Prevalence & risk factors for iron deficiency anemia among pregnant women attending antenatal care clinics in Qena city

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Abstract

Background: Iron deficiency anemia (IDA) during pregnancy is a universal public health problem. There is geographical variation in the prevalence and risk factors.
Objectives: This study aims to measure the prevalence and risk factors for IDA among pregnant women attending antenatal care in Qena city.
Patients and Methods: This is a hospital based cross sectional study in two hospitals in Qena city, Qena General hospital and Qena University hospital. Informed consent from women was taken. Review of 1000 pregnant women with IDA was done. Data were collected using pretested interviewer administered questionnaire. Blood hemoglobin concentration was done. Anemic women had serum iron & ferritin tested to confirm the presence of IDA.
Results: The prevalence of IDA was 37.4%. Multiple logistic regression analysis identified 5 risk factors of anemia during pregnancy, these are the age group 30- <35 years (AOR: 3.968; CI:1.135-13.878; P value: 0.03), the birth spacing ≤ 2 years (AOR: 3.089; CI: 2.293-4.161), the low socioeconomic status (AOR: 4.794; CI:2.940-7.819; P value: < 0.001), the second trimester (AOR: 3.120; CI:1.912-5.092; P value: < 0.001), and the absence of iron supplementation (AOR: 1.507; CI: 1.105-2.055; P value: 0.01).
Conclusion: The prevalence of IDA during pregnancy was 37.4%. There were five risk factors related to IDA during pregnancy: women age, birth spacing < 2 years, low socio-economic status, second trimester, and no iron supplementation during the pregnancy.

Keywords: Iron; Anemia; Prevalence; Risk

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Introduction

Anemia during pregnancy is a universal public health problem associated with an increased risk of maternal morbidity and mortality. Globally, 42% of pregnant women, suffer from anemia. (**Milman, 2011**) Anemia during pregnancy is defined as a hemoglobin (Hb) of less than 11 g/dl at any time during pregnancy. (**World Health Organization, 2008**) Alternatively, anemia is defined as a hemoglobin (Hb) of less than 11 g/dl in the first and third trimester and less than 10.5 g/dl in the second trimester. (**Pavord et al., 2020**)

Iron deficiency anemia (IDA) constitutes the majority (75-80%) of cases of anemia during pregnancy. (**DeLoughery, 2017**) Other acquired causes of anemia include acute blood loss, inflammation or malignancy, megaloblastic anemia, acquired hemolytic anemia and aplastic anemia. Hereditary causes of anemia include thalassemia, sickle cell anemia, other hemoglobinopathies and hereditary hemolytic anemia**.** (**Goonewardene et al., 2012**) The increased iron requirements during pregnancy predispose the pregnant women to anemia. (**Bothwell, 2000**) Anemic mothers have an increased risk of fetal growth restriction, prematurity, intrauterine death, amnion rupture and increase risk for blood transfusion in the postpartum period**. (Helmy et al., 2018; Lin et al., 2018)**

Anemia during pregnancy is classified into: (a) Mild if hemoglobin level is 10-10.9 g/dl; (b) Moderate if hemoglobin level is 7-9.9 g/dl; and (c) Severe if hemoglobin level is less than 7 g/dl. (**World Health Organization, 2008**) Severe anemia in pregnant women is associated with an elevated risk of maternal and perinatal mortality **(Laura, 2009)**

Anemia during pregnancy have geographic difference in prevalence that may be related to nutritional deficiencies, infections, and personal characteristics as the absorptive ability of the intestine for iron or the prevailing dietary habits of each locality. (**Chaparro et al.,** 2019) The prevalence of anemia during in Egypt is considered as moderate in comparison to other parts of the world.(**World Health Organization, 2008**) A cross sectional study of rural districts in Al-Menoufia Governorate found that the risk factors of IDA are maternal age more than 30, low socioeconomic status (SES), and low intake of foods of animal origin, birth spacing less than 2years, and lack of antenatal care. (**Rezk et al., 2015**) This study aims to measure the prevalence rate and risk factors for iron deficiency anemia among pregnant women attending antenatal care in Qena city.

