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Prevalence and Risk Factors of Anemia among a Sample of Pregnant Females Attending Primary Health Care Centers in Makkah, Saudi Arabia

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Abstract: Anemia in pregnancy is associated with increased rate of maternal and perinatal mortality, premature delivery, low birth weight and other adverse outcomes. This study was conducted to determine the prevalence of anemia among pregnant females attending primary health care centers in Makkah, Saudi Arabia and to assess the etiologic risk factors contributing to it during pregnancy. A cross-sectional study was conducted on 100 randomly selected pregnant females; data were collected using an interview questionnaire to collect data about socio-demographic characteristics, medical, obstetric and dietary histories. Hematological indicators were obtained from the last recorded values in the patients' files. Anemia was defined as hemoglobin level of less than 11.0g/dl. Statistical analysis was performed using SPSS version 16. The observed prevalence rate of anemia found in this study was (39%) and was higher among females from 25 to less than 35 years, house wives and third trimester pregnant females. Multivariate analysis revealed that, low level of education,decreased birth spacing and history of anemia before pregnancy were associated with increased risk of anemia ($p<0.05$, OR = 18.821, 10.582 and 3.362 respectively). On the other hand, low parity and first trimester females had lower risk of anemia ($p<0.05$ OR = 0.165, 0.088, respectively). No association between the frequency of consumption of nearly all the studied food items and anemia was found. Emphasis should be placed on pregnant women since they were particularly at risk. Health professionals must pay more attention to teach pregnant women good long-term dietary habits as a part of an overall approach to health promotion.

Key words: Anemia, Iron deficiency, pregnancy female

INTRODUCTION

Iron deficiency continues to be the leading single nutritional deficiency in the world, despite considerable efforts over the past 3 decades to decrease its prevalence (Gautam *et al*., 2008). Globally, anemia affects 1.62 billion people. The highest prevalence is in preschool-age children (47.4) and the pregnant women (41.8%) and the lowest prevalence is in men (12.7%). However, the population group with the greatest number of individuals affected is non-pregnant women (468.4 million) (WHO, 2008).

Anemia and specifically iron deficiency anemia, is an important health care concern. The World Health Organization calls iron deficiency the most common anemia (CDC, 2002), as it is estimated to affect approximately 2 billion people worldwide. In developing countries this high rate has been related to insufficient iron intake, exacerbated by chronic intestinal blood losses due to parasitic and malarial infections (Wu *et al*., 2002).

In developed countries it is more commonly due to insufficient iron intake. Although declining in prevalence in the United States since the l970s primarily as a result of food and formula supplementation, it remains a notable finding in toddlers, adolescents and women of childbearing age. Iron deficiency (the lack of adequate iron stores in the body to meet physiological needs for growth) affects 9% of children under 2 years of age, 9-1% of adolescent females and less than l% of adolescent boys. Iron deficiency anemia (anemia resulting from lack of adequate iron to meet needs for red blood cell formation) affects 3% children under 2 years of age, up to 3% of adolescent females and less than 1% of adolescent males (Tender and Chang, 2002). Reduction of iron deficiency and anemia in these vulnerable populations remains a national health objective for 2010 (CDC, 2002).

Women in developing countries are always in a state of precarious iron balance during their reproductive years. Their iron stores are not well developed because of poor nutritional intake, recurrent infections, menstrual blood loss and repeated pregnancies (Brabin *et al*., 2001).

During the first 2 trimesters of pregnancy, iron-deficiency anemia increases the risk for preterm labor, low-birth-weight babies and infant mortality and predicts iron deficiency in infants after 4 months of age (Brabin *et al*.,

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2001). It is estimated that anemia accounts for 3.7% and 12.8% of maternal deaths during pregnancy and childbirth in Africa and Asia, respectively (Khan *et al*., 2006).

Iron deficiency is responsible for lost productivity and premature death in adults (Wu *et al*., 2002) and has been implicated as a cause of perinatal complications such as low birth weight and premature delivery in affected mothers (CDC, 2002). In children, the initial manifestations may be subtle and amenable to treatment. Long-term findings attributable to iron deficiency include increased susceptibility to infection and poor growth (Ioli, 2002).

