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RESEARCH ARTICLE

Assessment of Risk Factors for Women with Iron Deficiency Anemia During Pregnancy

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ABSTRACT

Background: **Globally, iron insufficiency is the most common nutrient deficiency and the primary cause of anemia. Iron deficiency can result in maternal anemia and decreased infant iron reserves due to increased iron demand during pregnancy.**

Objective: **The study was designed to assess the risk factors encountered during pregnancy among pregnant women with iron deficiency anemia.**

Materials and Methods: **The study was conducted on one hundred pregnant women enrolled on the health care centers who were diagnosed as anemic. The data were obtained from all through direct interviews using a special questionnaire covering the sociodemographic characteristics, diet habits, and supplements taken during pregnancy. The one-way ANOVA test analysis was done to see the association of each variable with the anemia severity. The probability value $<$0.05 was considered statistically significant.**

Results**: The results indicated that there was no statistically significant relation between iron deficiency anemia and all the socio-demographic characteristics which included; age, parity, educational level, occupation, family size, and gestational age. While there is a highly statistically significant relation between iron deficiency anemia and diet habit of pregnant women regarding the frequency of intake of meats, fishes, vegetables, and fruits at *p-value* = 0.001, intake pulse at *p-value* = 0.012, intake of nuts at *p-value* = 0.021, and drinking tea at *p-value* = 0.001.**

Conclusion: **Educating pregnant women to eat iron-rich foods may be useful as a strategy for reducing iron deficiency anemia during pregnancy, also using of iron supplements, folic acid and vitamin B_{12} is regarded as a successful way to treat anemia.**

Keywords: Folic acid, iron deficiency anemia, iron supplement, vitamin B_{12}.

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1. Introduction

Anaemia is a condition in which the number of red blood cells or hemoglobin levels in the blood is below their normal levels which leads to a decrease in the ability of the blood to carry oxygen. The ideal concentration of hemoglobin required to meet physiological demands varies according to factors such as age, gender, the height of habitation, smoking status, and pregnancy. Pregnant women are primarily affected by anemia, a severe worldwide public health issue. The World Health Organization estimates that 40% of pregnant women worldwide are anaemic [1]. Even though anemia can have many causes, the most common ones are hemoglobinopathies; nutritional deficiencies, particularly those related to iron deficiency, though deficiencies in folate, vitamins B12, and A are also important causes; and infectious diseases like malaria, TB, HIV, and parasitic infections [2].

Iron deficiency is the most global nutritional problem affecting large population groups in most developing countries. Mostly iron deficiency occurs due to; inadequate iron intake, malabsorption of iron despite adequate intake, increased needs for iron as in pregnancy and lactation, or iron loss more than that be absorbed. The prolonged iron deficiency leads to iron deficiency anemia [3]. When a woman exhibits iron deficiency (ID) or IDA symptoms and her hemoglobin levels are less than or equal to 11 g/dL, depending on what is normal for that particular person, that woman is diagnosed with iron deficiency anemia (IDA) in pregnancy [4]. In 75% of cases of pregnancy-related anemia, the dietary lack of iron is the most common cause of anemia worldwide. Throughout pregnancy, hemoglobin levels fluctuate throughout the trimesters and there is a physiological hemodilution that peaks between weeks 20 and 24 of gestation [5].

Pregnancy usually results in insufficient amounts of iron being mobilized from reserves and absorbed from the diet to meet the demands placed on mothers. In addition, iron deficiency is relatively common during pregnancy due to the increased iron demand and the fact that many women begin pregnancy with low or depleted iron stores [6]. Hemoglobin levels in the blood naturally decrease in the middle of the trimester. The larger rise in plasma volume during pregnancy, as opposed to the slightly increased mass of red blood cells, is the cause of this physiological decline. As a result of this physiological process, blood viscosity is somewhat diluted, promoting placental blood circulation [7].

