron deficiency anemia, such as the regularity regarding the menstrual cycle in female students and the history of medical diseases in the family. Written permission was acquired before peripheral blood samples were collected. All blood samples that were drawn into EDTA tubes were examined in the laboratory services of the Al An-Noaman Hospital's hematology unit. An automatic blood cell counter (Coulter LH 750®) was used to measure the hemoglobin (Hb) concentrations, red cell indices (MCH, MCV, MCHC), platelets count, RDW, RBC count, and RBC count. Hematologists carried out the

morphological assessment. With the use of the VIDAS ®FERRITIN (FER) kit from BIOMERIEUX, USA, the serum ferritin level was measured using an automated quantitative enzyme-linked fluorescence immunoassay (11,12).

Statistical analysis:

Version 26 of the Statistical Package for Social Sciences (SPSS) was used for analyzing the data. The information was displayed as means, ranges, and standard deviations. Frequencies and percentages are used to present categorical data. The Fisher exact test was utilized when the predicted frequency was less than five, and the chi-square test was performed to evaluate the relationship between the prevalence of IDA and specific information. P-values less than 0.05 were regarded as red.

Results:

The study involved 100 students, with a mean age of 20.34 ± 0.84 years; 74% of the participants were female, 26% were male, 52% had a good economic situation, 68% of fathers were employed, 54% of mothers were housewives, 66% had a normal weight, 60% of the females had a regular menstrual cycle, 78% had a healthy nutritional pattern, and 54% of students did not exhibit any clinical features of anemia (asymptomatic), as indicated in table (1).

Table 1: Distribution of study medical students by general characteristics

Variable	No. (n= 100)	Percentage (%)
Gender		
Male	26	26.0
Female	74	74.0
Economic state		
Good	52	52.0
Moderate	48	48.0
Father occupation		
Employee	68	68.0
Private work	20	20.0
Retired	12	12.0
Mother Occupation		
Housewife	54	54.0
Employee	44	44.0
Retired	2	2.0
Weight		
Normal	66	66.0
Overweight	30	30.0
Obese	4	4.0
Nutritional pattern		
Healthy	78	78.0
Unhealthy	22	22.0
Menstrual cycle n= 74		
Regular	60	81.1
Irregular	14	18.9
Family history of medical diseases		
HPT and/or DM	6	6.0
No	94	94.0
Clinical Features of anemia		
Pallor with palpitation	12	12.0
Pallor	12	12.0
Palpitation	10	10.0
Hypotension	12	12.0
Asymptomatic	54	54.0

38% of students had low S. ferritin levels; 22% had low hemoglobin levels; 20% had low RBC levels; 12% had low MCV levels; 16% had low MCH levels; 10% had low MCHC levels; 10% had low HCT level; and 8% had high RDW level as shown in table (2)

The highest prevalence of IDA has been seen significantly higher among females (48.6%, P= 0.001), those who had fathers working private work (70%, P= 0.004), those who had housewife mothers (51.9%, P= 0.006), those with under or normal weight (48.5%, P= 0.007), and females who had irregular menstruation (78.6%, P= 0.012) as can be seen in table (3).

Table 2: Distribution of students by CBC investigation and Ferritin level

Variable	No. (n= 100)	Percentage (%)
S. Ferritin level		
Low	38	38.0
Normal	62	62.0
Hb level		
Low	22	22.0
Normal	78	78.0
RBC level		
Low	20	20.0
Normal	80	80.0
MCV		
Low	12	12.0
Normal	88	88.0
MCH level		
Low	16	16.0
Normal	84	84.0
MCHC level		
Low	10	10.0
Normal	90	90.0
HCT level		
Low	10	10.0
Normal	90	90.0
RDW level		
High	8	8.0
Normal	92	92.0

Abbreviations: RBC, red cell count; Hb, hemoglobin; Hct, hematocrit; MCV, mean cell volume; MCH, mean cell hemoglobin; MCHC, mean cell hemoglobin concentration; RDW-CV, red cell distribution width coefficient of variation.

