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Review Article

Assessment of Anemia, IDA and ID among Pregnants in Qatar: Cross Sectional Survey

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Keywords Anemia; Iron Deficiency Anemia; Iron Deficiency

Abbreviations ANC: Antenatal Care; CBC: Complete Blood Count; CMIA: Chemiluminescent Microparticle Immunoassay; Hb: Hemoglobin; HIV: Human Immunodeficiency Virus; HMC: Hamad Medical Corporation; HTN: Hypertension; ID: Iron Deficiency; IDA: Iron Deficiency Anemia; MCH: Mother and Child Health; MCH: Mean Corpuscular Hemoglobin; MCHC: Mean Corpuscular Hemoglobin Concentration; MCV: Mean Corpuscular Volume; PHC: Primary Health Care; PHCCs: Primary Health Care Centers; RBC: Red Blood Cells; SF: Serum Ferritin; US: United States; WHO: World Health Organization

Abstract

Introduction: Anemia, especially iron deficiency anemia, is an important public health problem in developing countries. Pregnant women, owing to their high iron demand are vulnerable to anemia. Reportedly 52% of pregnant women in developing countries, in contrast to 20% in developed countries, are affected. It is associated with serious maternal as well as fetal complications, such as preterm delivery, low birth weight, perinatal mortality and in severe anemia maternal death. Iron supplements are considered the most effective way to prevent and treat IDA but it should be taken regularly.

Objectives: The objectives of the study are estimate the prevalence of anemia, iron deficiency and iron deficiency anemia in addition to the associated factors among Arab pregnant women in Qatar.

Methodology: All eligible Arab women who attended the antenatal clinics of PHCCs during the data collection period were enrolled, a total of 450 women were interviewed using Arabic version questionnaire, hemoglobin and serum ferritin concentration were investigated to estimate anemia, ID and IDA.

Results: The prevalence of anemia was 27.1% (Hb<11g/dl), of which 74.5% were mildly anemic while 25.5% were moderately anemic. The prevalence of ID was 35.4% (SF <15µg/l) and the prevalence of IDA was 15.9%.

Anemia was significantly associated with gestational age, while ID was significantly associated with nationality, gestational age and inter-pregnancy space.

Conclusion & Recommendations: Anemia, ID and IDA during pregnancy are major problems as the prevalence of anemia among pregnant women in the current study was 27.1% which is considered as moderate based on WHO classification. However, Prevalence of ID and IDA were high. This prevalence is similar to that found in other developing countries but still behind the status in the industrialized countries, so preventive strategies and interventions must be instituted. Revising Maternal Health Program at Primary Health Care level to address the problem of ID & IDA among pregnant women.

Introduction

Anemia in pregnancy remains a major public health problem in nearly all developing and many industrialized countries. At 2001, the WHO estimated the prevalence of anemia among pregnant women in most industrialized countries to be around 20% , while in developing countries 52 % of pregnant females are anemic [1,2].

Over half of the world's pregnant women are anemic, and 458 million adult women suffer from iron deficiency, it accounts for 24% of the diseases in these women [3]. As for the Global Burden of Disease (GBD) 2002 estimates, it was assumed that 60% of anemia was due to iron deficiency in non-malaria areas and 50% in malaria areas [4]. Despite the progress in the social, economic and health status in the Arab Gulf Countries, IDA is still one of the main health problems in these countries with a prevalence ranging from 22.6 % to 54.0%, and if not controlled, may lead to many serious health consequences as increased maternal morbidity and mortality. Iron deficiency anemia (IDA) is associated with 22 percent of all maternal deaths. It is the 15th most important risk factor for total global mortality, and the 13th most important risk factor contributing to the global burden of disease [5,6]. The cause of IDA is multi-factorial, depending on age, sex, dietary habits, health and socio-economic status of the community [7, 8].

In developing countries, severe anemia is the main causal factor in up to 20% of maternal deaths [9,10]. Iron deficiency anemia may contribute to increased morbidity and mortality by increasing maternal susceptibility to infection [7]. Anemia has serious complication on the fetus. It was associated with lower Apgar score, perinatal complications, preterm birth as well as low birth weight

[11,12]. The main problem in IDA that public health services of many countries continue to treat iron deficiency anemia as a clinical issue and focus on treatment rather than prevention. Over the past years, there have been several global preventive strategies and approaches that address IDA which are: dietary diversification, food fortification, iron supplementation and improvement of the nutritional status of pregnant women [13].

State of Qatar has paid remarkable attention to maternal health. Health care during pregnancy is a major activity that raises the health of the mother, the embryo, and the newborn [14]. Despite national policies to prevent and treat anemia during pregnancy, the true prevalence and determinants are not well defined except old figures about prevalence of IDA among pregnant women in Qatar was 30% [15]. This study is recommended by local authority, to get updated epidemiological data on this important health problem. Determining the magnitude, severity, distribution and determinant of IDA can serve as a basis for planning policies and tailored cost effective intervention programs.

