

## Prevalence of Hemoglobin Anemia among Pregnant Women in the Northeast of Iran

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### ABSTRACT

**Introduction:** Anemia is one of the major public health problems among pregnant women in the world. It causes low birth weight and maternal mortality during pregnancies. This study aimed to determine the prevalence of anemia and its associated factors among pregnant women.

**Methods:** This cross-sectional study was conducted on 400 pregnant women in Shirvan city, Iran in 2015. For sampling, each of the three centers in this city were considered as a single cluster and the number of required participants from each center was selected proportional to the number of pregnant women covered by each center using systematic approach. Data were collected from health records of families using a checklist were analyzed by descriptive statistics and appropriate statistical tests including chi-square, Fisher's exact, and McNemar's test.

**Results:** The age mean  $\pm$  SD of the pregnant women was  $29.9 \pm 5.3$  with a range of 16-40 years. Most of pregnant women were in the age group of 18-35 (84.5%) years, had high school education (65.8%), and were housewives (87.8%). The prevalence of anemia in pregnant women in the first and third trimester were 4.75% (CI<sub>95%</sub>: 2.66%-6.84%) and 16% (CI<sub>95%</sub>: 12.40%- 19.60%), respectively. Prevalence of anemia increased in the third trimester ( $p < 0.01$ ).

**Conclusion:** Shirvan is one of the areas with a mild prevalence of anemia. However, iron deficiency anemia, as a nutritional disorder can be prevented. Therefore, community-based interventions should be implemented considering the identified associated factors.

**Keywords:** Prevalence, Iran, Pregnancy

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### Introduction

Anemia is the most common and widespread nutritional disorder in the world and it is the most common complication during pregnancy (1). This disorder is a global public health problem that affects all the developed and developing countries. It has major consequences on the health and socioeconomic level (2). Anemia is defined as a condition in which hemoglobin level is less than normal and the number of red blood cells or the oxygen-carrying capacity is insufficient to eliminate the physiological needs (2, 3). Blood hemoglobin is the most reliable indicator of anemia. According to the World Health Organization (WHO), Anemia in pregnant women refers to a hemoglobin concentration of less than 11 g/dl in the first and third trimester and a 0.5 g/dl reduction in the second trimester (4). Moreover, WHO has divided the areas into four regions according to the prevalence of anemia. The prevalence of anemia  $\geq 4.9\%$  is anemia-free area; from 5 to 19.9% shows a slight public health importance, from 20 to 39.9% and higher than 40% have moderate and severe public health importance (5). It is estimated that 41.8% of pregnant women are anemic worldwide (4). Iron deficiency anemia is one of the most important factors and it was estimated that 50% anemia can be attributed due to iron deficiency (6). Low intake of iron, especially during pregnancy, and bleeding are the reasons for iron deficiency in 2:3 of pregnant women (1). Iron deficiency occurs in all stages of life cycle and affects all age groups, but children and pregnant women are more vulnerable (7). Iron deficiency in pregnant women may increase the risk of miscarriage, stillbirth, prematurity, birth defects, low birth weight infant, as well as maternal and neonatal mortality rate. Women are half of the world's population and their health status has an impact on their children's health (8). Pregnancy is one of the most sensitive and critical phenomena during the women's life. Due to the physiological changes of women as well as the vulnerability of the fetus during pregnancy, they need extra care (9). The contextual effective and causative factors of anemia differ among the pregnant women. Interaction of multiple factors such as women's

socio-demographic, economic, nutritional, and health causes anemia in pregnant women. Availability of the local information on the magnitude and related risk factors of anemia has a major role on its management and control in pregnancy. The difference in reported anemia rates may be due to the characteristics of the target population or differences in laboratory tests. The prevalence of anemia was 17.5% in Bandar Abbas (10), 12.9% in Zahedan (11), and 9.9% in Tehran (12). However, no adequate and reliable information is available on the prevalence and factors leading to anemia in pregnant women in Shirvan city, Iran. Therefore, the aim of this study was to determine the prevalence of anemia and its associated factors among pregnant women referred to health centers in Shirvan city, Iran.

