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Research Article

Anaemia and Caesarean Section in Caucasian Race: assessment of Risk Factors and Management Strategies

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ABSTRACT

Background: Anaemia among pregnant women is a significant public health concern, particularly in developing countries, due to its adverse effects on both maternal and fetal health. This study addresses the gap in research regarding anaemia in pregnant women in northern Iran, specifically among those undergoing elective caesarean sections. The objective is to assess the prevalence of anaemia in this population.
Method: This retrospective cross-sectional study included 719 Caucasian pregnant women who were candidates for elective caesarean sections from September 2020 to March 2023. Patient data was collected from hospital electronic records. Anaemia was defined as haemoglobin <10.5 g/L in the three months before delivery and under 10 g/L after delivery. The Chi-square test was employed to compare anaemia prevalence across different demographic groups, with a significance level set at p-value < 0.05.
Results: Among the 719 participants, key demographic findings revealed that most had primary education (26.8%), while only 12.4% held university degrees. Most (59.8%) resided in urban areas, with the largest age group being 31-36 (30.5%). Most women (75.2%) reported no history of miscarriage, and 98.2% experienced no bleeding during pregnancy. Notably, 57.7% of women reported no underlying health conditions; however, 9.2% had gestational diabetes, while others had blood disorders, neurological issues, or gastrointestinal problems. The prevalence of anaemia among patients undergoing elective caesarean sections was found to be 10.85%. Anaemia was more prevalent in women aged 25-30 years.
Conclusion: integrating nutritional counselling into routine prenatal care can help address dietary deficiencies before they contribute to anaemia. Moreover, collaboration between healthcare providers and community leaders may foster greater acceptance of health interventions. By tailoring educational programs to local contexts and addressing specific cultural beliefs about nutrition and health, policymakers can create more effective strategies to combat anaemia in pregnant women.

Keywords: Anaemia; Caesarean Section; Foetus; Pregnancy

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INTRODUCTION

The prevalence of anaemia worldwide is 24.8%, affecting 1.62 billion people.[1] The most affected groups in Africa and Southeast Asia are women and children. The global prevalence of anaemia during pregnancy was 38% in 2011. Although this decreased from 43% in 1995, it still constitutes a significant public health problem in low- and high-income countries. The prevalence of maternal anaemia in high-income countries was estimated at 25% in 2011.[2] According to UK guidelines on anaemia in pregnancy, anaemia in the first trimester is defined as haemoglobin less than 11 g/dL, in the second and third trimesters as haemoglobin less than 10.5 g/dL, and after delivery as haemoglobin less than 10 g/dL. Recent observational data from a multicentre study in the UK involving 2103 women estimated the prevalence of anaemia to be 24.4%.[3,4] There is evidence that anaemia is a risk factor for maternal and neonatal clinical outcomes such as low birth weight.[5] A recent study on iron deficiency anaemia in Israel 2015 showed an increased risk of caesarean section, blood transfusion, and low Apgar score.[6, 7]

In a study conducted by Milad Azami and colleagues at Ilam University of Medical Sciences as a meta-analysis from 2005 to 2016, the prevalence of anaemia in Iranian pregnant women was reported to be 17%. The highest prevalence of anaemia in this study was related to the centre of the country (23%), and the lowest was related to the west (12%). In this study, the prevalence of anaemia in urban and rural pregnant women was calculated to be 21% and 8%, respectively. This study concluded that anaemia in Iranian pregnant women has increased in the last 11 years compared to the years before 2005. Therefore, appropriate intervention programs should be developed and implemented in prenatal clinics or before marriage.[7,8] Furthermore, in some countries, folate deficiency and human immunodeficiency virus infection were not strongly associated with anaemia; parasitaemia was associated with a decrease in mean haemoglobin level in pregnancy.[9] The diagnosis of anaemia, especially iron deficiency anaemia, is simple and inexpensive.[10] More importantly, its treatment is also inexpensive and simple and can be treated after removing the underlying cause such as bleeding, parasitic factors,[11] poor diet, gastrointestinal diseases, menstrual disorders, prescribing dietary supplements such as iron tablets, and in very severe cases, iron injections or blood transfusions. During pregnancy, anaemia is a significant cause of maternal morbidity and mortality in developing countries and has both maternal and fetal consequences.[12,13] It can also lead to preterm birth,[14] low birth weight,[15] fetal mental retardations, and stillbirth.[16,17]