Subject and Methods

Qatar is peninsula one of the Arabic Gulf countries located halfway down the west coast of the Arabian Gulf. The total land area of Qatar is approximately 11,437 square kilometers. On 2010, the Qatar Statistics Authority estimated the total Population of Qatar as being 1,699,435 individuals, distributed among 1,284,739 males and 414,696 females, 1,284,739 males and 414,696 females, with the majority living in Doha, which is the capital of the country. A Cross sectional survey was used, the estimated sample size (462) had taken into consideration the known prevalence of anemia in pregnancy (50%) [1,8], 95% confidence level and error rate 5%, and 20% to compensate for non-response, All eligible Arabic pregnant women who attended the first antenatal visit (booking) during the study period from February to March 2011 were enrolled to compose a homogenous group that share similar language as well as similar cultures. The antenatal care services are provided free of charge to pregnant women at nine primary health care centers together with other promotive, preventive and curative care twice / a week . They were invited to participate, and given the right to decline participation without jeopardizing receipt of care at the local health clinics. The aim of the study was carefully explained to the participants. Those who agreed to participate read three copy consent forms where one copy was added to the participant's file, one was given to the participant, while the third one was attached to the questionnaire. The researcher read the consent form to illiterate women. Confidentiality of the information was assured all through the study by coding the questionnaires as well as ensuring privacy while collecting data.

Data Collection

Using Arabic version structured questionnaire which was developed by the investigator and the content and face validity were established by extensive literature review and expert panel from Qatar University Consultant Nutrition Department and trainers of Community Medicine Department. The questionnaire was prepared in English and translated into Arabic with back translation at Hamad Medical Corporation accredited translation Center. The questionnaire included the following sections: The 1st section included socio demographic data: age, socioeconomic status (occupation, number of family members sharing same apartment, level of education and monthly family income) as well as smoking history. The 2nd section contained questions about other potential determinants of anemia including Obstetric history (number of pregnancies, gestational age, inter-pregnancy interval, gestational age at delivery, antenatal, postnatal and neonatal complications. The interview was conducted by the investigator and Arabic-speaking PHC nursing staff that was working in the selected PHCCs and had previous experience in health -related research. Training sessions to data collectors was done by the investigator prior to data collection

Laboratory Investigation

Blood specimens for assessment of Hb and serum ferritin measurement were withdrawn under strict infection control procedures according to PHCC infection control policy. The prevalence of anemia is best determined by using reliable method of hemoglobin concentration, which is done at the PHCCs by fully automated machines (CBC analyzer) that is being calibrated every morning at all PHCCs according to HMC standards. Serum ferritin: Although serum ferritin level is the most specific biochemical test that correlates with relative total body iron stores, it is not routinely done and was requested by the investigator for study purpose. A low serum ferritin level reflects depleted iron stores and hence is a precondition for iron deficiency in the absence of infection. Serum ferritin at HMC is measured by the ARCHITECT Ferritin assay which is a two-step immunoassay to determine the presence of ferritin in the human serum and plasma using Chemiluminescent Microparticle Immunoassay (CMIA) technology with flexible assay protocols referred to as Chemifex [16].

Anemia was considered if the hemoglobin level is less than 11.0 g/dl. Mild anemia , hemoglobin level between 10.9-10.0 g/dl and moderate anemia , hemoglobin level 9.9- > 7.0 g/dl ,while severe anemia was considered if hemoglobin level is ≤ 7.0 [1]. Women were considered iron deficient if serum ferritin level is less than 15 μg/l [17]. Iron deficiency anemia was considered if the hemoglobin level is less 11 g/dl and serum ferritin level is < 15 μg/l.

Data Management

SPSS version 18 was used for data entry and analysis. Proportions, means and standard deviations were calculated. Chi-square test was used to assess differences between two or more categorical variables. Student t test was used to compare between continuous variables. Multivariate regression analysis was performed to identify the most influential risk factors. An Alpha (p) value of ≤ 0.05was the cut-off level of significance, all variables regardless of their level of significance in the univariate analysis were introduced in the regression model. Ethical considerations: this study was funded by the research department and approval of IRB of Hamad Medical Corporation was obtained and informed consent was obtained all cases of anemia was referred to family physician for management.

Results

This was a cross sectional survey that was conducted among pregnant women attending PHCCs. Consent to participate was secured from 450 women whom met the eligibility criteria, attended the health center during the data collection period and agreed to participate giving a response rate of 97.4%. Most of the participants were non Qatari and housewives (78.7% and 74.7%, respectively), this almost represent the population distribution in Qatar as non-Qatari

Table 1: Frequency distribution of socio demographic characteristics & reproductive history of pregnant women attending PHCCs, N=450.