### Methods

The present cross-sectional study was conducted in 2015. The research environment included urban health care centers covered by the health network of Shirvan city. This city is located in northeastern of Iran and composed of 97111 individuals with 24656 households. The study population included all pregnant women attending urban healthcare centers who had completed their pregnancy. Shirvan city had three urban healthcare centers. The general population of the pregnant women covered by the first, second, and third health centers were 407,175,, and 219 individuals, respectively. The sample size was estimated as 400 using the related formula and by considering the confidence level of ( $Z^2$ ) 95%, the sampling error of (d) 0.04, and the expected prevalence of (p) 0.21 for anemia in Iranian pregnant women based on a previous study (13).

For sampling, each of the three centers was considered as a single cluster and the number of individuals selected from each center was proportional to the total number of pregnant women covered by each center. Systematic sampling approach was used and the participants were selected from the list of pregnant women. The data were collected from health records using the list of families registered in checklists. The checklist

included demographic information, such as age, education, and occupation. It also contained characteristics associated with pregnancy, such as the number of pregnancies, pregnancy interval, labor rank, history of abortion, and history of stillbirth, history of preterm birth and low birth weight, as well as information about blood hemoglobin of the mother in the first and third trimester of pregnancy.

In this study, only the hemoglobin parameter was used to determine anemia in pregnant women. The inclusion criteria in this study were the existence and availability of the completed health records and care forms of the pregnant women in urban healthcare centers. The exclusion criteria included having a recorded disease associated with anemia such as minor thalassemia and sickle-cell disease, having multi fetal pregnancies, and receiving or donating blood during pregnancy.

In order to observe confidentiality of information, the individuals' names were not mentioned on the checklists. Finally data were analyzed by SPSS version 23 using descriptive statistics and analytical tests such as chi-square and Fisher's exact tests to evaluate the relationship between quality data and

anemia in pregnant women during the first and third trimesters of pregnancy. Furthermore, McNemar's test was used to evaluate the effect of anemia on the frequency of anemia in the first and third trimesters of pregnancy. The significant level was set at  $P \leq 0.05$  for all tests.

## Results

The study involved a total of 400 pregnant women, who attended urban healthcare centers at Shirvan, North of Iran. The age mean  $\pm$  SD of the pregnant women was  $29.9 \pm 5.3$  years with a range of 16-40 years. The frequency distribution of the participants showed that 6 women (1.5%) were less than 18 years, 338 women (84.5%) were from 18 to 35 years, and 53 individuals (13.3%) were more than 35 years. In addition, frequency distribution of pregnant women based on the education level indicated that 39 women (9.8%) had primary school education, 263(65.8%) had high school education, and 98 women (24.4%) had academic education. In our study, 351 (87.8%) pregnant women were housewives and 49 (12.2%) were employed. Other pregnancy characteristics of the studied women are presented in Table 1.

**Table 1.** Pregnancy characteristics of the pregnant women, who referred to health centers in Shirvan, Iran in 2015 (n = 400)

Variables	Level	N (%)
Number of pregnancies	1	3(0.8)
	2	195(48.8)
	3	137(34.3)
	4	45(11.3)
	5 $\leq$	20(5)
Pregnancy rank	1	275(68.8)
	2	97(24.2)
	3 $\leq$	28(7)
Pregnancy intervals	3 $>$	106(26.5)
	3 $\leq$	294(73.5)
History of abortion	No	294(73.5)
	Yes	106(26.5)
History of stillbirth	No	383(95.8)
	Yes	17(4.2)
History of preterm birth	No	392(98)
	Yes	8(2)
History of low birth weight children	No	362(90.5)
	Yes	38(9.5)

The prevalence rates of anemia in pregnant women who referred to health centers in Shirvan city in the first and third trimester of pregnancy were 4.75 % (CI 95%=2.66-6.84%) and 16 % (CI 95%=12.40-19.60%), respectively. Among pregnant women, the mean of hemoglobin in the first trimester (12.66±1.09) was significantly higher than the third trimester (12.03±1.27) of pregnancy and mean of hemoglobin decreased significantly in the third trimester compared to the first trimester of pregnancy (p< 0.01). Chi-square and Fisher's exact tests were carried out to assess

the relationship of anemia with demographic information and pregnancy characteristics. The results showed that in the first trimester of pregnancy, anemia had a statistically significant relationship with the variables of education and occupation of pregnant women (P ≤ 0.05). Furthermore, in the third trimester, a significant relationship was observed between prevalence of anemia and occupation of pregnant women (P ≤ 0.05). No significant relationship was observed among other variables and anemia in the first and third trimesters of pregnancy (Tables 2 and 3).