In addition to iron deficiency, additional micronutrient deficiencies can arise during pregnancy and impact both the fetus and mother's health. For instance, folic acid shortage raises the risk of neural tube abnormalities, while calcium insufficiency is linked to growth limitation and preeclampsia. Twenty to thirty percent of women have vitamin B insufficiency. Therefore, iron supplementation is a component of a pregnancy-related multiple micronutrient supplementation regimen [8]. One of the micronutrients needed for the body to oxygenate itself is iron, which is also essential for the synthesis of energy in cells and the body as a whole. Therefore, a person's serum iron content and storage affect cellular functions as well as general health. This is demonstrated by the systemic indicators and symptoms of iron deficiency and the detrimental effects it has on a person's quality of life [9].

Maternal iron deficiency directly affects the iron stores of newborns and their birth weight and may cause cognitive and behavioral problems in childhood. An iron supplement is recommended in pregnancy on low incomes for pregnant women in developing countries and deficiency cases, but overtreatment should be avoided [10].

2. Materials and Methods

This cross-sectional study was conducted between December 2021 and March 2022 at some primary healthcare centers in Basra, a city in southern Iraq. The study included 100 pregnant women aged between 17–40 years, who enrolled the primary health centers in order to receive the necessary health care during pregnancy.

All pregnant women were checked by a care physician and also the hemoglobin level was measured for each one of them. Those women who showed symptoms of anemia and a hemoglobin level less than 11.0 gm/dl were labeled as anemic according to the WHO criteria. The pregnant women were categorized according to their suffering from the disease into mild and moderate anemia cases, and depending on the WHO classification, which considered that the patients with a hemoglobin level ranging from 9 to 10.9 g per liter are patients with mild anemia, while those which have a hemoglobin level range between 7 and 8.9 grams per liter are patients with moderate anemia. It was found that 92 of our patients suffer from mild cases, while the remaining 8 suffer from moderate cases.

Data were obtained from all pregnant women through direct interviews using a special questionnaire form prepared for the purpose of the study. A detailed questionnaire formula was prepared to record all the relevant information for all participant women, it included the following:

2.1. Demographic & Social Characteristics

They include age, education, occupation, family size, parity, gestational age, space between pregnancies, and level of hemoglobin.

2.2. Dietary Habits and Patterns

They were rated according to the frequency of eating where an intake of food (5 or more weekly) is considered a good pattern, (1–4 weekly) as an average pattern, and (not taking food items) as a poor pattern. the food mostly rich in iron according to their groups are (red meat, vegetables & fruit, pulses, nuts, fish).

2.3. Supplements Intake

They include iron, folic acid, and vitamin B_{12}. Next, all of the data were input, examined, and shown in tables and graphs using SPSS v.22. The analysis included calculating the means, frequencies, proportions, and rates of the provided data for each variable. To determine the relationship between each independent variable and the outcome variable, a one-way ANOVA Test analysis was performed. A probability value was deemed statistically significant if it was less than 0.05.

3. Results and Discussion

The results of the present study were collected, tabulated, statistically analyzed and discussed in the following sections, tables and figures.

3.1. Distribution of Pregnant Women Concerning Their Severity of Anemia

Fig. 1 shows that the largest percentage of pregnant women in the study (92%) suffered from mild anemia (with hemoglobin level 9.0–10.9 g/dL) and the remaining of them (8%) had moderate anemia (with hemoglobin level 7.0–8.9

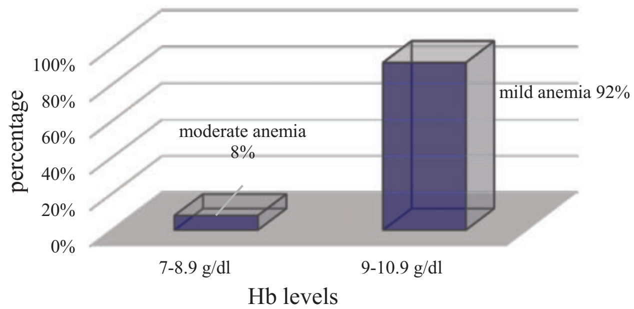

Fig. 1. Distribution of pregnant women concerning their severity of anemia (No. = 100).