Characteristic	Frequency	%
Nationality		
Qatari	96	21.3
non-Qatari	354	78.7
Age		
< 25	129	28.7
25-	249	55.3
> 35	72	16
Household members		
≤3	226	50.1
4-	115	25.6
>6	102	22.7
Missing	7	1.6
Educational Level		
Illiterate	17	3.8
Up to high school	186	41.3
University educated & above	244	54.2
Missing	3	0.7
Employment Status		
Employee	113	25.1
House-wife	336	74.7
Missing	1	0.2
Monthly family Income (QR)		
≤5,000	92	20.4
5,001-10,000	181	40.2
>10,000	161	35.8
Missing	16	3.6
Smoking history		
No	448	99.6
Yes	2	0.4
Gravida		
Primigravida	110	24.4
Multigravida (2-5)	283	62.9
Grandmultigravida ≥6	57	12.7
Parity	N= 450	
Nuliparous	127	28.2
Multipara (1-3)	252	56.0
Grandmultipara ≥4	71	15.8
Inter-pregnancy space	N= 333*	
≤ 1 year	147	44.1
>1- 3	173	52.0
>3	13	3.9

*missing values and NA (primigravida).

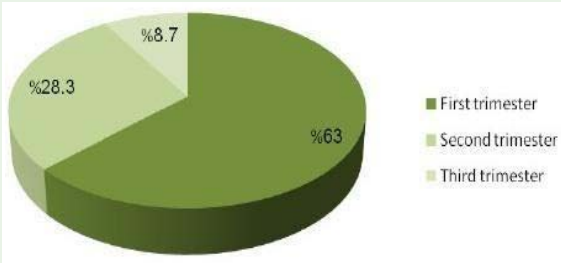

Figure 1: Distribution of pregnant women according to the current Gestational age, PHCCs, N=450.

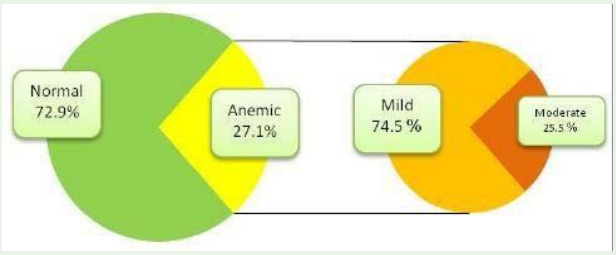

Figure 2: The prevalence of anemia among pregnant women, PHCC, n=391*.
*missing values as some of the pregnant women fulfill the questionnaire but did not go for blood test.

to Qatari 4 to one. More than half of the participating pregnant women were between 25 and 35 years old (55.3%) with a mean value of 28.4 ± 5.7 SD. The educational level "university and above" was the most frequent level among the participants (54.2%). The monthly family income was mainly between 5,001 and 10,000 QRs (40.2%). Only two (0.4%) of the participants were current smokers. When assessing the reproductive history of study participants, around 63% of the participants were multi gravida with 2 to 5 pregnancies and more than half of them were multipara with 1 to 3 children (56%). The inter-pregnancy space of more than one third of them was ≤ one year (44.1%) (Table1). Most of the pregnant women were in the first trimester (63.0%), while only (8.7%) were in the third trimester, where this was for them the first visit and booking in the health center as shown in (Figure 1).

The prevalence of anemia among participants was found to be 27.1%, of which 74.5% were mildly anaemic while 25.5% were moderately anaemic (Figure 2). The current study revealed that more than one third of the pregnant women were iron deficient (35.4%). IDA was considered with a hemoglobin level less than 11 g/dl in addition

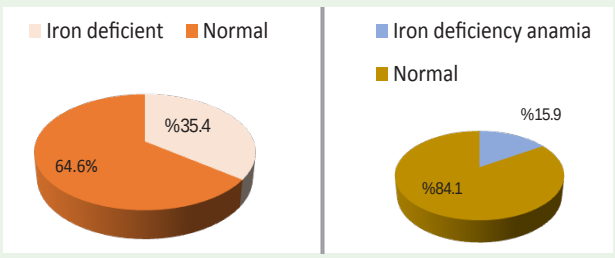

Figure 3: The prevalence of iron deficiency and IDA among pregnant women, PHCCs, n=373*.

Table 2: Prevalence of anemia according to socio-demographic characteristics & reproductive history of pregnant women, PHCCs, n=391.

