Original Article

Prevalence of iron deficiency anemia and some related factors among pregnant women referred to healthcare centers in Bandar Lengeh, Iran, in 2015

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Background: Iron deficiency anemia (IDA) during pregnancy is a common nutritional disorder with adverse effects for the baby, such as premature birth and low birth weight, and the mother, such as cardiovascular symptoms and reduced physical and mental strength. Therefore, identifying factors affective on IDA will assist the improvement of the health of the mother and fetus. This study aimed to determine the prevalence of IDA in the first and third trimester of pregnancy and some related factors in pregnant women referred to healthcare centers in Bandar Lengeh, Iran, in 2015.

Materials and Methods: In this cross-sectional study, 418 pregnant women, who were referred to health centers in the city and had completed their pregnancy, were assessed through systematic sampling. Data were collected using the researcher-made checklist and through a review of health records. Data were analyzed using chi-square, Fisher's exact, and McNemar's test.

Results: The mean age of the participants was 27.17 ± 5.62 and most participants were in the age group of 18-35, had high school education, were homemakers, and experienced their first pregnancy. The findings of the study showed that the prevalence of IDA was 22.5% (confidence interval: 18.4%–26.5%) and 45.9% (Confidence interval: 41.1%–50.6%) in first and third trimester of pregnancy, respectively. IDA in first and third trimester of pregnancy had significant correlation with pregnancy interval ($P < 0.009$ and $P < 0.001$, respectively); with increase in the pregnancy interval, the prevalence of IDA also increased.

Conclusions: According to the results, it seems that the prevalence of IDA was undesirable, especially in the third trimester. Since this eating disorder is a preventable complication and pregnant women are a group at risk of anemia, attention to the expansion of pre-pregnancy care, increased awareness of mothers regarding appropriate nutrition and maintenance of a diverse and balanced diet, regular consumption of supplements, contraception in older women, and maintenance of appropriate intervals between pregnancies seem essential.

Keywords: Iron Deficiency Anemia, Pregnant Women, Trimester, Hemoglobin, Iran.

Introduction

Anemia is presently a common nutritional problem in the world and it is associated with potential adverse effects such as reduced power of labor and reproductive disorders (1). In this disorder, the volume of red blood cells and the serum levels of iron decrease, and in case of failure to compensate this loss, the hemoglobin levels also decrease and anemia occurs (2). Iron deficiency is the most common cause of anemia during pregnancy. Increased risk of anemia during pregnancy is

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caused by the mother's increased need for iron, fetal and placental iron demand for growth, increased red blood cell mass, and the mother's increased blood volume in the third trimester (3). This disorder during pregnancy is a recognized risk factor for the mother and fetus. The most important fetal complications include growth retardation, preterm birth, and intrauterine death, and the main maternal outcomes include cardiovascular symptoms, loss of immune function, weakness, fatigue, and reduced blood supply (4). However, anemia is not a disease, but a symptom like fever, and it is very common during pregnancy. Due to the lack of oxygen in the tissues, complications such as fatigue, dizziness, weakness, and shortness of breath, which are symptoms of anemia, occur (5).

According to the World Health Organization (WHO), Iron Deficiency Anemia (IDA) in pregnant women refers to a hemoglobin concentration of less than 11 g/dl in the first and third trimester and a 5 g/dl reduction in the second trimester (6). Women, from the first months of pregnancy and even much later, suffer from iron deficiency accompanied with a reduction in red blood cell count. In a normal pregnancy with a single fetus, the pregnant mother requires about a thousand milligrams of iron. It seems that this total amount of iron extends many women's sources of iron. If the body cannot compensate this difference through the digestive system, it results in IDA (7).

According to the results of studies conducted in different regions, factors such as low education levels, teenage pregnancy, multiple births, poor nutritional status, wrong food habits, history of parasitic diseases, irregular use or non-use of iron, and abortion were effective on the incidence of IDA (8-10).

Anemia associated with iron deficiency is a major problem in developing countries. It was estimated that 52% of pregnant women in developing countries were anemic, while this ratio in developed countries was 23% (11). The WHO estimated that IDA constituted about 20% of the 515000 maternal deaths worldwide in 2005 (12). The numerous studies carried out on the epidemiology of IDA among pregnant women of different societies, including Iran, have reported contradictory results. A survey conducted in 11 regions of Iran in 2001 on 4368 healthy pregnant women in their 5^{th}-9^{th} months of pregnancy estimated their iron status (due to the need to evaluate the effect of iron supplementation), the results of this study showed that the prevalence of IDA in pregnant women was 21.5% (13). The prevalence of IDA in pregnant women in a study conducted in Shiraz, Iran, in 2011 was estimated as 12.3% (12). According to a study conducted in Thailand in 2009, the prevalence of IDA in the first and third trimesters was 1.3% and 41.7%, respectively (14).