A study in KSA showed that the prevalence of anemia during pregnancy in women attending the antenatal clinic at Al-Hada Hospital during the period of the study was found to be 26.8%. Eighty four percent of the 26.8% patients with anemia had an iron deficiency anemia. (Al Zahrani, 2005). Therefore it is important to diagnose and treat anemia to ensure the optimal health of the mother and the newborn (Khan *et al*., 2006). This study was conducted to determine the prevalence of anemia among pregnant females attending primary health care centers in Makkah, Saudi Arabia and to assess the etiologic risk factors contributing to it during pregnancy.

MATERIALS AND METHODS

Subjects: A cross-sectional study was conducted between December 2010 and march 2011. The study included 100 randomly selected pregnant females attending Al-Noor General Hospital and Maternity and Children Hospital in Makkah, Saudi Arabia., Pregnant females who agreed to participate were included. Females with history of ante-partum hemorrhage or hemoglobinopathies were excluded. The study protocol, including data collection, was approved by the hospital Board.

METHODS

Interview questionnaire: A specially designed questionnaire was prepared. The questionnaire was divided into three main areas covering; socio-demographic data, medical and obstetric histories including previous and current use of iron supplements.

Food frequency questionnaire (FFQ): The FFQ included frequency response formats to recall each pregnant diet. The food intake frequencies were classified into four categories: 1time per week, 2-5 times per week, more than 5 times per week and rarely, the questionnaire included the most important items that are rich or poor in iron or influences the absorption of iron. Therefore, we included six categories: dairy products, Protein foods, vegetables, fruits, cereals and miscellaneous groups of food.

Anthropometric assessment: The height was measured to the nearest 0.1 using the stadiometer (Gibson, 2005). Pregnant females were asked to report their pre-pregnancy weight and pre-pregnancy BMI was then calculated as weight in kilograms divided by the square of height in meters (CDC, 2011) and categorized according to the WHO criteria (Gee *et al*., 2008).

Laboratory investigations: Hematological parameters including : Hemoglobin (Hb), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), Red Blood Cell (RBC) count and Hematocrit value (HCT), were taken from the last recorded values in patients' files.

Based on hemoglobin level, all patients with a value less than 11g/dL were considered anemic. Hemoglobin level less than 7 g/dl indicates sever anemia,7-8.9 g/dl moderate anemia,and levels between 9-10.9 mild anemia (Mirzaie *et al*., 2010).

Data analysis: Statistical analysis was performed using the Statistical Package for Social Science (SPSS) version 16 (SPSS Inc., Chicago, IL, USA). Univariate analysis was conducted using analysis of variance for continuous variables and Pearson's Chi square (x^2) test or Fisher exact test for categorical variables. P value of less than 0.05 was considered to indicate statistical significance.logistic regression analysis was done to detect the variables that best predict the occurrence of anemia among the studied sample. Results based on severity of anemia were omitted due to small numbers in subgroups.

RESULTS

Prevalence rate of anemia among the studied population: Based on Hb level the overall prevalence rate of anemia among the studied population was (39.0%) (Fig. 1) and was most prevalent in the third trimester (71.8%) compared to the second trimester pregnancy (25.6%) (Fig. 2).

Socio-demographic characteristics of women with and without anemia: Table 1 showed that females less than 35 years had the highest prevalence rate of anemia (69.2%) among the anemic group. The anemic group had lower level of education than the none anemic group ($p>0.05$) and most of them were not working ($p<0.05$)

Distribution of the studied females according to their obstetric and medical histories: Table 2 showed that 66.7% of the anemic group versus 41.0% of the none anemic group get pregnant at an interval of two years or less ($p = 0.01$), and 74.4% of the anemic group compared to 44.4% of the none anemic group were anemic before this pregnancy ($p<0.01$). On the other hand no association was detected between anemia, gestational age, age at first pregnancy, parity, number of