Characteristic	Frequency			p-value
	<11	≥11	Total	
Nationality			n= 391	
Qatari	56 (63.6)	32 (36.4)	88	0.028
Non-Qatari	74 (24.4)	229 (75.6)	303	
Maternal Age			n= 391	
< 25	29 (26.9)	79 (73.1)	108	0.926
25-	60 (27.8)	156 (72.2)	216	
> 35	17 (25.4)	50 (74.6)	67	
Educational Level			n=389*	
Illiterate	3 (20.0)	12 (80.0)	15	0.533
Up to high school graduate	40 (24.5)	123 (75.5)	163	
University educated and above	61 (28.9)	150 (71.1)	211	
Employment Status			n=390*	
Employee	27 (27.3)	72 (72.7)	99	0.928
Housewife	78 (26.8)	213 (73.2)	291	
Household members		n=386*		
≤3	44 (23.0)	147 (77.0)	191	0.097
4–6	27 (26.7)	74 (73.3)	101	
>6	33 (35.1)	61 (64.9)	94	
Family Income			n=377*	
≤ 5,000	23 (29.1)	56 (70.9)	79	0.497
5,001-10,000	36 (23.5)	117 (76.5)	153	
> 10,000	42 (29.0)	103 (71.0)	145	
Gestational Age			n=379*	
First	44 (18.5)	194 (81.5)	238	0.001
Second	38 (36.2)	67 (63.8)	105	
Third	16 (44.4)	20 (55.6)	36	
Gravidity			n= 391	
Primigravida	21 (23.1)	70 (76.9)	91	0.578
Multigravida	71 (28.7)	176 (71.3)	247	
Grandmultigravida	14 (26.4)	39 (73.6)	53	
Parity			n= 391	
Nulliparous	22 (21.0)	83 (79.0)	105	0.242
Multiparous	64 (29.0)	157 (71.0)	221	
Grandmultiparous	20 (30.8)	45 (69.2)	65	
Inter-Pregnancy Space			n=296**	
≤ 1 year	39 (30.7)	88 (69.3)	127	0.570
>1-	40 (25.5)	117 (74.5)	157	
>3	4 (33.3)	8 (66.7)	12	

*missing and NA values.

Table 3: Prevalence of ID according to socio demographic characteristics& Reproductive history among pregnant women, PHCCs, n=373.

Characteristic	Frequency			p-value
	<15	≥15	Total	
Nationality			n= 373	
Qatari	41 (56.9)	31 (43.1)	72	0.001
Non-Qatari	91 (30.2)	210 (69.8)	301	
Maternal Age			n= 373	
< 25	37 (36.6)	64 (63.4)	101	0.912
25-	72 (34.4)	137 (65.6)	209	
> 35	23 (36.5)	40 (63.5)	63	
Educational Level			n=372*	
Illiterate	7 (58.3)	5 (41.7)	12	0.066
Up to high school graduate	60 (39.2)	93 (60.8)	153	
University educated and above	64 (30.9)	143 (69.1)	207	
Employment Status			n=373	
Employee	36 (39.1)	56 (60.9)	92	0.387
Housewife	96 (34.2)	185 (65.8)	281	
Household members			n=366*	
≤3	50 (27.9)	129 (72.1)	179	0.014
4–6	40 (40.4)	59 (59.6)	99	
>6	39 (44.3)	49 (55.7)	88	
Family Income			n=362*	
≤ 5,000	30 (36.6)	52 (63.4)	82	0.976
5,001-10,000	53 (35.6)	96 (64.4)	149	
> 10,000	46 (35.1)	85 (64.9)	131	

Determinant	Serum ferritin Level			p-value
	<15	≥15	Total	
Gestational Age		n=364*		
First	64(27.7)	167 (72.3)	231	0.001
Second	48 (45.7)	57 (54.3)	105	
Third	17 (60.7)	11 (39.3)	28	
Gravidity		n=373		
Primigravida	30 (36.1)	70 (63.9)	84	0.504
Multigravida	80 (33.8)	157 (66.2)	237	
Grandmultigravida	22 (42.3)	30 (57.7)	52	
Parity		n=373		
Nulliparous	32 (32.0)	68 (68.0)	100	0.354
Multiparous	73 (34.8)	137 (65.2)	210	
Grandmultiparous	27 (42.9)	36 (57.1)	63	
Inter-Pregnancy Space		n=284**		
≤ 1 year	36 (28.1)	92 (71.9)	128	0.031
>1-	61(42.4)	83 (57.6)	144	
>3	6(50.0)	6(50.0)	12	

*missing and NA values.

Table 4: Factors influencing anemia among pregnant women attending PHCCs, n= 39.