**Table 2.** Evaluation of the relationship between the prevalence of anemia and its effective factors in the first trimester of pregnancy among pregnant women who referred to health centers in Shirvan, Iran in 2015

Variables	Level	Anemia (N%)	Normal (N%)	P-value
Education	less secondary school	9(47.4)	39(10.2)	<0.001
	high school	7(36.8)	251(65.9)	
	University	3(15.8)	91(23.9)	
Occupation	Housewife	12(63.2)	335(87.9)	.007
	Employee	7(36.8)	46(12.1)	
Number of pregnancies	1	0(0)	3(.8)	.681
	2	8(42.1)	187(49.1)	
	3	8(42.1)	129(33.9)	
	4	2(10.5)	43(11.3)	
	5≤	1(5.3)	19(5)	
Pregnancy rank	1	12(63.2)	263(69)	.248
	2	7(36.8)	90(23.6)	
	3≤	0(0)	28(7.4)	
Pregnancy intervals	3>	4(21.1)	102(26.8)	.581
	3≤	15(78.9)	279(73.2)	
History of abortion	No	14(73.7)	280(73.5)	.985
	Yes	5(26.3)	101(26.5)	
History of stillbirth	No	17(89.5)	366(96.1)	.19
	Yes	2(10.5)	15(3.9)	
History of preterm birth	No	18(94.7)	374(98.2)	.325
	Yes	1(5.3)	7(1.8)	
History of low birth weight children	No	16(84.2)	346(90.8)	.409
	Yes	3(15.8)	35(9.2)	

**Table 3.** Evaluation of the relationship between the prevalence of anemia and its effective factors in the third trimester of pregnancy among pregnant women who referred to health centers in Shirvan, Iran in 2015

Variables	Level	Anemia (N%)	Normal (N%)	P-value
Education	Less than secondary school	10(15.6)	38(11.3)	.544
	High school	38(59.4)	220(65.5)	
	university	16(25)	78(23.2)	
Occupation	Housewife	50(78.1)	297(88.4)	.026
	Employee	14(21.9)	39(11.6)	
Number of pregnancies	1	0(0)	3(9)	.686
	2	27(42.2)	168(50)	
	3	28(43.8)	109(32.4)	
	4	7(10.9)	38(11.3)	
	5≤	2(3.1)	18(5.4)	
Pregnancy rank	1	43(67.2)	232(69)	.274
	2	19(29.7)	78(23.3)	
	3≤	2(3.1)	26(7.7)	
Pregnancy intervals	3>	16(25)	90(26.8)	.767
	3≤	48(75)	246(73.2)	
History of abortion	No	44(68.8)	250(74.4)	.347
	Yes	20(31.3)	86(25.6)	
History of stillbirth	No	63(98.4)	320(95.2)	.492
	Yes	1(1.6)	16(4.8)	
History of preterm birth	No	63(98.4)	329(97.9)	1
	Yes	1(1.6)	7(2.1)	
History of low birth weight children	No	59(92.2)	303(90.2)	.615
	Yes	5(7.8)	33(9.8)	

In addition, the frequency distributions of pregnant women in the first and third trimesters of pregnancy were assessed based on anemia. The results showed that only 4 (1%) pregnant women, who were anemic in the first trimester, had normal hemoglobin levels in the third trimester and 49

(12.3%) women with normal hemoglobin levels in the first trimester developed anemia in the third trimester. On the other hand, the first and third trimesters of pregnancy were considered as a significant factor in explaining the prevalence of anemia in women ( $P < 0.0001$ ) (Table 4).