Patients and Methods

Study Setting and Design

Hospital based cross sectional study in two hospitals in Qena city: Qena General hospital and Qena University hospital.

Study Population

Review of 1000 pregnant women was done. Cases were excluded if they were known anemic due to chronic disease as thalassemia, or those who had high /normal serum iron or high/normal serum ferritin. Other exclusion criteria: women who were seriously ill, mental disorder, and women who were unable to hear and/or speak during data collection period.

Sample Size and Sampling Procedures

Sample size was based on the single population proportion formula using the following equation(Z^2xPxq/d^2) with a confidence level of 95% and p value of 5% and population size is 1000 pregnant women. Multistage sampling technique was be used to select the study participants. A proportional allocation was employed to obtain the sample size from the selected health facilities and a systematic random sampling method was used to select the study participants from each antenatal clinic in the respective hospital.

Data Collection

Data were collected using pretested interviewer administered questionnaire, which contained socio-demographic

characteristics (age, education, occupation, marital status, and others), obstetric and gynecological history (trimester, gravidity, parity, and others), and iron intake. The socioeconomic status was calculated using a questionnaire of six variables (education, occupation, income, wealth, and job status).(**Omer et al., 2017**) Blood hemoglobin concentration was measured using a Mission Plus analyzer (manufactured by ACON Laboratories, Inc. San Diego, USA), a pre-caliberated instrument designed for the measurement of hemoglobin concentration. Venous blood was drawn, through micro curettes, and inserted into the Mission Plus Hg analyzer and the result was recorded. Women who were found to have anemia, serum iron & ferritin were tested to confirm the presence of iron deficiency anemia.

Statistical Analysis

The statistical analysis was performed using SPSS version 24. Categorical variables were summarized as numbers and percentages, whereas normally distributed continuous variables were presented as means and standard deviations. To identify factors associated with the outcome variable (anemia), the binary logistic regression analysis was performed for each independent variable and crude odds ratio (COR) with 95% confidence intervals will be obtained. Then, multivariable logistic regression model to determine independent predictors for the outcome variable among the pregnant women. The strength of statistical association was measured by adjusted odds ratios (AOR) and 95% confidence intervals. Pearson correlation was used to correlate between continuous and continuous variables. Spearman's correlation was used to correlate between continuous and categorical variables. To correlate two categorical variables, point biserial correlation was used. All tests were two-sided and p value < 0.05 was considered statistically significant.

Ethical considerations

All the regulations of the ethical committee of the faculty of medicine were followed. Each patient had private file with non-disclosure policy at data presentation where all presented data don't contain any personal information specifying the identity of any of the patients. All the patients had clear verbal and written description about the study. Only those consented to participate after descriptions (informed consent) were enrolled in the study.

Results

In the present study, a total number of 1000 of pregnant women were examined for estimation of prevalence rate of anemia. There were 374 anemic pregnant women, giving a prevalence of 37.4% .

(**Table 1**) showed that the low hemoglobin level ranged from 5 g/dl to 10.9 g/dl in anemic women. The mean age of the pregnant women was not significantly different. The peak age for anemic women and non-anemic women was at 20-< 25 years for both. There was statistically significant difference between the socioeconomic status and the presence of anemia.

(**Table 2**) showed that there was no significant difference between the presence of anemia and any of the following: age at marriage, gestational age, iron supplementation, or history of miscarriage. However, birth spacing and previous surgery both have significant association to the presence of anemia. After controlling for confounders by using the binary logistic regression analysis as shown in table 3, there were 5 factors predict the risk of anemia during pregnancy, these are the age of the woman, the birth spacing ≤ 2 years, low socioeconomic status, the second trimester, and no iron supplementation.

The overall association between anemia and age group was highly significant. The Odds ratio for the age group 30-<35 was 3.96 means that they have near to 4 times

the risk of anemia than those who aged < 20 years old. Women who gave birth within the last 24 months are 3 times more likely to have anemia than those who had birth of more than 24 months duration (**Table.3**).

