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Research Article

Prevalence of Anemia, Iron Deficiency Anemia and its Sociodemographic Factors among Pregnant Women in Garmian Province, Kurdistan Region of Iraq

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ABSTRACT

Anemia is the most common hematologic abnormality in pregnancy. Maternal anemia is associated with adverse fetal, neonatal, and childhood outcomes. This study aims to determine the prevalence of anemia, and iron deficiency anemia (IDA), the severity of the condition, and study the effect of some sociodemographic factors on pregnant women in Garmian province. The study was conducted among 157 pregnant women in Garmian province between 17 and 49 years old. Participants completed a questionnaire that included sociodemographic characteristics, disease, and gestational age. A hematological evaluation, including a complete blood count and serum for ferritin testing. Results of this study have shown that the prevalence of anemia and IDA were 34.4% and 15.3%, respectively. Almost three-quarters of the pregnant women had mild anemia, while 31% of the participants had moderate anemia, and about 60% of the participants were diagnosed with normocytic anemia. The second trimester had the highest prevalence, with 51.9% for the anemic and 45.8% for IDA participants, while the first trimester showed the lowest prevalence, with 14.8% for the anemic and 12.5% for IDA participants. Age, occupation, gravidity with anemia, and IDA did not make a significant difference. Moreover, there was no significant difference in blood indices between anemic and IDA participants. The serum ferritin level was unaffected by the pregnancy trimesters.

Keywords: Anemia, hematological parameters, iron deficiency anemia, pregnant women, severity of anemia

INTRODUCTION

Anemia in maternity is defined by a low hemoglobin (Hb) concentration of <11 g/dL. Furthermore, the low red blood cell (RBC) count, and decreased packed cell volume.[1,2] Pregnancy-related anemia is a highly unusual finding in hematological tests. It is thought to have an unfavorable effect on fetuses, newborns, and children. Anemia in the mother will increase the likelihood of a transfusion during birth. Iron deficiency (ID) is the most significant problem with anemia during pregnancy.[2] Iron plays an important role in a wide range of cellular metabolism, including oxygen transport by RBC Hb, electron transport, and DNA synthesis. Almost three of the four parts of the body's total iron are contained in heme, Hb, and myoglobin, with the remaining parts stored as ferritin and hemosiderin.[3]

ID is the insufficiency of iron in the body below normal levels to maintain all physiological functions. ID anemia (IDA) develops when the bodily iron levels drop too low to maintain healthy RBC synthesis.[4] In the absence of infection, serum ferritin is a susceptible and widely used test for the diagnosis of ID, which shows decreased serum ferritin with <15 ng/mL in the age of 5 years or older, both in males and females.[5] It has been shown that IDA has been associated with hazardous neonatal mortality, premature delivery, low birth weight (LBW), child cognitive growth, and motor development in pregnant women.[6] ID is the most common cause of anemia, It causes around 50% of all types of anemia, and this is the most widespread nutritional deficiency globally.[7] ID is the probable cause of about 75% of all anemia cases during pregnancy.[8] ID is a major dietary problem throughout the world. A pregnant

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woman's diet is inadequate to satisfy her iron requirements.[9] Women need 4.4 milligrams of iron daily during pregnancy,[10] which is approximately double their normal requirement. In addition, they need more iron than usual due to the increased need for iron during pregnancy.[11] When the mother's RBC mass increases along with fetal growth, the iron requirements increase. Women need to take additional iron supplements daily during their pregnancy. Taking these supplements significantly lowers the risk of developing anemia during pregnancy.[12]

Anemia is considered a global health problem that influences many countries with a big concern for public health besides communal and financial development.[13,14] It affects people at different stages of life but is more common in pregnant women and children.[13] Globally, anemia affected around 29% of non-pregnant women and about 38% of pregnant women aged 15–49 in 2011. In 2019, anemia was 29.6% in non-pregnant women and 36.5% in pregnant women.[15,16]

There is a wide range of social, cultural, and environmental factors that affect the prevalence of anemia during pregnancy. Anemia is widespread in many countries worldwide. It is highly influenced by nutrition, infectious diseases, genetics, and strong menstrual bleeding on a biological level.[17] It has been shown that the risk of anemia is increased by deficiencies of vitamins A and B12, C, D, E, folate, zinc, riboflavin, and copper, and infection with hookworm, schistosomiasis, and HIV.[17,18] Furthermore, it has been shown that there is a potential relationship between Helicobacter infection and anemia.[19]

However, normal hemodilution occurs during pregnancy and ranges between 20 and 24 weeks, and Hb levels vary throughout pregnancy.[11] It is well known that Hb naturally decreases throughout the second trimester. This decrease is related to a larger increase in plasma levels compared to RBC mass. The relative hemodilution of blood viscosity brought on by this process promotes placental blood flow.[20] Some women have little or no iron stored when they become pregnant, and this problem can cause severe ID during pregnancy.