TABLE I: Distribution of the Socio-Demographic Data and their Relation with the Degree of Iron Deficiency Anemia Among Pregnant Women (No. = 100)

Socio-demographic variables	Mild anemia (n = 92)		Moderate anemia (n = 8)		Hemoglobin level	*p-value*
	No.	%	No.	%	Mean ± SD	
Age						
17–24	21	22.8	2	25	9.721 ± 0.825	0.168
25–32	47	51.1	4	50	9.847 ± 0.799	
33–40	24	26.1	2	25	10.135 ± 0.695	
Parity						
Primigravida	40	43.5	6	75	10.029 ± 0.699	0.071
Multigravida	52	56.5	2	25	9.744 ± 0.825	
Education level						
Illiterate	11	11.9	4	50	9.572 ± 0.727	0.138
Primary	28	30.4	1	12.5	9.814 ± 0.886	
Secondary	39	42.4	2	25	9.952 ± 0.702	
Higher	14	15.	1	12.5	10.227 ± 0.678	
Occupation						
Housewife	87	94.5	6	75	9.901 ± 0.798	0.289
Employee	5	5.5	2	25	9.571 ± 0.629	
Family size						
2–6	20	21.7	1	12.5	10.037 ± 0.722	0.263
6–10	30	32.6	3	37.5	9.829 ± 0.820	
>10	42	45.6	4	50	9.720 ± 0.825	
Gestational age						
1st trimester	23	25.1	4	50	9.781 ± 0.809	0.130
2nd trimester	43	46.7	2	25	9.860 ± 0.802	
3rd trimester	26	28.2	2	25	10.133 ± 0.663	

g/dL), and there are no any cases of severe anemia in this study.

Based on prevalence, the WHO classified anemia's public health relevance as follows: normal (≤4.9%), mild (5.0%–19.9%), moderate (20.0%–39.9%), and severe (≥40%) [11]. Based on these data, anemia in the participating women in this study would be classified as a mild public health problem. Similar conditions were noted in Pakistan, where the majority of individuals had moderate anemia (14.8%), severe anemia (0.7%), and mild anemia (75.0%) [12]. According to similar research from India, the majority of people (50.9%) had mild anemia, which was followed by moderate anemia (30.17%) and severe anemia (18.9%), in that order [13]. Mild anemia predominates in the majority of anemic women in the current study when compared to other studies, and this may be due to differences in the study area and the administration of iron supplementation in our health centers which helps in combating anemia during pregnancy.

3.2. Distribution of the Socio-Demographic Data and Their Relation with the Degree of Iron Deficiency Anemia

The distribution of the socio-demographic data and their relation with the degree of iron deficiency anemia of pregnant women participating in this study were presented in Table I.

The study showed that there was no statistically significant relation between the degree of iron deficiency anemia and all the socio-demographic data of the pregnant women taken in this study. Although there is no statistically significant relationship between the severity of anemia and sociodemographic characteristics in this study but we noted that there are differences in the level of hemoglobin within the subgroups for each characteristic which indicates that there was a lower prevalence of anemia at the following subgroups: older ages, having low parity, women having education, less gestational age, and those in the 3rd trimester of pregnancy. These results are consistent with studies conducted elsewhere [14]–[16].

Because the iron reserves are repeatedly depleted during pregnancy, it was anticipated that anemia would tend to rise as the number of children increased. In actuality, multiparty conception is typically thought to be the cause of anemia during pregnancy, particularly when the pregnancies happen quickly after one another. This investigation could not discover any statistically significant correlation between the incidence of anemia and the growing child population. Maybe after the first pregnancy, with the knowledge learned from it, a healthier diet and improved awareness, as well as more interactions with other pregnant women, could lessen its impact [17].

This study also shows no statistically significant correlation between the prevalence of anemia and increasing gestational age, indicating that all pregnant women were susceptible to anemia throughout the gestational period. This suggests that early review for antenatal care centers would be a crucial preventive measure in pregnancy. An Indian study found the same result [18].