Iron deficiency anaemia is the most common form of malnutrition in the world and the most common type of anaemia.[18] Most anaemia during pregnancy is also due to iron deficiency.[19] There is a correlation between anaemia and caesarean delivery, with anaemia potentially increasing the risk of needing a C-section and complicating the outcomes of such surgeries. Pregnant women with anaemia who undergo caesarean sections face increased risks related to blood loss, recovery challenges, and infection. Healthcare providers must monitor haemoglobin levels and manage anaemia effectively throughout pregnancy to minimize these risks and ensure better outcomes for both the mother and baby.

Managing pregnant women with anaemia who are undergoing a caesarean section (C-section) requires careful planning and consideration. Here are key strategies for effective

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management: 1. preoperative assessment, such as assessing the severity of anaemia and determining the underlying cause; 2. preoperative optimization, such as iron supplementation and nutritional support; 3. Intraoperative management includes using techniques to minimize blood loss during surgery and preparing for potential blood transfusions if significant blood loss is anticipated. Given the importance of anaemia among pregnant women as one of the high-risk and sensitive population groups in the world and in our country, Iran, as well as the adverse effects of anaemia on the mother and foetus, timely diagnosis and treatment of this disease is essential. The primary indication for caesarean section was a previous caesarean delivery (69.4%), with other reasons including fetal heart rate abnormalities, meconium presence, and various medical conditions. Since a similar study has not been conducted in north Iran and Caucasian race-based, a study was designed to investigate anaemia in pregnant women who are candidates for elective caesarean section. The study assessed only elective, rather than emergency, caesarean section patients to focus on those most likely to benefit from targeted preoperative iron therapy. This study aims to investigate the prevalence of anaemia in this group of mothers, considering that bleeding in caesarean surgery is more significant than in natural childbirth and also increases the likelihood of postpartum anaemia.

METHOD

This was a retrospective cross-sectional and descriptive study including Caucasian Pregnant women candidates for elective caesarean section referred to Motahari Educational and Treatment Centre in Urmia in North Iran from September 2020 to March 2023 as the sample.

A total of 719 pregnant women who were candidates for an elective caesarean section between September 2020 and March 2023 were enrolled in the study. This study period was chosen to provide a sufficiently large sample size for analysis and recent data relevant to our current and evolving practice. The laboratory archive extracted the patient's haemoglobin values during term and before delivery. Also, other demographic, laboratory and outcomes data were collated from the hospital electronic data warehouse, including history of anaemia, previous pregnancy history, history of abortion, history of bleeding during pregnancy, history of hereditary blood diseases, type of probable anaemia, dose and frequency of iron supplementation, current gestational age, place of residence (village or city), patient's age, occupation, level of education, reason for caesarean section, were collected and recorded in the relevant checklists. In this study, anaemia was defined as haemoglobin <10.5 g/L.[19]

Patient data was collected from hospital electronic records. Anaemia was defined as haemoglobin <10.5 g/L in the three months before delivery and under 10 g/L after delivery. The primary aim was to establish the incidence of anaemia at the time of delivery and any associated predictors. Secondary outcomes included any association between the primary outcome and complications defined by the hospital discharge complication coding system and an evaluation of the number of blood tests carried out antenatal per trimester.

Quantitative variables were reported as mean, standard deviation and qualitative variables as frequency (percentage) in appropriate tables. The Chi-square test was used to compare the frequency of anaemia according to months of pregnancy, age groups, urban or rural residence, and educational level. A significance level of less than 0.05 was considered. Data analysis was performed using a computer program.