According to the WHO recommendations on the prevention, control, and treatment of anemia in women as part of prenatal treatment, daily oral iron and folic acid supplementation is advised to lower the risk of LBW, maternal anemia, and ID. According to the United Nations multiple micronutrient preparation, supplements may include additional vitamins and minerals in addition to iron and folic acid to address any potential maternal micronutrient deficits. Any attempts to prevent and control anemia should be supported by a diet rich in bioavailable iron.[21] This study aims to determine the prevalence of anemia, IDA, the severity of the condition, and some associated sociodemographic characteristics in pregnancy in the Garmian area.

MATERIALS AND METHODS

Study Design

This study was performed on 157 pregnant women aged 17–49 years, who attended both Garmian Medical City and Zanko Medical Laboratory during August 2021 and October 2022 in Kalar City/Kurdistan region of Iraq. Blood samples have been collected from the patients to perform hematological assessments anonymously.

Data Collection

The data were collected from pregnant women by using a questionnaire form. The questionnaire was created to investigate disease and sociodemographic factors. The pregnant women were divided based on gravidity into primigravida and multigravida, and on their occupations into employees and non-employees, with ages ranging from ≤29, 30–39, to 40–49 years.

Laboratory Assessment

Venous blood (5 mL) was collected from the participants in this study and placed in an EDTA tube for a complete blood count (CBC) test, and a gel tube for a serum ferritin test. In Zanko Medical Laboratory, the blood samples were collected, and the CBC test was performed on a fully automated hematology analyzer (Medionic M51). The collected blood was centrifuged by an (LC-04L Centrifuge). The serum ferritin test was assessed by (Cobas e411 analyzer) after serum preparation by centrifugation of blood sample at 3500 rpm for 10 min. Each test was done immediately after collecting the blood samples.

In Garmian Medical City, blood samples were collected, and a CBC test was analyzed by a fully automated hematology analyzer (Swelab Alfa Plus) for the CBC test. Centrifugation of blood samples was performed at 3500 rpm/10 min by (an 80–1 Electric Centrifuge). Serum ferritin was tested with a Cobas e411 analyzer after serum preparation. All tests were performed immediately following the collection of blood samples.

Differential Value and Statistical Analysis

Haemoglobin and serum ferritin criteria were used for the diagnosis of anemia and IDA based on WHO guidelines.[1,5] Pregnant women who measured Hb <11 g/dL and serum ferritin <15 ng/mL were defined as IDA.

The severity of anemia is categorized according to WHO thresholds,[1] including mild anemia, where Hb levels range between 10 and 10.9 g/dL, and moderate anemia, where blood Hb levels range between 7 and 9.9 g/dL. The present findings were compared with how the WHO categorizes anemia and IDA in the community as significant for public health based on prevalence estimates derived from Hb and serum ferritin levels in the blood.[1,5] Anemia was divided into two categories based on mean cell volume (MCV) levels.[22] Statistical analysis was evaluated using Microsoft Excel 2014 for the achieved data. The Chi-square test was used to determine the difference between the different groups. A $P < 0.05$ was considered statistically significant.

Ethics Statement

The studies involving human participants were reviewed and ethically approved by the scientific and ethical of the Biology department, University of Garmian. The participants provided their written informed consent to participate in this study. Participants were guaranteed anonymity and confidentiality for their responses, and they were assured of having the

ability to withdraw their responses for any reason at any time, without any implications.

RESULTS

In the present study, out of a total of 157 pregnant women in the Garmian/Kurdistan region of Iraq of different ages ranging from (17 to 49) years, 124 were from Kalar, 6 from Kifry, 21 from Rizgary, 3 from Bawanour, and 3 from Sarqala were involved in this study. Based on Hb levels, the prevalence rate of anemia among the total number of women was 54 (34.4%) with a mean Hb of 10.1 ± 0.83, and (65.6%) non-anemic women with a mean Hb of 12.14 ± 0.79, as shown in Table 1.