Table 3: Association between the prevalence of iron deficiency anemia and certain characteristics (gender, socioeconomic status, and menstrual cycle regularity in females).

Variable	IDA		Total (%) n= 100	P – value
	Yes (%) n= 38	No (%) n= 62		
Gender				
Male	2 (7.7)	24 (92.3)	26 (26.0)	0.001
Female	36 (48.6)	38 (51.4)	74 (74.0)	
Economic state				
Good	22 (42.3)	30 (57.7)	52 (52)	0.355
Moderate	16 (33.3)	32 (66.7)	48 (48)	
Father occupation				
Employee	20 (29.4)	48 (70.6)	68 (68.0)	0.004
Private work	14 (70.0)	6 (30.0)	20 (20.0)	
Retired	4 (33.3)	8 (66.7)	12 (12.0)	
Mother Occupation				
Housewife	28 (51.9)	26 (48.1)	54 (54.0)	0.006
Employee	10 (22.7)	34 (77.3)	44 (44.0)	
Retired	0 (0)	2 (100.0)	2 (2.0)	
Weight				
Under or Normal	32 (48.5)	34 (51.5)	66 (66.0)	0.007
Overweight	6 (20.0)	24 (80.0)	30 (30.0)	
Obese	0 (0)	4 (100.0)	4 (4.0)	
Nutritional pattern				
Healthy	26 (33.3)	52 (66.7)	78 (78.0)	0.07
Unhealthy	12 (54.5)	10 (45.5)	22 (22.0)	
Menstrual cycle n= 74				
Regular	25 (41.7)	35 (58.3)	60 (81.1)	0.012
Irregular(heavy)	11 (78.6)	3 (21.4)	14 (18.9)	

Discussion:

Iron deficiency is thought to be the most prevalent cause of anemia, yet other nutrient deficiencies, like a lack of vitamin B12, could also result in various types of anemia (13,14). Having some unfavorable health complications. It is not exclusive to people from low socioeconomic backgrounds; it is also common in wealthy cultures. The average age of the students in the presented work was 20.34 0.84 years, with 74% females and 26% men. Other Iraqi and global investigations were conducted with similar age groups (8, 9,15, 16).

This study reveals that a high prevalence of IDA was seen significantly among females (48.6%, P= 0.001), while male prevalence was 7.7%. Another study revealed similar results (1, 3,6,8,17, 18). According to the study, females in medical school who experienced heavy irregular menstruation had a considerably higher prevalence of IDA (78.6%, P= 0.012). Other research done on the same cohort of females at Chitwan Medical College supports these results (16). Our findings differ from those of other Arabian studies conducted among female students at Jazan University and indicate that irregular heavy menses and IDA (2.04%) are not correlated with regular light menses (97.96%). Because 34.70% of the female participants in this Arabian study were married, the researchers concluded that the low iron levels in female students could be explained by the higher iron requirements associated with pregnancy

and lactation (18). Unlike testosterone, menstrual blood loss and estrogen limit erythropoiesis, making women more susceptible to anemia (19). Healthy women who menstruate normally lose an average of 1 mg of iron every cycle (2). The average loss for menorrhagic women is five to six times greater than normal. According to a study on the effects of menstrual disorders in women, over one-third of nursing students reported having menorrhagia. This can have a negative effect on students' academic performance by causing them to miss lectures, lose focus and understanding throughout lectures, or feel like they want to sleep during lectures. It can also negatively affect students' performance in the classroom (20).