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All patient information was kept confidential. The research project was implemented after approval by the Ethics Committee of Urmia University of Medical Sciences and obtaining an ethical code (IR.UMSU.REC.1397.125)

RESULTS

A total of 719 pregnant women who were candidates for an elective caesarean section between September 2020 and March 2023 were enrolled in the study. The demographic characteristics of different variables are shown in Table 1. According to Table 1, Most women had primary education (26.8%), and the lowest frequency was related to university education (12.4%). Almost half of women (about 59.8%) were urban. Two hundred forty-three women (33.8%) had one previous pregnancy, and 15.2% were nulliparous. Most mothers were in the age group of 31-36 years (30.5%), and the age group above 36 years (20.6%) had the lowest frequency. Five hundred forty-one mothers (75.2%) had no history of previous miscarriage. Almost all (98.2%) had no history of bleeding during pregnancy. The indication for Caesarean section in 69.4% of women was having a previous Caesarean section. Other indications for Caesarean section included fetal heart rate drop (37 people with 5.1%), meconium (24 people with 3.3%), arrest of descent or dilatation (9 people with 1.3%), abnormal fetal presentation (60 people with 8.6%), anatomical problems (14 people with 1.9%), placental problems (12 people with 1.7%), heart problems (3 people with 0.4%), discopathy (5 people with 0.7%), valuable fetus (8 people with 1.1%), fetal distress (7 people with 1%), fetal macrosomia (2 people with 0.3%), severe preeclampsia (12 people with 1.7%), genital warts (2 people with 0.3%), trauma (10 people with 1.4%), positive OCT test (5 people with 0.7%), self-requested (1 person with 0.1%), and a combination of these (9 people with 1.3%).

Almost half of women (57.7%) had no underlying disease, and 9.2% of them had gestational diabetes. Other underlying diseases included blood diseases (anaemia, thalassemia, thrombocytopenia) (2.4%), neurological diseases (epilepsy, migraine) (1.3%), infertility 1.9%), depression (0.4%), heart diseases (valvular), benign or malignant tumour (lipoma, meningioma, ovarian or breast cancer), liver problems (fatty liver, elevated liver enzymes), kidney and urinary tract problems (pyelonephritis, hydronephrosis, polycystic kidney, kidney stones, urinary tract infection), gastrointestinal problems (gastritis, dyspepsia), asthma (dyspnea), lupus, and a combination of these (11.4%).

Table 1. Frequency and Percentage of Qualitative and Quantitative Variables in Women Candidates for Elective Caesarean

Variables	Frequencies	Percentage
Mothers' education	157	21.8%
Illiterate		
Primary school	193	26.8%
Middle School	114	15.9%
High School	71	9.9%
Diploma	95	13.2%
University degrees	89	12.4%
Place of Residence		
Village	289	40.2%
City	430	59.8%

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Variables	Frequencies	Percentage
Number of Previous Pregnancies		
0	109	15.2%
1	243	33.8%
2	185	25.7%
> 2	182	25.3%
Mother's age per year		
< 25	150	20.9%
25-30	202	28.1%
31-36	219	30.5%
< 36	148	20.6%
Number of Children		
0	145	20.2%
1	304	42.3%
2	195	27.1%
> 2	75	10.4%
Number of Previous Miscarriages		
0	541	75.2%
1	133	18.5%
2	25	3.5%
3	15	2.1%
4	5	0.7%
History of Bleeding During Pregnancy		
-	706	98.2%
+	13	1.8%
Supplement use		
No or Unorganized	298	41.4%
Yes	421	58.6%
Caesarean Section Indication		
Previous Caesarean Section	499	69.4%
Other Indications	220	30.6%
Underlying disease		
No disease	415	57.7%
Diabetes	66	9.2%
Hypertension	34	4.7%
Thyroid disease	53	7.4%
Other	151	21%
Gestational age		
< 37 weeks	238	33.1%
≥ 37 weeks	481	66.9%
Third Trimester Haemoglobin		
< 10.5	78	10.8%
≥ 10.5	641	89.2%
Haemoglobin After Delivery		
< 10	124	17.2%
≥ 10	595	82.8%

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Table 2. Mean and Standard Deviation of Quantitative Variables in Women Candidates for Elective Caesarean Section

Variables	Mean	SD	Max	Min
Mother's Age	30.77	6.2	46	16
Gestational Age	37.35	2.3	42	25
Haemoglobin in the third trimester	11.85	1.08	15.5	8.4
Haemoglobin After Delivery	11.28	1.29	17.7	5.9

Table 3. Frequency of Anemia in the Third Trimester of Pregnancy Based on Studied Variables in Women Candidates for Elective Caesarean Section