Determinant	OR (95% CI)*	p-value
Nationality		
Qatari	1	
non-Qatari	0.50.(3-1.3)	0.168
Maternity Age		
< 25**	1	
25-35	1.0(0.4-2.4)	0.958
> 35	0.8(0.3-2.8)	0.757
Household members		
≤3	1	
4-	1.1(0.5-2.5)	0.787
>6	1.4(0.6-2.5)	0.451
Educational Level		
Illiterate	1	
Up to high school graduates	2.3(0.4-12.4)	0.323
University educated & above	2.8(0.5-16.6)	0.264
Monthly family Income (QR)		
≤5,000**	1	
5,001-10,000	0.8(0.4-1.8)	0.558
>10,000	0.9(0.4-2.0)	0.708
Gestational Age		
First**	1	
second	1.9(1.0-3.5)	0.062
Third	4.9(1.8-12.9)	0.001
Parity		
Nuliparous	1	
Multipara (1-3)	6.4(0.8-55.7)	0.094
Grandmultipara ≥4	7.3(0.7-76.2)	0.096
Inter-pregnancy space		
≤ 1 year	1	
>1- 3	0.6(0.5-9.5)	0.168
>3	2.1(0.5-9.5)	0.341

*missing and NA values.

to serum ferritin level of < 15 μg/l. IDA was found to be 15.9% among the study participants (Figure 3). When assessing relations between anemia and socio demographic characteristics. It was found that more than one third of Qatari pregnant women were anemic (36.4%) in comparison to 24.4% non-Qatari women and the relation was statistically significant (χ^2=4.8, df =1, p=0.028). On the other hand, more than three fourth of the illiterate pregnant women and those with household ≤ three were not anaemic. However, these relations were not statistically significant. On studying the relation between anemia and reproductive history, there was statistically significant relation between gestational age and anemia, where the prevalence of anemia was 55.6% in the third trimester in comparison to 36.3% and 18.5% in the second and first trimesters, respectively, showing trend pattern (χ^2 =28.2, df= 2, p=0.001). Grand multiparous woman and inter-pregnancy space of > three years showed high prevalence of anemia compared to other categories. However, these relations were not statistically significant (Table 2). Regarding socio demographic the relation between iron deficiency and characteristics, nationality showed statistically significant relation with the serum ferritin level. It was found that more than half of the Qatari women (56.9%) were iron deficient in comparison to 30.2% non-Qatari women (χ^2 =18.1, df= 1, p=0.001). There was statistically significant relation between iron deficiency and number of household members where the prevalence of iron deficiency was 44.3% among those living with more than six household members in comparison to 40.4% and 27.9% among those living with 4-6 and ≤ three household members, respectively (χ^2= 8.5, df= 2, p= 0.014). Concerning the relation between ID and reproductive history, gestational age and inter-pregnancy space showed statistically significant relation where the prevalence of ID in the first and second trimesters were 27.7% and 45.7%, respectively while it was 60.7% in the third trimester (χ^2 =18.7, df= 1, p=0.001). Participating women with a space of more than three years showed higher prevalence of ID (50%) compared to 42.4% and 28.1% in the other categories (χ^2 =7.0, df= 2, p=0.031) (Table 3). The influence of the nationality, maternal age, educational level, household members, family income, gestational age, parity and inter- pregnancy space on anemia was investigated by multivariate logistic regression. The only factor that had significant association with anemia was gestational age as the pregnant woman in the third trimester was 4.9 times more likely to have anemia than the pregnant woman in the first trimester (adjusted OR= 4.9 , CI: 1.812.9, p= 0.001) (Table 4).

Discussion

Pregnancy is a period of rapid growth and cell differentiation, both for the mother and the fetus. Consequently, it is a period when both are very susceptible to alteration in dietary supply, especially of nutrients which are marginal under normal circumstances. Iron deficiency anemia is still a major public health problem in developing countries especially among pregnant women. The aim of the current study was to explore the magnitude and determinants of anemia and ID among pregnant women, which will help local authority to plan policies and effective interventions aiming at improving maternal and fetal health. The present study indicates that in spite of the efforts made by the decision makers at Hamad Medical Corporation as well as Primary Health Care Corporation, pregnant women still has high prevalence of anemia though slightly lower than other neighboring countries.

The prevalence of anemia among Arab pregnant women attending PHCCs was found to be 27.1 %, of which 74.5% were mildly anaemic and 25.5% were moderately anaemic. There were no cases of severe anemia among the study population, most probably because iron deficiency mostly does not produce severe anemia like anemia due to infections (hookworm infestation, malaria and HIV) of ID and IDA was 35.4% and 15.9%, respectively [18]. The prevalence in the current study is similar to the figures in other countries from the Eastern Mediterranean Region. As the prevalence of anemia, ID and IDA was 26.7%, 51.2% and 16.7% respectively among Moroccan pregnant females in 2007 but with different cut off values (according to the CDC criteria in which the pregnant female is considered anemic if her hemoglobin level is < 11 g/dl in the first and third