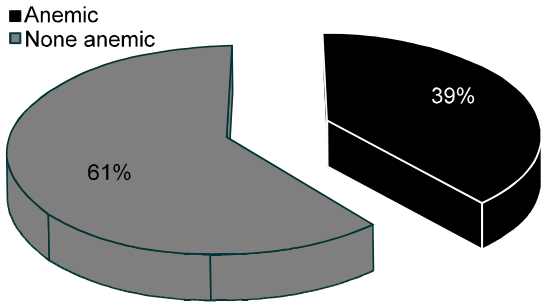

Fig. 1: Prevalence of anemia among the studied females

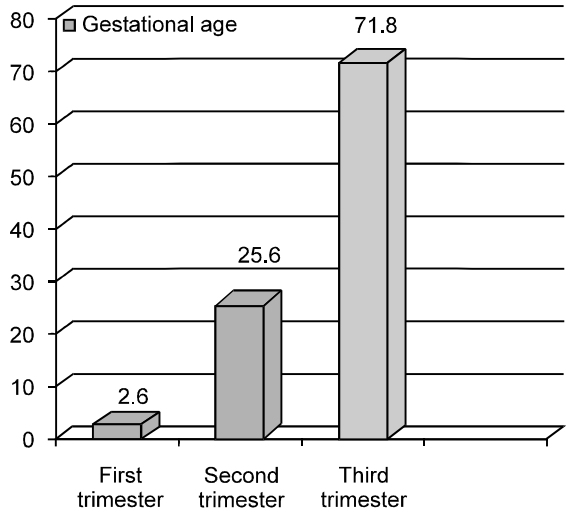

Fig. 2: Prevalence of anemia across the three stages of pregnancy

living children, history of miscarriage, heavy menstrual bleeding,and vaginal bleeding in this pregnancy ($p>0.05$). Moreover, previous and current use of iron supplements as a main preventive measure for iron deficiency anemia, did not seem to differ between the anemic and none anemic group ($p>0.05$).

Frequency of consumption of different food groups: The anemic and none anemic groups were nearly similar regarding the frequency of consumption of the different food groups (Table 3) however, the anemic group showed higher consumption of pea (contain tannins and phytates that inhibit absorption of iron) and potatoes (contain zinc that inhibits iron absorption) ($p<0.05$). Moreover, the anemic group reported higher consumption of tea and coffee which contain tannins, although the difference between them was not statistically significant ($p>0.05$).

Hematological values for anemic and none anemic groups: Table 4 shows that there was highly statistical significant difference between both groups regarding values of Hb, HCT, MCV, MCH and MCHC ($p<0.001$). (89.7) of the studied sample had mild anemia while (10.3%) had moderate anemia and none had severe anemia (Fig. 3).

Indicators of anemia among the studied population: Logistic regression analysis (Table 5) revealed that, low level of education, decreased birth spacing and history of anemia before pregnancy were associated with increased risk of anemia ($p<0.05$, OR = 18.821, 10.582 and 3.362, respectively). On the other hand, low parity

Table 1: Socio-demographic characteristics of women with and without anemia

	Anemic (n = 39)		None anemic (n=61)			
Demographic data	N	%	N	%	Chi^2	p-value
Age groups	6	15.4	9	14.8		
15-	21	53.8	41	67.2		
25-	12	30.8	10	16.4	3.57	0.31
35-	0	0.0	1	1.6		
45-55						
Nationality						
Saudi	36	92.3	52	85.2	1.12	0.23
None Saudi	3	7.7	9	14.8		
Level of education of pregnant females						
Illiterate/can read and write	8	20.5	1	1.60		
Primary /preparatory	8	20.5	12	19.7	12.00	0.007
Secondary school	11	28.2	16	26.2		
University or higher	12	30.8	32	52.5		
Income (Saudi Riyal/month)*						
1000-3000	6	23.1	8	21.6	0.9	0.22
3000-5000	7	26.9	12	34.4		
>5000	13	50.0	17	44.0		
Work Status						
Working	5	12.8	21	34.4	5.77	0.02
House wife	34	87.2	40	65.6		

*13 of the anemic group and 24 of the none anemic group refused to answer

Table 2: Distribution of the studied females according to their obstetric and medical histories