Variables		Haemoglobin > 10.5	Haemoglobin ≤ 10.5	*p*-value
		n(%)	n(%)	
Mother's Age (Years)	< 25	18(23.1)a	132(20.6)a	0.623
	25-30	25(32.1)a	177(28.6)a	
	31-36	19(24.4)a	200(31.2)a	
	> 36	16(20.5)a	132(20.6)a	
Mother's Education	Illiterate	21(26.9a	136(21.2)a	0.291
	Primary school	20(25.6)a	173(27)a	
	Middle school	17(21)a	197(15.1)a	
	High school	6(7.7)a	65(10.1)a	
	Diploma	9(11.5)a	86(13.4)a	
	High degree	5(6.4)a	84(13.1)a	
Place of Residence	Rural	24(30.8)a	265(41.3)a	0.072
	Urbane	54(69.2)a	367(58.7)a	
Number of Previous Pregnancies	0	12(15.4)a	97(15.1)a	0.942
	1	26(13.3)a	217(33.9)a	
	2	22(28.2)a	163(24.5)a	
	> 2	18 (23.1)a	164 (25.6)a	
Number of children's	0	13 (16.7)a	132 (20.6)a	0.591
	1	31 (39.7)a	273 (42.6)a	
	2	36 (33.3)a	169 (26.4)a	
	> 2	8 (10.3)a	67 (10.5)a	
History of Bleeding during Pregnancy	Negative	77 (98.7)a	629 (98.1)a	0.712
	Positive	1 (1.3)a	12 (1.9)a	
Underlying disease	Negative	40 (51.3)a	375 (58.5)a	0.013
	Diabetes	15(19.2)a	51 (8)b	
	Hypertension	1 (3/1)a	33 (5.1)a	
	Thyroid disease	5 (6.4)a	48 (7.5)a	
	Other disease	17 (21.8)a	134 (20.9)a	
Supplement use	Negative	35 (44.9)a	263 (41)a	0.515
	Positive	43 (55.1)a	378 (59)a	
Miscarriage	Negative	59 (75.6)a	482 (75.2)a	0.931
	Positive	19 (24.4)a	159 (24.8)a	
Caesarian history	Positive	58 (74.4)a	441 (68.8)a	0.314
	Other indications	20 (25.6)a	200(31.2)a	

a and b: Based on the Bonferroni correction test, the same letters in each column indicate no significant difference, and different letters indicate a significant difference in the frequency of that grouping in each variable between the two groups (haemoglobin less than 10.5 and haemoglobin greater than or equal to 10.5). According to this, based on the underlying disease, the frequency between the two groups is significantly different (the group of diabetes or impaired blood sugar).

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Table 2 shows different variables in women candidates for elective caesarean section. Haemoglobin less than 10.5 was defined as anaemia in the third trimester of pregnancy. In general, 78 women (10.8%) had anaemia in the third trimester of pregnancy. The frequency of anaemia based on the studied variables, except underlying diseases, did not have a statistically significant difference. However, the highest frequency of anaemia was in the age group of 25-30 years (32.1%), in illiterate women (26.9%), urban women (69.2%), and women with one pregnancy (33.3%). The frequency of anaemia based on the underlying disease was higher in women with diabetes or impaired blood sugar (19.2%) (p=0.013), as shown in Table 3.

Table 4. Comparison of Anemia Frequency After Delivery Based on Studied Variables in Women Candidates for Elective Caesarean Section