Today, in Iran, in order to prevent IDA, iron supplements in the form of pills and drops are distributed among high-risk groups, such as pregnant women who are in their fourth month of pregnancy until three months after delivery, through health systems and health centers. This measure can improve iron deficiency relatively fast and it can be used as an important strategy to solve this problem in groups of the population which are more susceptible to iron deficiency (7). Low intake of iron supplements were due to the unawareness of pregnant mothers regarding their necessity, unpleasant taste, and side effects. The success of the iron supplementation program requires strengthening the training of health workers, providing maternal education, and producing higher quality supplements (1).

To prevent future outcomes for both the mother and fetus, research on the prevalence of IDA among pregnant women has an important role in decision-making and political planning (11). Since the completion of the international iron supplementation program, based on the high prevalence of anemia, the WHO has recommended prevalence studies to monitor health regeneration (15). The highest rate of childbirth complications and maternal and fetal mortality in terms of socioeconomic status of women was related to the lower

classes of society, and multiple pregnancies (16). Anemia in various regions, due to being affected by climatic, social, economic, and cultural conditions, has different prevalence and accurate statistics on the prevalence of anemia in pregnant women is not available (8). There are also no records of the prevalence of IDA among pregnant women in Bandar Lengeh, Iran. Therefore, in this study, the prevalence of IDA and factors influencing it were studied among pregnant women in Bandar Lengeh. It was expected that the results of this study would provide useful information for more favorable healthcare during pregnancy and improved maternal health.

Material and Methods

This was a cross-sectional study conducted in 2015. The research environment included urban healthcare centers covered by the health network of Bandar Lengeh. This city is located in the southern part of Iran, and its population is 116 thousand. The study population included all pregnant women attending urban healthcare centers who had completed their pregnancy.

The sample size was estimated using formula (1) and considering the confidence level of (Z^2) 95%, sampling error of (d) 0.04, and prevalence of (p) 0.21 of IDA in pregnant women based on previous studies (13).

$$(1)\quad n = \frac{Z^2_{1-\frac{\alpha}{2}} \times p \times (1-p)}{d^2}$$

Therefore, sample size was estimated as 398 individuals and with the possibility of sample loss it was determined as 420 individuals.

Bandar Lengeh had two urban healthcare centers (Shahid Rajayi and Shahid Ghaderinezhad) and one health clinic (Shahid Bahonar). The general population of pregnant women covered by Shahid Rajayi Health Center was 333 individuals, Shahid Ghaderinezhad Health Center was 335 individuals, and Shahid Bahonar Clinic was 158 individuals. For sampling, each of the three centers were considered as a single cluster and the number of subjects assigned to each center was selected proportional to the number of pregnant women covered by each center, through systematic approach, and from the list of pregnant women (register center of continuous care of pregnant women in the centers).

The data were gathered using a checklist containing demographic information such as age, education, occupation, and ethnicity, and characteristics associated with pregnancy such as pregnancy interval, planned or unplanned pregnancy, labor rank, history of bleeding during pregnancy, history of preterm birth and low birth weight, the number of health care services received, and information about blood hemoglobin of the mother in the first and third trimester of pregnancy. Data were extracted from the family health records. IDA in pregnant women according to the WHO description is based on the hemoglobin parameter (6); therefore, in this study, only the hemoglobin parameter was used to determine IDA in pregnant women.

The inclusion criteria included having health records in an urban healthcare center. The exclusion criteria included having a recorded disease associated with anemia such as thalassemia minor and sickle-cell disease (SCD), multifetal pregnancies, receiving or donating blood during pregnancy, and preterm birth (less than 37 weeks). In this study, given that the family records were examined, the confidentiality of the subjects were considered and the individuals' names were not mentioned on the checklists.