	Anemic (n = 39)		None anemic (n = 61)			
Variables	N	%	N	%	Chi^2	P value
Parity						
Gravida 1	6	15.4	15	24.6	1.93	0.59
Gravida 2	4	10.2	8	13.1		
Gravida 3	6	15.4	10	16.4		
Gravida4 or more	23	59.0	28	45.9		
Gestational age groups						
First trimester	1	2.6	11	18.0	5.62	0.06
Second trimester	10	25.6	11	18.0		
Third trimester	28	71.8	39	64.0		
Age at first pregnancy						
<20	16	41.1	21	34.4	1.17	0.76
20-	10	25.6	14	23.0		
25-	11	28.2	20	32.8		
30-	2	5.1	6	9.8		
Number of living children						
No living children	6	15.4	19	31.1	4.42	0.22
1-2	12	30.8	20	32.8		
3-4	14	35.9	13	21.3		
≥ 5	7	17.9	9	14.8		
Miscarriage						
Yes	16	41.0	18	29.5	1.40	0.24
No	23	59.0	43	70.5		
Birth spacing						
≤ 2 years	16	66.7	25	41.0		
> 2 years	23	33.3	36	59.0	6.28	0.01
Heavy Menstrual Bleeding						
Yes	8	20.5	6	9.8	2.25	0.13
No	31	79.5	55	90.2		
Vaginal Bleeding in this pregnancy						
Yes	4	10.3	7	11.5	0.04	0.85
No	35	89.7	54	88.5		
Use of intrauterine device						
Yes	5	12.8	9	14.8	0.07	0.79
No	34	87.2	52	85.2		
Having anemia before pregnancy						
Yes	29	74.4	27	44.4	8.74	0.003
No	10	25.6	34	55.6		
Iron supplementation before pregnancy						
Yes	11	28.2	11	18.0	1.44	0.23
No	28	71.8	50	82.0		
Iron supplementation in this pregnancy						
Yes	29	74.4	51	83.6	1.27	0.26
No	10	25.6	10	16.4		
Pre pregnancy BMI categories						
Underweight	5	12.8	2	3.3	4.91	0.18
Normal	19	48.7	26	42.6		
Overweight	8	20.5	21	34.4		
Obese	7	18.0	12	19.7		

and first trimester females had lower risk of anemia ($p<0.05$ OR = 0.165, 0.088, respectively).

DISCUSSION

Anemia in pregnancy remains a major problem in nearly all developing and many industrialized countries. The world Health Organization estimates that 58% of pregnant women in developing countries are anemic. In the Arab Gulf countries, maternal anemia, especially iron deficiency anemia has been considered as one of the most important public health problems (Rashed *et al*., 2008).

In the current study the overall prevalence rate of anemia among the studied sample was 39%. Similar result was reported by Rashed and his colleague in Alkhobr province in Saudi Arabia (Rashed *et al*., 2008) and Haniff and his colleague in Malaysia (Haniff *et al*., 2007). On the contrary, Ziauddin and Persson found that the prevalence of anemia during pregnancy in Bangladesh was 50% (Ziauddin and Persson, 2004) low socio-economic profile in Bangladesh can explain this difference. Also, our result was inconsistent with Abu-Hasira who found that the prevalence of iron deficiency anemia in Nablus was 21.7%, (Abu-Hasira,

Table 3: Distribution of the studied groups according to frequency of consumption of different food groups

	Once/week				Two-five/week				More than five/week				Rarely			
	Anemic		None anemic		Anemic		None anemic		Anemic		None anemic		Anemic		None anemic	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Dairy products																
Milk	5	12.8	9	14.8	9	23.2	11	18	9	23.1	10	16.4	16	41	31	50.8
Yogurt	6	15.4	16	26.2	13	33.4	15	24.6	13	33.3	15	24.6	7	17.9	15	24.6
Cheese	3	7.7	7	11.5	8	20.5	12	19.7	5	12.8	10	16.4	23	59	32	52.4
Proteins																
Liver	10	25.6	12	19.7	4	10.3	5	8.2	2	5.1	1	1.6	23	59	43	70.5
Meat	5	12.8	6	9.8	7	17.9	17	27.9	1	2.6	1	1.6	26	66.7	37	60.7
Chicken	14	35.9	14	23	2	5.1	6	9.8	0	0	0	0	21	53.8	41	67.2
Egg	8	20.5	16	26.4	7	17.9	19	31.1	5	12.8	1	1.6	19	48.7	25	41
Fish	12	30.8	17	27.9	4	10.3	7	11.5	1	2.6	0	0	22	56.4	37	60.7
Bean	2	5.1	10	16.4	2	5.1	2	3.3	1	2.6	0	0	34	87.2	49	80.3
Pea*	7	17.9	19	31.1	6	15.4	1	1.6	1	2.6	1	1.6	25	64.1	40	65.6
Vegetables																
Potatoes*	11	28.2	26	42.6	20	51.3	13	21.3	5	12.8	12	19.7	3	7.7	10	16.4
Spinach	12	30.8	19	31.1	5	12.8	6	9.8	1	2.6	2	3.3	21	53.8	34	55.7
Greenery	6	15.4	8	13.1	8	20.5	8	13.1	19	48.7	35	57.4	6	15.4	10	16.4
Fruits																
Dates	6	15.4	7	11.5	11	28.2	14	23	18	46.2	30	49.2	4	10.3	10	16.4
Peach	7	17.9	10	16.4	7	17.9	4	6.6	1	2.6	5	8.2	24	61.5	42	68.9
Nuts	10	25.6	16	26.2	3	7.7	7	11.5	5	12.8	4	6.6	21	53.8	34	55.7
Cereals																
Bread	6	15.4	8	13.1	1	2.6	10	16.4	18	46.2	28	45.9	14	35.9	15	24.6
Rice	3	7.7	3	4.9	1	2.6	1	1.6	3	7.7	2	3.3	32	82.1	55	90.2
Miscellaneous																
Coffee	7	17.9	11	18	4	10.3	14	23	13	33.3	11	18	15	38.5	25	41
Cola	1	2.6	2	3.3	3	7.7	3	4.9	2	5.1	1	1.6	33	84.6	55	90.2
Tea (Soon after meals)	4	10.3	6	9.8	0	17.9	10	16.4	17	43.6	18	29.5	11	28.2	27	44.3