Variables		Haemoglobin > 10.5	Haemoglobin ≤ 10.5	*p*-value
		n(%)	n(%)	
Mother's Age (Years)	< 25	25 (20.2) a	125 (21) a	0.535
	25-30	35 (28.2) a	167 (28.1) a	
	31-36	33 (26.6) a	186 (31.3) a	
	> 36	31 (25) a	117 (19.7) a	
Mother's Education	Illiterate	31 (25) a	126 (21.2) a	0.491
	Primary school	37 (29.8) a	156 (26.2) a	
	Middle school	19 (15.3) a	95 (16) a	
	High school	13 (10.5) a	58 (9.7) a	
	Diploma	10 (8.1) a	85 (14.3) a	
	High degree	14 (11.3) a	75 (12.6) a	
Number of Previous Pregnancies	0	23 (18.5) a	86 (14.5) a	0.067
	1	30 (24.2) a	213 (35.8) a	
	2	39 (31.5) a	146 (24.5) a	
	> 2	32 (25.8) a	150 (25.2) a	
Number of children's	0	27 (21.8) a	118 (19.8) a	0.095
	1	41 (33.1) a	263 (44.2) a	
	2	43 (34.7) a	152 (25.5) a	
	> 2	13 (10.5) a	62 (10.4) a	
Abortion	No	91 (73.4) a	450 (75.6) a	0.599
	Yes	33 (26.6) a	145 (24.4) a	
History of Bleeding during Pregnancy	No	119 (96) a	587 (98.7) a	0.041
	Yes	5 (4) a	8 (1.3) a	
Underlying disease	Negative	70 (56.5) a	345 (58) a	0.621
	Diabetes	14(11.3) a	52 (8.7) a	
	Hypertension	5 (4) a	29 (4.9) a	
	Thyroid disease	6 (4.8) a	47 (7.9) a	
	Other disease	29 (23.4) a	122 (20.5) a	
Supplement use	Negative	53 (42.7) a	245 (41.2) a	0.748
	Positive	71 (57.3) a	350 (58.8) a	
Gestational age	Less than 37 weeks	38 (30.6) a	200 (33.6) a	0.523
	Greater than or equal to 37 weeks	86 (69.4) a	395 (66.4) a	
Caesarian history	Positive	79 (63.7) a	420 (70.6) a	0.131
	Other indications	45 (36.3) a	175 (29.4) a	

a : Based on the Bonferroni correction test, the same letters in each column indicate no significant difference in the frequency of that grouping in each variable between the two groups.

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Table 4 shows the frequency of anaemia after delivery based on the studied variables in women candidates for elective caesarean section. Haemoglobin less than 10 was defined as anaemia after delivery. In general, 124 women (17.2%) had anaemia after delivery. The frequency of anaemia after delivery based on the studied variables, except based on the history of bleeding during pregnancy, did not have a statistically significant difference. However, the highest frequency of anaemia was in the age group of 25-30 years (26.6%), illiterate women (25%), those with primary education (29.8%), women with two previous pregnancies (31.5%), women with two children (34.7%), gestational age more than 37 weeks (69.4%).

DISCUSSION

Anaemia is one of the most common medical problems worldwide, especially among women.[1] The physiological differences between women and men have increased the prevalence of this disease among women. Pregnancy in women increases the likelihood of anaemia due to increased needs or exacerbates underlying anaemia. The main population affected by anaemia are African and Southeast Asian women and girls. The global prevalence of this disease, according to a 2011 review, is 38%, estimated to be 25% in high-income countries.[2,10] In addition to maternal complications of anaemia, such as early fatigue, reduced tolerance to physical activity, lethargy, reduced mood, and shortness of breath, there is evidence of the impact of this disorder on the infant, such as low birth weight.[5] Studies also cite pregnancy anaemia as a risk factor for caesarean section, blood transfusion, and low infant Apgar scores.[6] This disease is more of a symptom than an independent disease, and medical, social, cultural, economic, and nutritional factors are involved in its development and progression.

From this perspective, health and treatment systems around the world have prioritized this group of the population as a high-risk and high-priority population and have developed and implemented extensive health and treatment programs for the diagnosis and treatment of anaemia in pregnant mothers. For managing low haemoglobin levels in pregnant mothers, healthcare providers start with an emergency assessment to rule out urgent issues like internal bleeding. In cases of severe anaemia (haemoglobin <7 g/dL), consultation with a haematologist and blood transfusion is needed. For moderate anaemia (7-10 g/dL), prescribing nine elemental iron tablets daily for one month is recommended, and performing a reticulocyte index test after one week is also recommended, along with dietary iron advice. In mild anaemia (10-11 g/dL), prescribing two elemental iron tablets daily for one month is advised; also request a reticulocyte index test and dietary recommendations. Additionally, checking ferritin levels in suspected beta thalassemia minor cases before starting iron therapy is essential to prevent side effects.[29,30] In Iran, with the expansion of health and treatment services for pregnant mothers, one of the goals of diagnosis, treatment, and, more importantly, prevention of anaemia, especially iron deficiency anaemia, as the most common cause of anaemia during pregnancy, has been prioritized. In the present study, anaemia in the third trimester was defined as a haemoglobin concentration of less than 10.5 grams per decilitre, and based on this, this study was designed and implemented. According to the findings of this study, the prevalence of anaemia in the studied patients was 10.85%. This finding is similar to the study conducted by Milad Azami and colleagues, which reported