trimester and < 10.5 g/dl in the second trimester while she will be considered iron deficient if her serum ferritin level is <12 μg/l) [19]. while in Southern Iran, 2002, the prevalence of anemia and ID was 16.7% and 28.5%, respectively using similar cut off value for anemia but lower value for iron deficiency (< 12 μg/l)[18]. The prevalence of anemia among pregnant women in 2007 in Malaysia was 35% (Hb<11 g/dl) [20]. The prevalence found in our study is slightly lower than that found in the GCC countries taken into consideration the different years of the studies as these figures might be changed if recent studies are conducted. In Riyadh, Saudi Arabia, 2005, 31.7% pregnant women attending ANC clinic were anemic while 50.2% were iron deficient and the prevalence of IDA was 23.8% (Hb< 11 g/dl and SF < 12 μg/l) [20, 21] while Bahraini national survey in 1995 revealed that 40% of pregnant women suffer from IDA and 33.5% had anemia (Hb<11 and SF <17 ng/ml) [22]. The prevalence of anemia in South Sharqiya district in the Sultanate of Oman in 2003 was 43.6% (Hb<11 g/dl) [23]. Although the prevalence in the current study is lower than countries in the region, we are still behind the prevalence in the developed countries. The prevalence of IDA among pregnant women in the US in 2000 was 22%; of them 54% had ID (Hb< 11 g/dl and SF < 12 μg/l) [24] while the prevalence of anemia among pregnant women in 2003 in Finland was 2.6% ((Hb<10 g/dl) [24]. The WHO has classified the countries according to their prevalence of anemia based on the cut- off levels of hemoglobin according to the WHO criteria (< 11 g/dl) to Severe (≥ 40), Moderate (20.0-39.9), Mild (5.0- 19.9), Normal (≤4.9) [1]. According to prevalence obtained in the present study, Qatar is classified to have moderate public health significance of anemia based on the WHO classification of public health significance of anemia in populations. The current study showed that both anemia and ID frequency increased with increasing gestational age with significant relation in the multivariate analysis, a finding that is consistent with many studies in Morocco, Thailand and Saudi Arabia [19,21,25]. The prevalence of anemia was 55.6% in the third trimester in comparison to 36.2% and 18.5% in the second and first trimesters, respectively while the prevalence of ID was 60.7% in the third trimester and 45.7% and 27.7% in the second and first trimesters, respectively. The same finding was found in US, 2007 where the prevalence of anemia among pregnant women in the first, second and third trimesters was 7.1%, 11.5 and 33.5, respectively [26]. The low hemoglobin level in the third trimester in comparison to the first trimester partly artifactual as the maternal hemoglobin and hematocrit decline throughout the first and second trimesters, reach their lowest point late in second to early in the third trimester and then rise again when the pregnancy approaches term. In late pregnancy it is difficult to distinguish physiologic anemia from IDA [27]. In spite of the good socioeconomic status among Qatari population, the prevalence of anemia as well as ID was higher among Qatari pregnant women. The prevalence of anemia was 36.4% among Qatari pregnant women in comparison to 24.4% in the non-Qatari pregnant women. On the other hand, the prevalence of ID was 56.9% among Qatari pregnant women while it was 30.2% in the non-Qatari pregnant women and this relation was significant in the multivariate analysis. This could be explained by low iron intake resulted from low consumption of iron rich food as well as poor dietary habits like drinking carbonated beverages with the meal and tea or coffee after meals. They also used to eat date which is one of the richest sources of iron with laban or with Arabic coffee. Tea, coffee, laban and cola are food items that contain iron absorption inhibitors like calcium, polyphenol compounds (tannins) and phosphate. The prevalence of anemia as well as ID was equally distributed among all age groups. Studies done in Malaysia, Malawi and Saudi Arabia (Al-Khobar region) had similar findings and concluded that age alone is not an important determinant of hemoglobin value [20,28,29].

In contrary, studies in Morocco, China, Nigeria, Indonesia and Saudi Arabia (Asir region) found increased risk of anemia among extremes of age, less than 20 and more than 35 years of age [30,19,31,32].

The current study showed no difference in the distribution of anemia and ID prevalence between employed or housewife pregnant women and different family income. There was relation between anemia and ID with the educational level in which higher prevalence of anemia was found among highly educated pregnant women (28.9%) while the prevalence was higher among the illiterates in relation to ID (58.3%). The latter is consistent with other studies done in Saudi Arabia and Nigeria as the less educated women are less likely to maintain proper hygiene and sanitation and so will fall easy prey to infections [30,31,32]. On the other hand, the highly educated woman may be more concerned about her body image therefore tries to restrict her diet especially the food of animal origin even before getting pregnant so enters the pregnancy with low iron stores or could be the employment status of the educated women where the educated women usually are employee and there is no enough time to take care of their health including dietary habits. The present study showed that the prevalence of anemia and ID among pregnant women living with more than six household members was more than those living with less than three or with 4 to less than six household members. The prevalence of anemia and ID was 35.1% and 44.3%, respectively in pregnant women living with more than six household members. This could be explained that large household number is usually associated with lower socioeconomic status and it could be an indirect indicator of number of parities in which the pregnant women with low socioeconomic status and high parity is at increased risk of anemia and ID. A study done in Alaska, 2006 concluded that children who were living in homes with ≥ six household members were more likely to be iron deficient than those in homes with < six household members [33].