3.3. Distribution of Pregnant Women by Frequency of Intake for Selected Food Items and Their Relation with the Degree of Iron Deficiency Anemia

Table II showed that there is a highly statistically significant relation between iron deficiency anemia and diet habit of pregnant women regarding the frequency of intake of meat, fish, and vegetables & fruits all at *p-value* = 0.001,

TABLE II: Distribution of Pregnant Women by Frequency for Eating Selected Food and their relation with the Degree of Iron Deficiency Anemia (No. = 100)

Frequency for eating selected food	Mild anemia (n = 92)		Moderate anemia (n = 8)		Hemoglobin levels	*p-value*
	No.	%	No.	%	Mean ± SD	
			Red meat (per week)			
Not eating	6	6.5	3	37.5	9.933 ± 0.103	0.001***
1-	46	50	2	25	9.852 ± 0.927	
3-	37	40.2	2	25	11.224 ± 0.470	
5 or more	3	3.3	1	12.5	11.354 ± 0.436	
			Vegetables & fruits (week)			
Not eating	56	60.9	4	50	9.954 ± 0.905	0.001***
1-	22	23.9	2	25	11.177 ± 0.473	
3-	9	9.8	1	12.5	11.388 ± 0.525	
5 or more	5	5.4	1	12.5	11.323 ± 0.463	
			Pulses (per week)			
Not eating	5	5.4	3	37.5	9.920 ± 0.109	0.012*
1-	53	57.7	2	25	10.002 ± 0.961	
3-	28	30.4	2	25	11.244 ± 0.497	
5 or more	6	6.5	1	12.5	11.323 ± 0.463	
			Nuts (per week)			
Not eating	19	20.7	5	62.5	9.642 ± 0.780	0.021*
1-	43	46.7	1	12.5	10.265 ± 0.93	
3-	24	26.1	1	12.5	11.212 ± 0.484	
5 or more	6	6.5	1	12.5	11.371 ± 0.481	
			Fish (per week)			
Not eating	6	6.5	4	50	9.933 ± 0.103	0.001***
1-	63	68.5	2	25	10.213 ± 1.010	
3-	19	20.7	1	12.5	11.289 ± 0.530	
5 or more	4	4.3	1	12.5	11.291 ± 0.469	
			Tea & coffee			
Yes	55	59.8	5	62.5	9.794 ± 0.821	0.001***
No	37	40.2	3	37.5	11.132 ± 0.655	

Note: (*) Statistically significant at $p \leq 0.05$, (***) Highly statistically significant at $p \leq 0.001$.

intake pulse at *p-value* = 0.012, intake nuts at *p-value* = 0.021, and drinking tea at *p-value* = 0.001. There is a high increase in mean hemoglobin value for women who eat more meals weekly of red meat, fruit and vegetables, pulses, nuts, and fish while there is a high increase in mean hemoglobin value for women who not drink tea or coffee daily.

This study supports previous research that found anemic mothers were more likely to abstain from eating red meat and fish than from eating them. This is because these foods are high in iron, which raises hemoglobin levels, particularly during pregnancy when there is a high demand for iron [19], [20].

These results are consistent with a recent study carried out in northern Ethiopia's Dessie region, which discovered a substantial correlation between a higher risk of anemia and a poor intake of green vegetables. Fruit and vegetables are rich in vitamin C which enhances the bioavailability of iron in the human body [21].

Both pulses and nuts are good sources of non-heme iron, although the quantity of iron absorbed may be low, these sources are eaten in large enough amounts that the iron found in them can be an important portion of daily intake [22].

A polyphenolic substance found in both tea and coffee is known to prevent plants from absorbing inorganic iron from their diet [23]. Pregnant women may be particularly affected by this, as a large percentage of women eat legumes, dry beans, and whole grains, which are excellent sources of non-heme iron.