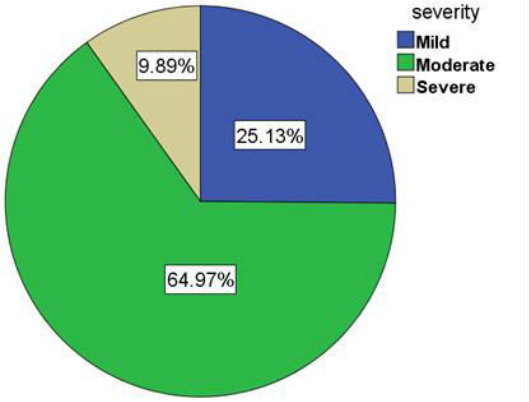

Fig.1. severity of anemia during pregnancy

Table 1: Socio-Demographic data of the studied pregnant women

Variables	Anemic women (n=374)	Non-anemic women (n=626)	P value
Age in years			
Mean ± SD	25.4 ± 5.1	24.8 ± 5.7	0.1
Age group: Number (%)			0.07
• < 20	42/374 (11.3)	74/626 (11.8%)	
• 20- < 25	133/374 (35.6%)	258/626 (41.2%)	
• 25 - < 30	90/374 (24%)	81/626 (13%)	
• 30 - < 35	102/374 (27.2%)	196/626 (31.3%)	
• ≥ 35	7/374 (1.9%)	17/626 (2.7%)	
Age at marriage in years			
Mean ± SD	18 ± 2.8	17.8 ± 2	0.1
Age group: Number (%)			0.1
• < 17	104/374 (27.8%)	164/626 (26.2%)	
• 17- < 20	176/374 (47%)	319/626 (51%)	
• 20 - < 25	80/374 (21.4%)	136/626 (21.7%)	
• 25- < 30	4/374 (1.1%)	4/626 (0.6%)	
• ≥ 30	10/374 (2.7%)	3/626 (0.5%)	
Education: Number (%)			0.1
• Illiterate	82/374 (21.9%)	116/626 (18.5%)	
• Educated	292/374 (78.1%)	510/626 (81.5%)	
Residence: Number (%)			0.9
• Rural	113/374 (30.2%)	187/625 (29.9)	
• Urban	261/374 (69.7%)	439/626 (70.1%)	
Socio-economic level: Number (%)			**< 0.001**
• Low	190/374 (50.8%)	179/626 (28.6%)	
• Middle	152/374 (40.6%)	327/626 (52.2%)	
• High	32/374 (8.6%)	120/626 (19.2%)	

Hemoglobin level: mean ± SD (Range)	8.7 ± 1.3 (5-10.9)	12.1 ± 0.7 (11-13)	**< 0.001**

Women with low socioeconomic status had more than 4 times risk of anemia when compared to women with high socioeconomic status (Odds ratio was 4.79). the second trimester increase the risk of anemia more than 3 times when compared to women in the first trimester. Women who did not have iron supplementation during the current pregnancy are 50% more likely to have anemia than those who had iron supplementation.

Analysis of the anemic pregnant women showed that 25.1%, 64.9%, and 10% of women had mild, moderate, and severe anemia respectively as seen in (**Fig.1**).

(**Table 4**) showed that the correlation between the degree of anemia and the patients characteristics was significant only for the age of the woman and for the iron supplementation.