Table 4: Hematological values for anemic and none anemic groups

	Anemic (n = 39) Mean ± SD	None anemic (n = 61) Mean ± SD	t	P value	95% Confidence interval
RBC (m/µl)	4.10±0.76	4.34±0.91	0.371	0.11	(0.63-0.07)
Hb (g/dl)	9.95±0.88	12.12±0.73	2.091	<0.001	(2.49-1.85)
HCT (%)	31.44±3.91	35.93±3.91	0.012	<0.001	(6.08-2.90)
MCV (fl)	74.33±13.64	83.37±5.87	4.26	<0.001	(12.97-5.11)
MCH (pg)	25.10±3.18	28.24±2.42	4.537	<0.001	(4.26-2.03)
MCHC (%)	32.16±3.33	33.89±1.93	4.249	<0.001	(2.68-0.77)

RBC: Red Blood Cell count, Hb: Hemoglobin, HCT: Hematocrit,MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration

Table 5: Logistic regression analysis of the factors associated with anemia

Variables	P value	Odd's ratio	95% CI of odd's ratio
Level of education of pregnant females			
Illiterate/can read and write	0.024	18.821	1.468 - 241.304
Primary /preparatory	0.263	2.478	0.506 - 12.1312
Secondary school	0.230	2.240	0.601 - 8.348
University or higher (reference category)			
Working status (working)	0.568	0.673	0.173 - 2.616
Parity			0.029 - 0.935
Gravida 1	0.042	0.165	0.099 - 4.463
Gravida 2	0.673	0.664	0.147 - 3.733
Gravida 3	0.716	0.741	
Gravida4 or more (reference category)			
Gestational age			
First trimester	0.047	0.088	0.008 - 0.967
Second trimester	0.245	2.159	0.590 - 7.891
Third trimester (reference category)			2.654 - 42.198
Birth spacing (≤ 2 years)	0.001	10.582	1.124 - 10.051
Having anemia before pregnancy (yes)	0.030	3.362	
Constant	0.004	0.087	

Note: Chi-square: 41.195; p = <0.001. Cox and Snell R square = 0. 338. Hosmer–Lemeshow test =10.339, p = 0.242

2007) and with Sukrat and Sirichotiyakul who found that the prevalence of anemia during pregnancy in Maharaj was only 20.1% (Sukrat and Sirichotiyakul, 2006).

The prevalence of anemia varies during the course of pregnancy, the present study revealed that the prevalence of anemia during the first trimester was 2.6, 25.6 % at the second trimester and 71.8% during the third trimester, our result is inconsistent with Karaoglu and his colleague,who found that the prevalence of anemia was 37.5% at the third trimester and (21.2%) at the second (Karaoglu *et al*., 2010) and with Rashed and his colleague, who found that 27.7 % of anemic pregnant females were at first trimester, 37.3% were at the second trimester and 50.2% were at the third trimester(Rashed *et al*., 2008) and also with Abu-Hasira, who reported that 12.7% of the anemic pregnant women were in the second trimester and 32% were in their third trimester (Abu-Hasira, 2007) however the inconsistency with the above studies was in the prevalence of anemia across the three trimesters of pregnancy but is consistent with them in that the highest prevalence of anemia was found in the third trimester. The lower prevalence of anemia observed in these studies might be due to the use of different cutoff points of hemoglobin to define anemia. Low level of education was one of the determinants of anemia detected in the current study (OR = 18.821), this has been shown in studies from several areas including,Saudi Arabia (Al- Oraini, 2005), Vietnam (Aikawa, 2005), Nablus (Abu-Hasira, 2007) and Turky (Karaoglu *et al*., 2010).This result may indicate less awareness regarding heath problems associated with decreased educational level.