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anaemia in pregnant women in western Iran to be 12%. However, our study only determined the prevalence and was only conducted on patients undergoing elective caesarean section, not all pregnant patients (Table 1). This finding is noteworthy even though 41.4% of the studied patients did not use iron supplements or used them irregularly (Table 2). The prevalence of anaemia in the study by Senadheera.D and colleagues, which included a study of 350 pregnant mothers in the first and second trimesters, was reported to be 16.6%. This study also examined iron deficiency status, which indicated iron deficiency in 36.6% of the studied mothers.[20] In our study, this investigation was impossible due to its retrospective nature and the lack of laboratory investigations in the patient's records.

The prevalence of iron supplement use in the study by Yesufu BM and colleagues was 31.8%. The high rate of non-use or irregular use of these supplements among the patients in the present research necessitates more education and emphasis on the need for regular use. In examining the relationship between demographic factors and the prevalence of anaemia, the interesting point was the higher prevalence of anaemia at admission among urban patients compared to rural patients (69.2% vs. 30.8%, respectively, Table 3). This may be explained by the broader coverage of maternal care programs in rural areas compared to urban areas and the possibility of service providers providing active services. However, this difference was not statistically significant (p = 0.072). This notable finding is consistent with the study by Milad Azami and colleagues, in which the prevalence of anaemia was reported to be higher in the urban population than in the rural population [21% and 8%, respectively].[7]

Senadheera D et al. In Sri Lanka, the prevalence of anaemia during pregnancy is less than 20%. This study aimed to determine the prevalence of anaemia, defined as haemoglobin concentration less than 11 g/dL, and iron deficiency using serum ferritin in women attending antenatal care. The prevalence of anaemia was calculated to be 16.6%. The best cut-off level of serum ferritin for diagnosing anaemia was less than 30 µg/L. 36.9% of pregnant women had iron deficiency. It was concluded that the prevalence of anaemia (16.6%) and iron deficiency (36.9%) during pregnancy were of mild to moderate public health importance, respectively.[20] In the study by Adanikin AI and colleagues, the only demographic variable associated with high prevalence of anaemia was the mother's occupation, with the disorder being more prevalent in unemployed or student patients (P = 0.007), which was explained by the relationship between patient income and anaemia.[21]

Late antenatal care uptake by women in low-income areas makes timely interventions in correcting anaemia difficult. Identify modifiable sociodemographic factors that predict anaemia before antenatal care initiation and provide appropriate recommendations.[21] Ikeanyi EM et al. showed that anaemia was 32.2% in this population at registration. At term or delivery, 736 of 1052 who met the study criteria improved from anaemia (21.4%, odds ratio=3.2, p<0.0001), which was a 69.9% prevention, and 316 remained anaemic despite antenatal services (9.2%, OR=0.43, p<0.00001). These individuals were similar in most confounding factors, such as social class, median age, body mass index, and gestational age at delivery (p>0.05).[22]

Another study showed that most respondents had a moderate level of knowledge and a positive attitude towards contraceptive methods. Still, a high proportion of them did not agree with the daily intake of iron supplements. Therefore, it was recommended that health

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education for women and close family members be strengthened to improve the agreement with using supplements.[23]

In their study, Sinha M et al. showed that health education programs are needed to emphasize adherence to iron supplementation and adequate consumption of iron-rich diets during pregnancy to strengthen them and achieve safe maternal and fetal outcomes.[24] Poor knowledge about the cause of anaemia, signs and symptoms, and an appropriate diet to prevent anaemia. Still, women's knowledge about the prevention and treatment of anaemia is vital.[25] Hemoglobinopathies should be screened in antenatal clinics to identify couples needing prenatal testing.[26]