Table 2: Obstetrical data of the studied pregnant women

Variables	Anemic women	Non-anemic women	P value
Gravida: Number (%)			0.7
• 1	171/374 (45.7%)	265/626 (42.3%)	
• 2	90/374 (24%)	194/626 (31%)	
• 3	78/374 (20.9%)	103/626 (16.5%)	
• 4	24/374 (6.4%)	42/626 (6.7%)	
• 5	8/374 (2.1%)	12/626 (1.9%)	
• 6	3/374 (0.9%)	10/626 (1.6%)	
Gestational age			
Mean ± SD	26.1 ± 10	25.3 ± 11	0.2
Age groups: Number (%)			0.2
• First trimester	33/374 (8.8%)	116/626 (18.5%)	
• Second trimester	178/374 (47.6%)	206/626 (32.9%)	
• Third trimester	163/374 (43.6%)	304/626 (48.6%)	
Iron supplementation during pregnancy: Number (%)			0.1
• No	153/374 (40.9%)	225/626 (35.9%)	
• Yes	221/374 (59.1%)	401/626 (64.1%)	
Miscarriage:			0.1
• Yes	322/374 (86.1%)	517/626 (82.6%)	
• No	52/374 (13.9%)	109/626 (17.4%)	
Birth spacing (last Delivery):			**< 0.001**
• < 2 years	271/374 (72.5%)	292/626 (46.6%)	
• ≥ 2 years	103/374 (27.5%)	334/626 (53.4%)	
History of previous surgery*:			**< 0.001**
• Yes	163/374 (43.9%)	153/626 (24.4%)	
• No	211/374 (56.1%)	473/626 (75.6%)	

*This included cesarean sections and other surgeries

Discussion

Iron deficiency anemia is a global problem associated with maternal and fetal morbidity and mortality. (**World Health 2008**)

In our study, the prevalence of IDA in 1000 pregnant women was 37.4% that only 374 out of 1000 pregnant women showed a low Hg level in a range from 5 to 10.9 and were at a risk of severe Iron deficiency anemia, and this ensure that anemia represented a major problem in pregnant women in Egypt and these results agreed with the results of the world health organization report of anemia affecting 34.2% of the Egyptian pregnant women in 2005 and 45.4% in Qena governorate in 2001. (**World Health Organization, 2008**) Studies from other Egyptian Governorates showed that the prevalence of anemia during pregnancy was 47% in Al-Gharbia Governorate **(Soliman et al., 2007**), 51.3% in Al-Menoufia Governorate. (**Rezk et al., 2015**). These figures are much higher than the prevalence in western countries which is around 25%. (**World Health Organization**, **2008**)

In our study, women in the age group of 30-35 years had near to 4 times the risk of having anemia in comparison to those at age <20 years. This was confirmed in other studies. (**Rezk et al., 2015**) This may reflect the lack of proper knowledge and experience about the proper food intake by younger women, lower reserve of iron in young women, or lack of iron supplementation during pregnancy.

Table 3. Binary logistic regression analysis for the potential risk factors for anemia

Variables	Crude Odds (95% C.I.)	P Value	Adjusted Odds (95% C.I.)	P Value
Age		**< 0.001**		**< 0.001**
• < 20	1		1	
• 20- < 25	1.101 (0.714-1.697)	0.6	1.203 (0.323-4.483)	0.7
• 25 - < 30	0.511 (0.315-0.828)	0.06	1.089 (0.309-3.838)	0.8
• **30 - < 35**	**1.958 (1.208-3.174)**	**0.7**	**3.968 (1.135-13.878)**	**0.03**
• ≥ 35	1.378 (0.529-3.593)	0.5	1.261 (0.374-4.250)	0.7
Age at marriage		0.08		
• < 17	1			
• 17- < 20	1.149 (0.846-1.562)	0.3		
• 20 - < 25	1.078 (0.745-1.560)	0.6		
• 25- < 30	0.634 (0.155-2.591)	0.5		
• ≥ 30	0.190 (0.051-0.707)	0.01		
Education				
• Educated	1			
• Illiterate	0.810 (0.590-1.112)	0.2		
Residence				
• Urban	1			
• Rural	1.016 (0.769-1.344)	0.9		
Previous miscarriage				
• No	1			
• Yes	1.306 (0.912-1.868)	0.1		
Birth spacing				
• ≥ 2 years	1		1	
• < 2 years	3 (2.284-3.966)	< 0.000	3.089 (2.293-4.161)	< 0.001
Socioeconomic level		**< 0.001**		**< 0.001**
• High	1		**1**	
• Mid	1.743 (1.128-2.693)	0.01	1.929 (1.196-3.109)	0.007