3.4. *Distribution of Pregnant Women According to Supplements Taken and Their Relation with the Severity of Iron Deficiency Anemia*

The distribution of pregnant women according to their supplement intake is presented in Fig. 2. The study showed

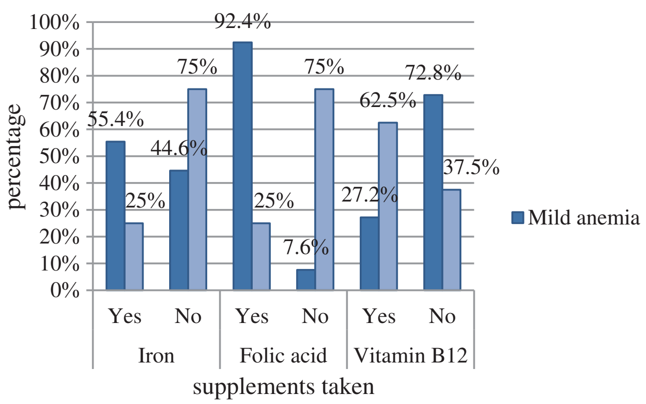

Fig. 2. Distribution of pregnant women according to supplement intake and hemoglobin levels.

TABLE III: The Relationship Between Supplements Intake by Pregnant Women and Hemoglobin Levels

Supplement taken	Hemoglobin levels Mean ± SD	*p-value*
	Iron	
Yes	11.209 ± 0.499	0.001***
No	9.764 ± 0.836	
	Folic acid	
Yes	10.655 ± 0.958	0.001***
No	9.623 ± 0.696	
	Vitamin B_{12}	
Yes	11.316 ± 0.85	0.001***
No	10.193 ± 0.962	

Note: (***) Highly statistically significant at $p \leq 0.001$.

that most women with mild anemia were taking iron supplements and folic acid regularly with a percentage of 55.4 for iron and 92.4 for folic acid. In the case of women with moderate anemia, the vast majority did not start taking iron supplements and folic acid with a percentage of 75 for both iron and folic acid. The study also showed that only about 27.2% of women with mild anemia started taking vitamin B_{12}, while most women with moderate anemia 62.5% started taking this vitamin.

Table III shows that there is a highly statistically significant relationship between the severity of anemia represented by the hemoglobin level and all three supplements which must be taken during pregnancy with *p-value* = 0.001. the highest increase in mean hemoglobin value was for those women who take supplements, with mean values, respectively, for iron 11.209 ± 0.499, folic acid 10.655 ± 0.958, and vitamin B_{12} 11.316 ± 0.85.

Because the mother's blood volume is increasing and the fetus and placenta are growing quickly, iron shortages may occur during pregnancy [24]. The current study's high rate of anemia in expectant mothers may be caused by the possibility that some women have severely low iron levels when they become pregnant. Low prenatal iron stores make it difficult to consume the necessary quantity of iron during the second half of pregnancy through diet, and there may be a higher risk of iron deficiency anemia, particularly as pregnancy approaches its end [25]. According to this study, the majority of women receiving iron/folic acid combinations did so in the early stages of their pregnancies; however, as pregnancies grew longer, the percentage of women receiving combination therapy decreased and a larger proportion of women received iron alone. These observations are in line with another global study recommendation for the management of iron [26].

This study indicates that there is a highly statistically significant relation between the degree of iron deficiency anemia and vitamin B_{12} supplements. The enzyme that changes l-methylmalonyl CoA into succinyl CoA requires vitamin B_{12}. This conversion is a crucial stage in the synthesis of hemoglobin [27].

4. Conclusion

Based on the results of the present study, the following can be concluded: The socio-demographic characteristics did not constitute risk factors for pregnant women suffering from iron deficiency anemia in our study because the results showed that there are no significant differences in the average hemoglobin levels of pregnant women with regard to the different socio-demographic characteristics that they possess. Most pregnant women who suffer from iron deficiency anemia had bad eating habits represented by not eating iron-rich foods, either through not knowing the types of iron-rich foods or practicing some diet and fear of gaining weight. The study concluded that the treatment program followed by the Ministry of Health is a successful program by providing pregnant women with iron supplements, and folic acid that help in iron absorption, as well as vitamin B_{12} when necessary, but some women who receive treatment do not take it, and justify their unwillingness to take any treatment during pregnancy because it may affect the fetus life and they prefer to be satisfied with eating iron-rich foods.

Conflict of Interest

Authors declare that they do not have any conflict of interest.

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