In consistency with previous studies, the prevalence of anemia and ID in the current study increased with increasing parity, however, this relation was not significant. A relation has been reported in pregnant women in Mexico and Saudi Arabia (Asir) [30,34]. The relation between anemia, successive pregnancies and short inter pregnancy intervals has been attributed to the cumulative demands on iron stores as result of these two factors. Even if iron stores are normal and diet was perfect in its nutritional value, a net loss of iron occurs in each gestation. Repeated pregnancies and deliveries deplete iron stores. Also when there is short spacing between pregnancies, the hemoglobin concentration deteriorates faster since the body does not have sufficient time to replace the stored iron [30,31,35]. This is contrary to the current study findings where the risk of anemia as well as ID increased with increasing the inter-pregnancy space. The relation was significant in multivariate analysis with ID in which the pregnant women with inter-pregnancy period of >1-3 years and > 3 years was associated with increased risk of ID (OR = 2.1 and 5.0, respectively). Controversial results were found in Nigeria as well as Saudi Arabia in which shorter inter-pregnancy space was significantly associated with anemia [30,31]. On the other hand, gravidity was not

found to be related to anemia or ID among our participants. Unlike the Ethiopian study in which the gravidity was related to anemia [36].

Limitation of the Study

This study was conducted in the primary health care centers only, while still some of the pregnant mothers follow their pregnancy in the private hospitals, also this study included only Arabic speakers which did not represent all population here in Qatar which consider as limitation, so we cannot generalize the results of this study .

Conclusion

The prevalence of anemia among pregnant women is moderate based on WHO classification and mostly of the mild type. However, prevalence of ID and IDA were high. Anemia was significantly related to gestational age while ID was significantly related to nationality, gestational age, and inter-pregnancy space.

Recommendations

Proper surveillance of anemia and ID status among pregnant women to ensure accurate recording and assessment and introduction of serum ferritin test early in the first trimester with the first ANC visit to catch the affected pregnant. Preventive strategies and interventions must be instituted. Revising Maternal Health Program at Primary Health Care level to address the problem of ID & IDA among pregnant women with particular attention to groups at greater risk in addition to the other public health measures. Further study is recommended to include pregnant women from governmental and private hospitals and also the non-Arabic speakers for good representation.