78% of the students in our study had healthy eating habits. There is no discernible link between medical students' bad eating habits and the prevalence of IDA (54.5%, p=0.07). It could, on the other hand, be the result of an insufficient iron supplement to make up for the iron lost from their heavy, irregular monthly menstrual cycle. The fact that medical students are aware of the kinds of diets that include iron, such as meat and green vegetables, could be another factor. Our finding disagreed with Hani. A study on Yazidis shows serum zinc levels were low in those with iron deficiency anemia, and it was suggested that combined zinc and iron supplementation be used for treating iron deficiency anemia in adolescents. The Yazidis are a religious minority population group that emigrated primarily from Sinjar city and are characterized by poverty and specific nutritional habits (9). According to a different study conducted among female students at Jazan University of Saudi Arabia, anemia may have been caused by low dietary iron intake and irregular meal consumption (an unhealthy nutritional habit). The study population's anemia rates were 49.41% of males and 55.10% of females, as well as 10.59% of males and 34.69% of females who reported not consuming red meat (18). Our study differs from previous research on the prevalence of Iron - deficiency anemia among University Students in the Noakhali Region of Bangladesh, which found that anemia was significantly (p=0.035) more common in those who were irregular in their breakfast consumption and anemia that might be exacerbated by unhealthy eating habits (17). The fact that medical students knew more about IDA than non-medical students was one factor contributing to the difference.

In the current study 66% of students had normal body weight; the highest prevalence of IDA was seen significantly higher among those with under or normal body weight (48.5%, P= 0.007), although healthy nutritional habit was seen in 78% of them and no significant association between the prevalence of IDA and unhealthy nutritional habit of medical students, this results may be due to the fast irregular meal consumption that not contain iron or poor appetite due to the stress of study of Medicine.

Socio-economic factors: -

In the current study, 52% of medical students had a good economic state; 68% of fathers were employees; and 54% of mothers were housewives. The highest prevalence of IDA was seen significantly higher among students who had fathers working private work (70%, P= 0.004), and those who had housewife mothers (51.9%, P= 0.006). This means that there is no relationship between the economic level and degree of education of parents on the nutritional status of students and their awareness about IDA, so medical students have IDA although they are at good economic and educational family levels. This did not agree with Hussain's study which showed that anemia prevalence is increased in people with lower socioeconomic status (3). A different study conducted in Palestine yielded results that differed significantly from ours in that it found that father education and income were the factors most likely to be linked to variations in medical students' knowledge of anemia. Specifically, students with the lowest income and father education scored the lowest, while those with higher SES scores on both factors had higher knowledge scores on anemia (21).

Hematological lab investigations of IDA: -

In the present study, 38% of students had low serum ferritin levels; and 22% had low hemoglobin levels. The serum ferritin range in the student's male was 6.9-122.4ng/L (normally 70 to 435 ng/mL), and the range of Ferritin in the student's female was 1.8-76.9 ng/mL (normally 10 to 160 ng/ml). The Hb level range in male students was 13.7-16.7 (normally 13.5-17.5), and the Hb level range in female students was 8-17.4 (normally 11.5-15.5g/dl) (22).

In the current study, 20% had low RBC levels, range in females students 3.82-4.92 (normally 3.9–5.6×10^{12}/L)), and in male students 4.72-6.22 (normally4.5 – 6.5×10^{12}/L), In this study, 10% had low hematocrit level (normally 40-52% in male and 36-48% in female) (22).

Twelve percent of medical students in the study had low MCV levels, sixteen percent had low MCH levels, ten percent had low MCHC levels (hypochromic microcytic indices), and eight percent had high RDW levels. Hematologists sent blood films of anemic medical students for investigation; the findings revealed pencil-shaped poikilocytes and hypochromic microcytic RBCS with sporadic target cells. Because the reticuloendothelial stores (ferritin) become entirely depleted before anemia arises when iron deficiency develops, we validate the IDA diagnosis in our study using serum ferritin. This outcome was consistent with previous research (9, 17, 18).

Conclusions.

High prevalence of IDA was seen significantly higher among females especially those who had irregular menstruation and those with under or normal weight. IDA can be diagnosed early from decreased iron stores (Ferritin) before the level of Hb decreases and before hypochromic microcytic RBCS appear in the peripheral blood film.

Recommendation:

Health education through specific nutritional seminars for medical students to reduce the prevalence of IDA in Iraqi society. A large sample size of students from different Iraqi medical and non-medical colleges is recommended in further studies.

Conflict of interest: None

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