Multiparity may induce anemia by reducing maternal iron reserves at every pregnancy and by causing blood loss at each delivery (Karaoglu *et al*., 2010), in this study low parity, was associated with lower risk of anemia (OR = 0.165) this result goes in accordance with Mirzaie *et al*. (2009).

Moreover, this study showed that women with short interpregnancy periods were at more risk of developing anemia during pregnancy, this goes in line with other studies (Marti-Carvajal *et al*., 2002). However, other studies did not show such association as low prevalence rate was found among participant with decreased birth spacing (Abu-Hasira, 2007).

In addition, this study showed that having anemia before pregnancy is one of the factors associated with anemia during pregnancy (OR = 3.362), where 74.4% of the

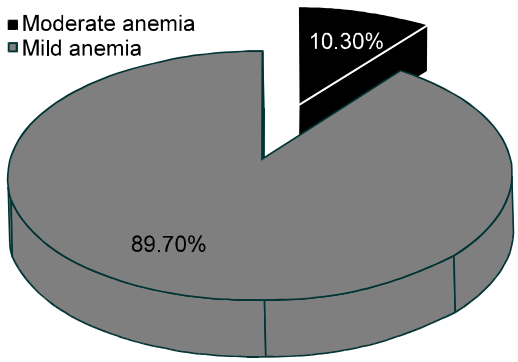

Fig. 3: Severity of anemia among the anemic group

anemic group were anemic before pregnancy, this result agreed with Al- Oraini (2005), who found that higher percentage of anemic pregnant female were anemic before pregnancy.

On the other hand, oral iron supplementation has often been reported to reduce anemia and to improve iron status (Haram *et al*., 2001). Among women enrolled in this survey no association was observed between taking iron supplementation either before pregnancy or during the current pregnancy and the prevalence of anemia, however as reviewed by Beard (2000) the efficacy of iron supplements depends on their composition, the applied dose and the way they are administered.,and whether women are anemic or not at pregnancy entry and on the initial iron stores.

Different studies showed the relationship between iron status and dietary intake in pregnant women (Belgnaoui and Belahsen, 2007). In the current study the frequency of consumption of different food groups was investigated, however the anemic and none anemic groups were nearly similar, this result was supported by other studies (Aikawa *et al*., 2005; Belgnaoui and Belahsen, 2007).

Many studies showed that tea (which contain polyphenols (tannins) that inhibit absorption of iron) has a significant harmful affect on the iron status (Belgnaoui and Belahsen, 2007). The present study,did not show such association although the anemic group reported frequent consumption of of tea than the none anemic group this result disagreed with Belgnaoui and Belahsen (2007) and Nelson and Poulter (2004) who found that the consumption of tea was significantly higher among anemic pregnant females.

It should be stressed that the information on food consumption was obtained by using the food frequency questionnaire that is subjected to recall bias instead of detailed food diaries to calculate precisely the food consumption in terms of calories and other numeric measures which leads to the presumption that what was reported by study groups was less reliable. The limited validity in these estimates should be taken into consideration when using these data to make decisions concerning public health recommendations.

Conclusion: The observed prevalence rate of anemia found in this study was (39%) and was higher among third trimester pregnant females, low level of education, decreased birth spacing and history of anemia before pregnancy were associated with increased risk of anemia). On the other hand, low parity and first trimester females had lower risk of anemia No association between the frequency of consumption of nearly all the studied food items and anemia was found.

Emphasis should be placed on pregnant women since they were particularly at risk. Additionally Physicians or other health professionals must pay more attention to teach pregnant women good long-term dietary habits as a part of an overall approach to health promotion. More direct dependence on hemoglobin and serum ferritin levels as a screening tool, for pregnant women in their second and third trimesters, along with a more aggressive approach to the level of iron stores at which iron supplementation should be prescribed.

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