**Table 4.** Frequency distribution of pregnant women based on anemia in the first and third trimesters of pregnancy

	First trimester of pregnancy			p-value
	Anemia N (%)	Normal N (%)	Total N (%)	
Third trimester of pregnancy	Anemia N (%)	15 (3.8)	49 (12.3)	0.0001
	Normal N (%)	4 (1)	332 (83)	
	Total N (%)	19 (4.8)	381 (95.02)	

### Discussion

The present study assessed the prevalence of anemia and its associated risk factors among the pregnant women who referred to healthcare centers in Shirvan city, Iran. The results showed that the prevalence rates of anemia among the pregnant women in the first and third trimesters were 4.75% (CI<sub>95%</sub>: 2.66%-6.84%) and 16% (CI<sub>95%</sub>: 12.40%- 19.60%), respectively. In other words, the prevalence of anemia increased in the third trimester. Consistent with our findings, previous studies also showed that the prevalence of anemia was higher in the third trimester (14-21) . The possible cause of this phenomenon is the physiology of pregnancy. With increase of the pregnancy age, the amount of anemia increases due to the increasing physiological needs of the body; as a result, pregnant women at the final stages of pregnancy are at greater risk of anemia. Therefore, supplementation of iron should be considered from the early stages of pregnancy. Inconsistent with our findings, a study conducted in Semnan, Iran (22) reported that the prevalence of anemia in pregnant women was higher in the first than the third trimester of pregnancy.

According to WHO categorization, the 5% - 19.9% prevalence of anemia is considered as a minor health problem (10) . In this study, we found lower prevalence of anemia among the pregnant women, which indicates that anemia is a mild public health problem in this population. This might be due to the long-term programs and interventions applied by Iran's Ministry of Health to reduce the prevalence of anemia among vulnerable groups, especially pregnant women. In primary health care services in Iran, all supplements and care are free for all pregnant women. Such studies reported that the prevalence rates of anemia and iron deficiency were 21.5% and 42.7%, respectively. The highest prevalence of anemia was observed in eastern provinces of Iran (Southern Kerman, South Khorasan and Sistan and Baluchestan). The lowest incidence rate was reported in central provinces of Iran (23). These results contradict

with our study, because we investigated a small town from the northern Khorasan province.

In the first trimester of pregnancy, we found that anemia had a significant correlation with the education level and occupation of the pregnant mothers; whereas, in the third trimester of pregnancy only mothers' occupation was significantly correlated with anemia. As expected, anemia was reduced with increased level of education in this study. Consistent with our findings, the result of other studies showed that higher levels of education of the pregnant women reduced the prevalence of anemia (21, 24, 14) . Moreover, the prevalence of anemia was lower in housewives than the employed women, which represents insufficient attention of employed pregnant women to their health, which can cause undesirable nutrition patterns and wrong food habits in them. This finding was consistent with the result of a previous study (25).

In our study, no correlation was found between anemia and other variables in the pregnant women. We used the blood hemoglobin concentration in order to determine the prevalence of anemia in pregnant women, because the parameter of hemoglobin concentration is used in the healthcare delivery system to diagnose anemia. Furthermore, the data of this parameter were accessible. This study is limited by its cross-sectional nature, whereby it may not explain the temporal relationship between the outcome variable and some explanatory variables; this limited interpretation of the estimated associations. Moreover, another limitation of the present study was that we used the health records of the pregnant women referring to health centers.

### Conclusion

In this study, prevalence of the anemia increased in the third trimester. One of the causes of anemia among the pregnant women in Iran may be their undesirable nutrition pattern and wrong food habits leading to low iron intake and absorption. This nutritional disorder is preventable;

so, iron and folic acid supplementation is recommended, particularly in women with poor nutritional status. The problem of anemia in pregnant women requires comprehensive interventions, such as nutritional education, improved sanitation, and enhanced quality of iron supplementation program. The results of this study can be the basis to improve the status of anemia by conducting educational interventions on mothers, and families, and mother's nutrition.

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### Conflict of interest

Authors declare that we have no conflict of interest.

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