References

1. United Nations Children's Fund/ United Nations University/ World Health Organization. Iron deficiency anaemia: assessment, prevention and control, a guide for programme managers. 2001.
2. The WHO Reproductive Health Library. Treatment for Iron Deficiency Anaemia in Pregnancy. 2016.
3. Joint WHO/ UNICEF Consultation on Strategies for Control of Iron Deficiency-Anaemia. Guidelines for the control of iron deficiency in countries of the Eastern Mediterranean Middle East and North Africa. Tehran, Islamic Republic of Iran. 1996.
4. World Health Organization: The World Health report 2002: Reducing Risk, Promoitng Healthy Life.
5. Stoltzfus, Rebecca J, Luke Mullany, and Robert E. Black. "Iron Deficiency Anemia." In Comparative Quantification of Health Risks: Global and Regional Burden of Disease , Attributable to Selected Major Risk Factors, edited by Majid Ezzati, Alan D. Lopez, Anthony Rodgers, and Christopher JL Murray. Geneva, Switzerland: World Health Organization. 2004; 163-209.
6. Ezzati, Majid, Stephen Vander Hoorn, Alan D Lopez, Goodarz Danaei, Anthony Rodgers, et al. "Comparative quantification of mortality and burden of disease attributable to selected risk factors." Alan D Lopez, Colin D Mathers, Majid Ezzati, Dean T Jamison, and Christopher JL Murray, editors. In; Global burden of disease and risk factors. Washington DC: World Bank and Oxford University Press 2006; 241-268.
7. Kraemer K, Zimmermann M B. Sight and Life press: Nutritional Anaemia, Switzerland. 2007.
8. Musaiger A O. Iron deficiency anemia in the Arab Gulf countries: the need for action. Bahrain Medical Bulletin. 23; 2001.
9. Galloway R, Dusch E, Elder L, Achadi E. Women's perceptions of iron deficiency and anemia prevention and control in eight developing countries. Soc Sci Med. 2002 ; 55: 529-544.
10. Moradi F, Mohammadi S, Kadivar A A, MasoumiS.J. Knowledge and Practice of Pregnant Women in Fars Province About Intake of Iron Supplements. Acta Medica Iranica. 2006; 45: 301-304.
11. Allen LH. Anemia and iron deficiency: effects on pregnancy outcome. Am J ClinNutr. 2000; 71: 1280-1284.
12. Nen HH, Nen KH, Nonen SH. Anaemia in the first but not in the second or third trimester is a risk for low birth weight. Clinical Nutrition. 2003; 22: 271-275.
13. Stoltzfus RJ, Dreyfuss ML. International Nutritional Anemia Consultative Group (INACG): Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anemia. 1998.
14. Statistical Authority. The Millennium Development Goals in the State of Qatar. 2008.
15. Amine EK. Nutritional assessment in Qatar; 1995. Qatar, WHO Regional Office for the Eastern Mediterranean. 1995.
16. Abbott Diagnostics Division: ARCHITECT ferritin. Ireland. 2008.
17. Karimi M, Kadivar R, Yarmohammadi H. Assessment of the prevalence of iron deficiency anemia, by serum ferritin, in pregnant women of Southern Iran. Med SciMonit. 2002; 8: 488-492.
18. Hyder SM Z, Persson L A, Chowdhury M, Lonnerdal B, Ekstrom EC. Anaemia and iron deficiency during pregnancy in rural Bangladesh. Public Health Nutrition. 2004; 7: 1065-1070.
19. Belganaoui S, Belahsen R. Anaemia and Iron efficiency Anaemia during Pregnancy in an Agricultural Region of Morocco: Effects of Dietary Intake and Iron Supplementation. Research Journal of Biological Sciences. 2007; 2: 118-126.
20. Haniff J, Das A, Onn LT, Sun CW, Nordin NM, Rampal S, et al. Anemia in pregnancy in Malaysia: a cross sectional survey. Asia Pac J Clin Nutr. 2007; 16: 527-536.
21. Al- Oraini E S. Dietary Etiological Factors Contributing to Anemia among Pregnant Saudi Women Attending Riyadh Armed Forces. Hospital King Saud University. 2005.
22. Moosa K, Zein Z A. Assessment of the iron status and dietary intake of pregnant women in Bahrain. Bahrain Ministry of Health. 1996.
23. Afifi M. Anaemia in Pregnancy at South Sharqiya Health Centers, Oman. The Journal of The Egyptian Public Health Association. 2003; 78: 39-54.
24. Alper B S, Kimber R, Reddy A K. Using ferritin levels to determine iron deficiency anaemia in pregnancy. Journal of Family Practice. 2000; 49: 829-832.
25. Sukrat B, Sirichotiyakul S. The Prevalence and Causes of Anemia during Pregnancy in Maharaj Nakorn Chiang Mai Hospital. 2006; 89: 142-146.
26. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention: pregnancy nutrition surveilance. 2007.
27. Scholl TO. Iron status during pregnancy: setting the stage for mother and infant. Am J Clin Nutr. 2005; 8: 1218-1222.
28. Van den Broek NR, Mhango CG, Rogerson SJ, Kambala B, White SA, Molyneux MA. Anaemia in pregnancy in southern Malawi: prevalence and risk factors. British Journal of Obstetrics and Gynecology. 2000; 107: 445-451.
29. Rasheed P, Koura MR, Al-Dabal BK, Makki SM. Anemia in pregnancy: a study among attendees of primary health care centers. Ann Saudi Med. 2008; 28: 449-452.
30. Mahfouz AA, El- Said MM, Alakija W, Badawi IA, al-Erian RA, Moneim MA, et al. Anemia among pregnant women in the Asir Region, Saudi Arabia: An epidemiologic study. Southeast Asian J Trop Med Public Health. 1994; 25: 84-87.
31. Okwu GN, Ukoha AI. Studies on the Predisposing Factors of Iron Deficiency Anaemia among Pregnant Women in a Nigerian Community. Pakistan Journal of Nutrition. 2008; 7: 151-156.

32. Suega K, Dharmayuda TG, Sutarga IM, Bakta IM. Iron Deficiency anaemia in Pregnant Women in Bali, Indonesia: a profile of risk factors and epidemiology. Southeast Asian J Trop Med Public Health. 2002; 33: 604-607.

33. Baggett HC, Parkinson A J, Muth PT, Gold BD, Gessner BD. Endemic Iron Deficiency Associated With Helicobacter pylori Infection Among School-Aged Children in Alaska. Pediatrics. 2006; 117: 396-404.

34. Levy TS, Villalpando S, Rivera JA, Rodríguez FM, Cisneros MC, Monterrubio EA. Anemia in Mexican women: A public health problem. saludpública de méxico. 2003; 45: 499-507.

35. King JC. The Risk of Maternal Nutritional Depletion and Poor Outcomes Increases in Early or Closely Spaced Pregnancies. The Journal of Nutrition. 2003; 133: 1732-1736.

36. Gibson RS, Abebe Y, Stabler S, Allen RH, Westcott JE, Stoecker BJ, et al. Zinc, Gravida, Infection, and Iron, but Not Vitamin B-12 or Folate Status, Predict Hemoglobin during Pregnancy in Southern Ethiopia. The Journal of Nutrition. 2008; 138: 581-586.