Furthermore, 54 (34.4%) pregnant women had an ID with a mean serum ferritin of 8.92 ± 2.8 ng/mL, and 103 (65.6%) pregnant women did not have ID with a mean serum ferritin of 42.64 ± 32.44 ng/mL, [Table 2]. In addition, 24 (15.3%) of pregnant women were diagnosed with IDA with a mean Hb of 10 ± 1.05 g/dL, and the mean of serum ferritin was 7.51 ± 2.88 ng/mL, [Table 3].

In the present study, out of 54 anemic patients, 37 (69%) of patients had mild anemia with Hb level ranges between 10 and 10.9 g/dL, while 17 (31%) of the patients had moderate anemia with Hb level ranges between 7 and 9.9 g/dL. Severe anemia was not observed among the patients, [Figure 1].

Moreover, microcytic anemia was observed in 21 (38.9%) pregnant women, while 33 (61.1%) of pregnant women were diagnosed with normocytic anemia, as shown in Figure 2.

Results of this study have shown that anemia and IDA were most prevalent among pregnant women in their second trimester (51.9%) and (45.8%), respectively, compared to the first and third trimesters. However, the first trimester showed the lowest prevalence rate of anemia and IDA, with (14.8%) and (12.5%), respectively, as shown in Table 4.

In the present study, women ≤29 years old showed the highest prevalence of anemia with 55.6% and IDA at 62.5%, while 40.7% of the anemic patients and 29.2% of the IDA patients were ranged between 30 and 39 years old, and the women with age group between 40 and 49 years old showed the lowest prevalence of anemia and IDA with 3.7% and 8.3%, respectively. There was no significant difference between age, occupation, and gravidity with anemia and IDA with $P = 0.1$, 0.5, and 0.3, respectively, [Table 5].

The gestational age concerning blood indices, which include these tests; RBC, Haematocrit, mean cell hemoglobin (MCH), MCH concentration (MCHC), and red cell distribution width (RDW), have shown that there is no significant difference between anemic pregnant women and IDA patients [Table 6].

DISCUSSION

Maternal anemia plays an essential role in elevating perinatal and neonatal mortality.[23] Moreover, the consequences of IDA on the physical and mental development of newborns and the productivity of adults are a major concern.[24] The present results showed that 65.6% of pregnant women were

Table 1: Prevalence of anemia among pregnant women (n=157)

Prevalence	Number	Percentage	Mean	SD
Anemic	54	34.4	10.1	0.83
Non-anaemic	103	65.6	12.14	0.79

%: Percentage of anemic and non-anemic pregnant women, SD: Standard deviation

Table 2: Iron deficiency and non-iron deficiency prevalence among pregnant women (n=157)

Prevalence	Number	Percentage	Mean	SD
Iron deficient	54	34.4	8.92	2.8
Non-iron deficient	103	65.6	42.64	32.44

%: Percentage of iron deficient and non-iron deficient pregnant women, SD: Standard deviation

Table 3: Prevalence of iron deficiency anemia in pregnant women (n=157)

Prevalence	Number	Percentage	Mean	SD
Iron deficiency anemia				
Hb	24	15.3	10	1.05
Serum ferritin	24	15.3	7.51	2.88

Hb: Hemoglobin, %: percentage of iron deficiency anemia among women according to their Hb and ferritin levels

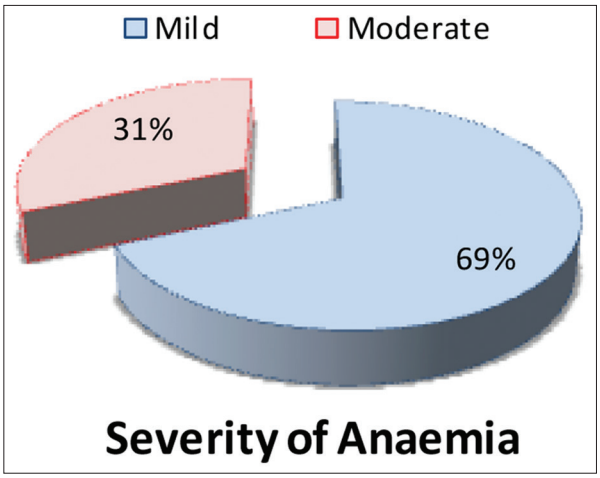

Figure 1: The distribution of the severity of anemia among the anemic patients

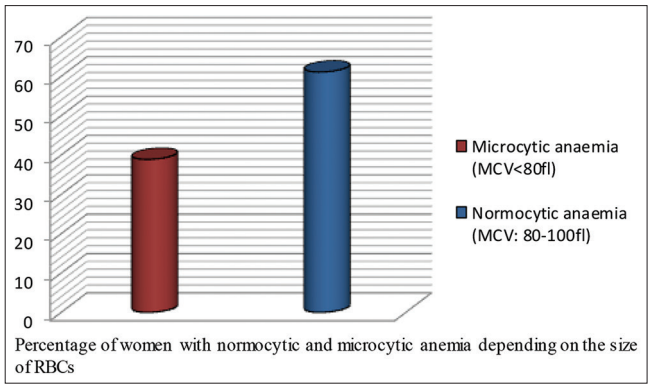

Figure 2: The distribution of types of anemia among anaemic patients

Table 4: The association between anemic and IDA among pregnant women in gestational age