After gathering the data, they were entered into SPSS software (version 23, SPSS Inc., Chicago, IL, USA) and statistical analysis was performed. Quantitative data were reported as mean ± SD and qualitative data were reported as number (%). To evaluate the relationship between quantitative data and IDA in pregnant women, chi-square and Fisher's exact tests were used. To study the effect of anemia in the first and third trimesters of pregnancy on the frequency of IDA in pregnant women,

McNemar's test was used. The significant level of the statistical tests was considered as 0.05.

Results

In total, 418 checklists were completed. Frequency distribution of 418 pregnant women based on age group was 21 patients (5%) of less than 18 years, 363 patients (86.8%) of 18-35 years, and 34 individuals (8.2%) of more than 35 years. In general, the mean age of pregnant women in this study was 27.17 ± 5.62 years (minimum 14 years and maximum 45 years). In addition, 5 patients (1.2%) were illiterate, 99 patients (23.7%) had primary school education, 93 patients (22.2%) had secondary school education, 166 (39.7%) had high school education, and 55 patients (13.2%) had university education. Moreover, 369 cases (88.3%) of pregnant women were of Persian ethnicity, 1 case (0.2%) was Turk, 1 case (0.2%) was Kurd, 31 patients (7.4%) were of Arab ethnicity, and 16 cases (3.8%) were of other ethnicities. Furthermore, 400 (95.7%) pregnant women were housewives and 18 (4.3%) were employed. Pregnancy characteristics of the studied women are presented in table 1. Overall, the prevalence of IDA in pregnant women referred to health centers in Bandar Lengeh in the first and third trimester of pregnancy was, respectively, 94 cases (22.5%) with interval estimation of 95% (18.4%-26.5%) and 192 cases (45.9%) with interval estimation of 95% (41.1%-50.6%).

Table 1: Pregnancy characteristics of the pregnant women who referred to health centers in Bandar Lengeh, Iran, in 2015 (n = 418)

Variables	Level	N (%)
Number of pregnancies	1	141 (33.7)
	2	121 (28.9)
	3	80 (19.1)
	4	37 (8.9)
	> 4	39 (9.3)
Pregnancy intervals	First time	155 (37.1)
	One year or less	13 (3.1)
	One to three years	89 (21.3)
	Three years or more	161 (38.5)
Pregnancy rank	0	167 (40.0)
	1	127 (30.4)
	2	69 (16.5)
	3 ≤	55 (13.2)
Number of received healthcare services	≤ 3	32 (7.7)
	4-6	207 (49.5)
	6 ≤	179 (42.8)
Planned or unplanned pregnancy	Planned	397 (95.0)
	Unplanned	21 (5.0)
Iron supplementation use	Yes	405 (96.9)
	No	13 (3.1)
History of bleeding during pregnancy	Yes	6 (1.4)
	No	412(98.6)
History of preterm birth	Yes	6 (1.4)
	No	412 (98.6)
History of low birth weight children	Yes	10 (2.4)
	No	408 (97.60

Distribution of the subjects in the first trimester showed that age, education, occupation, ethnicity, number of pregnancies, pregnancy rank, number of healthcare services received, planned or unplanned pregnancy, iron supplements use, history of bleeding

during pregnancy, history of preterm birth, and history of low birth weight children had no statistically significant relationship with IDA prevalence (P > 0.050).

In the first trimester of pregnancy, there was a statistically significant relationship between the variable of interval between pregnancy and anemia due to iron deficiency (P = 0.009). With increase in the interval between pregnancies, the prevalence of IDA in the first trimester of pregnancy also increased. There was a statistically significant relationship between prevalence of IDA and education level, occupation, number of pregnancies, pregnancy interval, and pregnancy rank of women (P < 0.050). Based on the results, in the third trimester, with the increase in university education level, the number of pregnancies, the pregnancy rank, and mothers' employment, the prevalence of IDA had decreased. Moreover, with increase in the interval between pregnancies, the prevalence of IDA increased (Table 2).