• Low	4 (2.563-6.181)	< 0.001	4.794 (2.940-7.819)	< 0.001
Gravida:		0.1		
• 1	1			
• 2	1.391 (1.015-1.907)	0.04		
• 3	0.852 (0.600-1.211)	0.3		
• 4	1.129 (0.660-1.932)	0.6		
• 5	0.968 (0.388-2.417)	0.9		
• 6	2.151 (0.584-7.928)	0.2		
Gestational age		**< 0.001**		**< 0.001**
• First trimester	1		1	
• Second trimester	3.037(1.965-4.695)		3.120 (1.912-5.092)	**< 0.001**
• Third trimester	1.885 (1.225-2.900)		1.788 (1.109-2.885)	0.01
Iron supplementation				
• Yes	1		1	
• No	1.234 (1.019-1.605)	0.050	1.507 (1.105-2.055)	0.01
Previous surgery				
• No	1		1	
• Yes	2.388 (1.816-3.141)	< 0.001	1.125 (0.832-1.521)	0.4

Table 4. Correlation between the severity of anemia and the patients' characteristics in the anemic group (n=374)

	Correlation Coefficient	***P* Value**
Age	0.069	0.1
Gestational age	0.04	0.4
Age at marriage	0.02	0.6
Education level	0.02	0.5
Residence	0.03	0.5
SES	0.04	0.4
Gravidity	0.02	0.6
Miascarriage	0.26	0.6
Iron supplementation	0.36	< 0.001
Birth spacing interval	0.04	0.4
History of surgery	0.05	0.3

There was no significant correlation between the age of pregnant women and severity of anemia. In addition, our study found that that the age at marriage was not significantly associated with the risk of anemia. Other studies found a similar result. (**Mokhtar et al., 2012**) Contrary to this, an Indian study showed a protective effect of the increased age at marriage. (**Perumal 2014**; **Hamed et al., 2017**)

In our study, there was no significant association between the prevalence · of anemia and the gestational age, the residence, education status, previous miscarriage, or gravidity. Other studies found a significant association between anemia and primary level of education, gestational age, and high parity. (**Abu Salem et al., 2016**;**Taner et al., 2015**)

In our study, the pregnant women with a birth spacing less than 2 years had significant reduction in the hemoglobin concentration when compared with the women that have a birth spacing more than or equal to 2 years. This can be explained that as the birth spacing of woman increases this will give a chance for the woman to regain the iron store in their bodies. So, the mothers gain the nutrients essential for fetal and maternal hematopoietic requirements and her body prepares for the hemostatic challenge of childbirth. (**Fisher et al., 2017**)

There was significant association between the prevalence of anemia and the lower state of the socioeconomic level. This may reflect the low quality of diet, less affordability to gain iron supplementation, and poor access to the health care services. Other studies also confirmed a similar association. (**Taner et al., 2015**; **Ndukwu et al., 2012**)

Our study showed that women in the second trimester have increased risk of anemia 3 times higher than those in the first trimester. This may be explained by the fact that the second trimester represents the peak time of iron requirements for the pregnant women. (**Bothwell, 2000**) Other studies found a similar association. (**Dei-Adomakoh et al., 2014**; **Taner et al., 2015**; **Vindhya et al., 2019**)

In the present study, pregnant women with previous cesarean section or other surgery had similar risk of anemia as women without previous surgeries. This finding is consistent with studies that found a comparable blood loss in vaginal delivery and cesarean section. (**Sobantka et al., 2010**; **Larsson et al., 2011**) Other studies found even a much higher risk of bleeding was associated with vaginal delivery than cesarean section. (**Wax 2006**; **Geller et al., 2010**; **Mascarello et al., 2017**)

Conclusion

IDA was present in 37.4% of pregnant women. Age of the mother, birth spacing of less than two years, low socioeconomic position, the second trimester, and the absence of iron supplementation during pregnancy were five risk factors associated with IDA during pregnancy.

Limitation of this study

Detailed analysis of dietary intake, body mass index (BMI), folic acid supplementation was not evaluated. The sub-group of women with severe anemia were not large enough to extract factors associated with severe anemia.

Conflict of Interests

The authors reported no conflict of interest.

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