Prevalence	Gestational age					
	First trimesters		Second trimesters		Third trimesters	
	No.	Percentage	No.	Percentage	No.	Percentage
Anemic=54	8	14.8	28	51.9	18	33.3
IDA=24	3	12.5	11	45.8	10	41.7

IDA: Iron deficiency anemia, %: Percentage of anemic and IDA women according to their trimesters

Table 5: The association of sociodemographic characteristics among anemic and IDA pregnant women

Variable	Anemia		IDA		*P*-value
	No.	%	No.	%	
Age group					
≤29	30	55.6	15	62.5	0.106609*
30–39	22	40.7	7	29.2	
40–49	2	3.7	2	8.3	
	Total=54 (100)				Total=24 (100)
Occupation					
Non employees	43	79.6	22	91.7	0.519276*
Employee	11	20.4	2	8.3	
	Total=54 (100)		Total=24 (100)		
Gravidity					
Primigravida	23	42.6	13	54.2	0.343961*
Multimigravida	31	57.4	11	45.8	
	Total=54 (100)		Total=24 (100)		

IDA: Iron deficiency anemia, *There is no significant difference between the different groups and the $P>0.05$

non-anemic, while 34.4% were anemic. Based on the level of Hb in the blood, indicates a moderate public health concern.[1] These results are consistent with a previous study that showed that the mean Hb level ranges to <11 g/dL.[25] The prevalence of anemia among pregnant women was 34.4% with ID and 65.6% with non-ID, ID may occur due to multi conditions such as bleeding, stomach and intestinal ulcer, and menstrual period and may occur with an inadequate supply of different nutrients, especially for the pregnant women who need more iron supply to replace the amount of lost iron each day, since most of the participants in this study are unemployed, and dietary awareness of the women might play an important role in developing ID.[26] This result of ID is considered a moderate public health issue based on the blood Hb level and ferritin level according to WHO based on the prevalence estimated from serum ferritin levels <15 μg/L.[5] About 69% of the anemic participants had mild anemia, and 31% had moderate anemia; the present findings are concomitant with other researchers with mild anemia of 72.9%, 32.5%, and 28.1%, respectively.[27,28] These varieties may relate to dietary diversity in different areas worldwide. They could be attributed to differences in socioeconomic, dietary habits, and health-seeking behaviors between cities with a community of relatively different lifestyles, feeding practices, and social norms.[29,30] Such as the consumption of red meat and leafy green vegetables that are an essential source of heme iron. Many studies have revealed that pregnant women who eat meat occasionally were 2.1 times at higher risk of being anemic than pregnant women who ate meat one or more times per week.[25,31] Other studies showed that drinking tea and coffee after meals which are a main inhibitor of non-heme iron absorption due to phenolic compounds in these beverages, might increase the risk of developing anemia.[29,31] All these factors are considered a significant association with anemia in pregnancy.[25,32,33] In addition, insufficient use or consumption of hematopoietic agents required for normal erythropoiesis, including iron, B12, and folic acid, appears to be a prevalent vitamin deficiency worldwide.[29,34]

Anemia etiologies can be distinguished into microcytic, normocytic, and macrocytic anemia using the MCV value. In the results of the study, microcytic and normocytic anemia are diagnosed in anemic pregnant women; macrocytic anemia is not. IDA is the most probable cause of microcytosis, including other factors such as premenopausal, menstrual, or blood loss without proper iron supplementation, thalassemia, sideroblastic anemia, and anemia caused by chronic diseases.[22] Most normocytic anemias are side effects of other diseases; they reflect a primary blood disorder. This is due to the anemia of chronic disease (inflammation, cancer), renal failure, endocrine failure (hypothyroidism, hypopituitarism), acute blood loss, marrow failure, and hemolysis.[35,36] According to the study's results, 38.9% of anemic subjects had microcytic anemia, and 61.1% had normocytic anemia; these results are comparable with those of the study done by Bayarkhuu and Tsogbadrakh,[37] in which 37.07% of pregnant women were affected by microcytic anemia, 46.55% by normocytic anemia, and 3.2% by macrocytic anemia. In a study conducted by Singh *et al*.[38] at King George's Medical University on 440 reproductive-age females from the Tharu tribe living in the Balrampur district along the Indo-Nepal border, microcytic, normocytic, and macrocytic anemia were found in 53%, 44.88%, and 2.12% of the subjects, respectively.