Table 2: Evaluation of the relationship between the prevalence of anemia caused by iron deficiency in the first and third trimester of pregnancy and its effective factors in pregnant women referred to health centers in Bandar Lengeh, Iran, in 2015

Variables	Level	first trimester of pregnancy			third trimester of pregnancy		
		Anemia N (%)	Normal N (%)	p-value	Anemia N (%)	Normal N (%)	p-value
Education level	Illiterate	0 (0)	4 (1.3)	0.464	1 (0.5)	4 (1.9)	0.018
	Primary school	26 (27.7)	72 (22.5)		53 (27.6)	45 (21.1)	
	Secondary school	16 (17.0)	75 (23.4)		47 (24.5)	43 (20.2)	
	High school	38 (40.4)	128 (40.0)		76 (39.6)	83 (39.0)	
	University	14 (14.9)	41 (12.8)		15 (7.8)	38 (17.8)	
Occupation	Housewife	90 (95.7)	306 (95.6)	0.96	188 (97.9)	200 (93.9)	0.044
	Employee	4 (4.3)	14 (4.4)		4(2.1)	13 (6.1)	
Number of pregnancies	1	34 (36.2)	106 (33.1)	0.967	50 (26.0)	89 (41.8)	0.012
	2	27 (28.7)	93 (29.1)		61 (31.8)	54 (25.4)	
	3	18 (19.1)	61 (19.1)		41 (21.4)	37 (17.4)	
	4	7 (7.4)	30 (9.4)		22 (11.5)	13 (6.1)	
	> 4	8 (8.5)	30 (9.4)		18 (9.4)	20 (9.4)	
Pregnancy intervals	First time	36 (38.3)	118 (36.9)	0.009	53 (27.6)	100 (46.9)	<0.0001
	One year or less	7 (7.4)	6 (1.9)		10 (5.2)	3 (1.4)	
	One to three years	24 (25.5)	63 (19.7)		56 (29.2)	26 (12.2)	
	Three years or more	27 (28.7)	133 (41.6)		73 (38.0)	84 (39.4)	
Pregnancy rank	0	38 (40.4)	128 (40.0)	0.857	60 (31.3)	105 (49.3)	0.003
	1	31 (33.0)	95 (29.7)		67 (34.9)	51 (23.90	
	2	13 (13.8)	55 (17.2)		36 (18.8)	32 (15.0)	
	3 ≤	12 (12.8)	42 (13.1)		29 (15.1)	25 (11.7)	

Types of tests: Chi-square and Fisher's exact tests

Table 3 shows the frequency distribution of pregnant women in the first and third trimester of pregnancy based on IDA. As illustrated in this table, only 18 (4.5%) pregnant women who were anemic in the first trimester had normal hemoglobin levels in the third trimester. In addition, 116 (28.9%) women who had normal hemoglobin levels in the first trimester became anemic in the third trimester. As the results of this table show, the first and third trimester of pregnancy was statistically significant as a factor in explaining the prevalence of IDA (P < 0.0001).

Due to the 5% missing data in this study, in some of the tables, the number of the subjects listed was less than the total number of the subjects.

Table 3: Frequency distribution of pregnant women based on iron deficiency anemia in the first and third trimesters of pregnancy

First trimester of pregnancy / Third trimester of pregnancy	Anemia N (%)	Normal N (%)	Total N (%)	p-value
Anemia N (%)	73 (18.1)	18 (4.5)	91 (22.6)	<0.0001
Normal N (%)	116 (28.9)	194 (48.5)	310 (77.4)	
Total N (%)	189 (47)	212 (53)	401 (100)	

Type of test: McNamara test

Discussion

In connection with the overall aim of the research to determine the prevalence of IDA in pregnant women according to hemoglobin concentration of less than 11 g/dl and its affective factors, it was found that the prevalence of IDA in pregnant women in the first and third trimester was 22.5% (CI 95%: 18.4%-26.5%) and 45.9% (CI 95%: 41.1%-50.6%), respectively. This showed the increase in the prevalence of anemia with increase in the age of pregnancy. In studies in Isfahan, Iran (17), Thailand (14), Mexico (10), Spain (18, 19), Pakistan (20), and Kuwait (21), the prevalence of anemia was reported higher in the third trimester. Therefore, the highest prevalence of IDA was observed in the eighth and ninth months. The possible cause of this phenomenon is the physiology of pregnancy; the maximum iron uptake by the fetus takes place after the thirtieth week of pregnancy. The dilution of the blood in the first and second trimester of pregnancy also reduced hemoglobin concentration and negative iron balance, especially in the third trimester of pregnancy (17). Therefore, mothers at the end stages of pregnancy are at greater risk of IDA, and this indicates the importance of continuous use of iron supplements since the early stages of pregnancy (14). Based on the results of a study conducted in Semnan, Iran, the prevalence of IDA in the first trimester was reported as 60.1% and in the third trimester as 48.7% (22). This result was inconsistent with the findings of the present study. This may be due to the differences in the diagnostic parameters of IDA used. Diagnostic parameters that were used in this study included hemoglobin, hematocrit, and ferritin, while the diagnosis of IDA in the present study was based on the criteria mentioned in the WHO definition, which was the concentration of blood hemoglobin.