Management strategy: For managing low haemoglobin levels in pregnant mothers, healthcare providers start with an emergency assessment to rule out urgent issues like internal bleeding. In cases of severe anaemia (haemoglobin <7 g/dL), consultation with a haematologist and blood transfusion is needed. For moderate anaemia (7-10 g/dL), prescribing 9 elemental iron tablets daily for one month is recommended, and performing a reticulocyte index test after one week is also recommended, along with dietary iron advice. In mild anaemia (10-11 g/dL), prescribing two elemental iron tablets daily for one month is advised; also request a reticulocyte index test and dietary recommendations. Additionally, checking ferritin levels in suspected beta thalassemia minor cases before starting iron therapy is essential to prevent side effects.[28,29] In Iran, with the expansion of health and treatment services for pregnant mothers, one of the goals of diagnosis, treatment, and, more importantly, prevention of anaemia, especially iron deficiency anaemia, as the most common cause of anaemia during pregnancy, has been prioritized. Consistent patient blood management (PBM) guidelines in obstetrics are still lacking, and recommendations regarding the timing of anaemia screening and the treatment recommendations for iron deficiency and IDA during pregnancy are still controversial[27].

The findings from our study underscore the critical need for enhanced health education and policy implementation to improve iron supplementation adherence among pregnant women. In Iran, while there are established health programs targeting maternal health, including anaemia screening and treatment protocols, the irregular use of iron supplements indicates potential barriers to effective implementation. Culturally, there may be misconceptions regarding the necessity of iron supplements or dietary iron sources. In some communities, traditional nutritional practices may not prioritize iron-rich foods, leading to inadequate intake.[28] Furthermore, socioeconomic factors play a significant role; women from lower-income backgrounds may face challenges in accessing quality prenatal care or affordable nutritional supplements. Government policies to improve maternal health must consider these cultural and socioeconomic dimensions. Enhanced community outreach programs that educate women about the importance of iron during pregnancy and provide accessible supplementation could improve adherence rates.

Additionally, integrating nutritional counselling into routine prenatal care can help address dietary deficiencies before they contribute to anaemia. Moreover, collaboration between healthcare providers and community leaders may foster greater acceptance of health interventions. By tailoring educational programs to local contexts and addressing specific cultural beliefs about nutrition and health, policymakers can create more effective strategies to combat anaemia in pregnant women.

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This study has several limitations. The mother's weight and height were not studied, and the frequency of anaemia in the first and second trimesters was not included in the study due to a lack of data in the patient's hospital records. As this is a retrospective series, its duration is also a limitation. By studying for three years, we obtained a reasonable sample size and a meaningful estimate of the prevalence of anaemia among patients undergoing elective caesarean sections. Increasing the study period in further research could improve the precision of these estimates. The mother's weight and height were not studied, and the frequency of anaemia in the first and second trimesters was not included in the study due to a lack of data in the patient's hospital records.

CONCLUSION

Iron supplementation during pregnancy is a very cheap, effective, and accessible method for preventing and treating iron deficiency anaemia and preventing its direct and indirect complications. Given the lack of use or irregular use of these drugs, it is vital to reflect this problem to the health sector and take necessary steps to change this behaviour. While our study contributes valuable insights into the prevalence of anaemia among pregnant women in Iran, it also highlights the need for continued research and targeted interventions that consider cultural practices and socioeconomic barriers. Addressing these factors is crucial for improving maternal health outcomes and reducing the incidence of anaemia during pregnancy.

Pregnancy clinics are significant centres for the prevention, diagnosis, and, if necessary, treatment of detected diseases. In addition to this, registering patient information for future follow-ups and extracting information for future studies is essential. Unfortunately, the clinics in developing countries may be unable to provide such prevention care. On the other hand, it is necessary to consider integrating clinical and laboratory information on pregnancy care with hospitalization information, especially in cases where examinations have been performed on an outpatient basis and in other private or public centres. The scattering of medical details and increasing unnecessary duplication in the diagnosis and treatment of patients is a serious obstacle.

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Ethics approval and consent to participate This study was performed according to the Helsinki Declaration and was approved by the Ethics Committee of Urmia University of Medical Sciences. No. IR.UMSU.REC.1397.125. The Ethics Committee of Urmia University of Medical Sciences waived the need for consent to participate.

Declarations

Authors' contribution

YK contributed to the investigation, review, and data analysis and wrote an article. MMH did the investigation and data collection. SS did supervision and formal analysis. MA conducted revision, reanalysis, and writing.

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Conflict of interest

There is no conflict of interest in this research.

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