The result of gestational age showed that there was no significance between IDA and anemic participants in relation to blood indices, and this finding is in concomitant with other study conducted in Saudi Arabia, which reported that there was no significant difference between anemia and blood indices associated with gestational age, and stated that a lower rate of spontaneous vaginal delivery was significantly associated with anemia, and this might be attributed to the fact that anemia was mostly mild and most participants were taking iron supplements.[39] A study by Liu *et al*.[40] also reported that preconception mild anemia increases the riskiness of LBW and small for gestational age (SGA) by 17% and 14%, respectively,

Table 6: The association between anemic and IDA pregnant women of gestational age in relation to blood indices

Variable	Gestational age						F	*P*-value
	Anemic=54			IDA=24				
	First trimester	Second trimester	Third trimester	First trimester	Second trimester	Third trimester		
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD		
RBC	4.27±0.69	3.89±0.35	3.89±0.62	4.53±0.14	3.8±0.3	3.7±0.35	0.706	0.49*
Hct	31.3±1.68	31.6±2.91	31.8±1.9	30.5±2.23	30.9±3.77	31.8±2.3	0.190	0.82*
MCH	24.05±5.14	26.2±3.49	26.7±3.94	20.43±2.05	26.4±3.8	27.8±1.9	1.328	0.27*
MCHC	31.69±1.33	31.96±0.94	32.02±1.06	30.3±0.25	32.3±1.02	32.2±1.19	2.354	0.102*
%RDW	14.3±1.47	14.7±1.85	14.4±2.08	14.4±0.4	13.9±1.19	13.7±1.4	0.149	0.86*

RBC: Red blood cell, Hct: Haematocrit, MCH: Mean cell hemoglobin, MCHC: Mean cell hemoglobin concentration, RDW: Red cell distribution width, F: Frequency, *There is no significant difference between the anemic and IDA women according to their gestational age and the $P>0.05$

but moderate and severe anemia had no significant association with LBW and SGA. In addition, maternal anemia and high Hb levels before pregnancy contribute to the increase of these risks of SGA, birth, preterm birth, and perinatal death. Moreover, a study by Patra *et al*.[41] has stated that women with severe anemia during the third trimester of pregnancy have high maternal mortality (6.2%) and perinatal mortality (60%).

Results of this study have shown that different ages, occupations, and gravidity did not produce significant influence both on anemia and IDA; no significance was found in gestational age concerning blood indices between the two groups. The result of this study was different from other studies regarding primigravida and multigravida and parity, and these studies indicate that frequent pregnancies are associated with anemia because frequent pregnancies do not give enough time to restore depleted iron stores.[41,42] Some risk factors that lead to IDA are multiple pregnancies and adolescent pregnancy, as well as delivery with hemorrhage.[43,44]

Many studies showed the role of blood indices and are recommended as the first step in evaluating pregnancy-associated anemia. The MCV, MCH, MCHC, RBC count, and RDW- CV% correlate with the ferritin levels and can help diagnose IDA.[45-47] At the same time, this study's result is in contrast with these studies and showed no significant influence in blood indices of the gestational age between the anemic women and IDA women. However, this study result was similar to a study done by Sultana *et al*.[48] showed that some hematological parameters, such as MCV, MCH, and MCHC, have low reliability in detecting IDA during pregnancy. These red cell indices may be mean values, which cannot express the small variation of red cell size that occurs in the early stage of ID; moreover, that may relate to an increase in plasma volume leading to hormonal disturbances and ID.[48-50]

CONCLUSION

Anemia and IDA during pregnancy continues to be a major health problem worldwide as well as in this study area. Three-quarters of pregnant women had mild anemia, and about two-thirds were diagnosed with normocytic anemia. The second trimester had the highest prevalence of anemia and IDA. There was no significant effect of blood indices and sociodemographic characteristics on anemia and IDA. The limitations of our study were that it was limited to Women's Specialized Hospital, and some information relating to the study parameter was missing. We suggest hematological examination for Hb and iron status from the beginning of pregnancy.

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