In general, various studies indicated that the prevalence of IDA differed greatly among different countries and even among different regions of a county and the range was between 12% and 43%. Iron deficiency and its related anemia in pregnant Iranian women is a health problem and the extent of its prevalence is different in the different regions of the country. The results of various surveys in Iran also showed that the changes in the prevalence of IDA in pregnant women ranged between 4.5% and more than 50% (13, 17). It seems that difference regarding geographic regions, lifestyle, diet, socioeconomic status, and the prevalence of infectious and parasitic diseases in different parts of Iran were the main reasons for the wide range of results reported in different studies (9).

The findings of this study showed a lower incidence of IDA in the third trimester of pregnancy with the increase in the number of pregnancies. This finding was similar to the results of a study in Pakistan (23), but was inconsistent with the results of 11 regions of Iran (13), Turkey (15), Isfahan, Iran (17), Semnan (22), Shiraz, Iran (24), and America (25). It is evident that repeated pregnancies cause the loss of iron in the mother's body, and in case of lack of attention and timely treatment, will cause severe and chronic maternal anemia. Its consequences range from

physical weakness, lethargy, early fatigue, and depressed mood for the mother. Thus, the mother's repeated pregnancies will have irreversible physical and mental consequences for the fetus and the mother. Therefore, provision of special care, and training and advice to observe a diverse and balanced diet along with iron supplementation is a necessity for mothers with fifth or higher pregnancy (17). The findings of the present study in this regard may be due to the mothers' experience and increase in their awareness about timely and adequate intake of iron supplements during pregnancy caused by their repeated pregnancies.

A significant negative correlation was observed between the prevalence of IDA and pregnant mother's education level and occupation in this study. Anemia was reduced with increase in the level of education and government employment. The results of other studies also confirmed the findings of this study and showed that the higher level of education and employment of the mother, and consequently, the increase in the level of nutritional information greatly helped to reduce the prevalence of anemia (12, 16, 17).

According to a survey conducted in 11 regions of Iran in 2001, the coverage of the supplementation program among pregnant Iranian women was estimated at about 84% and regular consumption of iron supplements had a significant effect in reducing the risk of anemia in pregnant women in Iran (13). Based on the findings of this study, although 97% of pregnant women were taking iron supplements, almost half (46%) of them suffered from IDA in the third trimester of pregnancy. This indicated the inadequacy of iron supplementation approach alone in the fight against IDA. Therefore, one of the causes of anemia and iron deficiency in pregnant women in Iran may be their undesirable nutrition pattern and wrong food habits that lead to low iron intake and absorption (13). Starting the pregnancy period with the absence of anemia or moderate consumption of iron supplements reduced the risk of anemia in late pregnancy. Although this action seemed adequate for the prevention of IDA, its prevalence in a large percentage of women was unclear (18, 26).

It was concluded that the improvement of the prevalence of IDA in pregnant women required appropriate nutrition training techniques in Southern Iran. Further studies are necessary to determine the appropriate nutritional advice through which the requirements of pregnant women can be designed according to the characteristics of each individual.

The limitation of this study was that in order to determine the prevalence of IDA, it was limited only to checking the blood hemoglobin concentration. Generally, in the healthcare delivery system, the parameter of hemoglobin concentration is used to diagnose anemia, because it is cheap and accessible as reference standard. Nevertheless, for some women, measuring only the hemoglobin concentration to detect IDA is not enough. Therefore, for the rapid and definitive diagnosis and timely treatment of IDA, the use of a combination of multiple parameters in the healthcare system is recommended. It is also recommended to use the potential of pre-pregnancy care programs in the healthcare system for the diagnosis and correction of anemia in women, so they can be prepared with a suitable physical condition for the start of their pregnancy.

Conclusion

According to the results, IDA prevalence was undesirable, especially in the third trimester of pregnancy. Since this eating disorder is a preventable condition and pregnant women are a group at risk for anemia, considering the expansion of pre-pregnancy care, increased awareness among mothers regarding correct patterns of nutrition and maintenance of a diverse and balanced diet, regular consumption of supplements, contraception in older ages, and maintenance of appropriate intervals between pregnancies seem necessary.

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