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Prevalence of Iron Deficiency Anemia among Pregnant Females Attending Antenatal Care Unit at Zagazig University Hospitals

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ABSTRACT

Background: Low iron stores were discovered in newborns born to moms who were iron deficient, suggesting that the fetus's ability to store iron from mothers with low stores is limited. Therefore, determining the risk factors for maternal iron insufficie.ncy may be useful in creating preventative measures to enhance the health of the kids.

Objective: The aim of the study was to improve the pregnancy outcomes by determining the prevalence of IDA and its risk factors among the pregnant females attending antenatal care clinic in Zagazig University Hospitals.

Patients and methods: This cross-sectional study included 354 pregnant females attending the antenatal care clinic in Zagazig University Hospitals during the period from September 1st, 2019, to the end of April 2020.

Results: There was statistically significant difference regarding age and socio-economic level between studied groups. Normocytic normochromic anemia was more among women with higher age group as 67.8% of anemic women had age group more than 28 years versus 53.5% of iron deficiency anemic women had age group less than 28 years. Regarding socio-economic level, there was statistically significant difference between iron deficiency anemic patients and normal CBC pregnant females with most of IDA pregnant females (56%) were of low socio-economic level and no one (0.0%) had high class. While, 47.5% & 52.5% of NNA pregnant females were of low and moderate socio-economic level respectively. All high class women were with normal CBC. **Conclusion:** Low socioeconomic standard, multiparity and recurrent pregnancy are considered high risk factors and should be considered.

Keywords: Iron deficiency anemia, Anemia, Pregnant.

INTRODUCTION

The WHO defines iron deficiency anemia (IDA) as a decreased level of total hemoglobin brought on by insufficient iron. Therefore, WHO defines anemia during pregnancy as having a hemoglobin level below 11 g/dl and 10 g/dl after delivery [(1)]. In order to prevent risks during pregnancy and delivery, IDA, the most frequent nutritional illness in the world, must be detected early and managed promptly. It is also the most common medical condition during pregnancy [(2)]. Early IDA identification and treatment reduces the negative consequences that pregnancy has on the mother and child, particularly the requirement for blood transfusions and the rates of perinatal morbidity and death [(3, 4)]. The frequency of IDA is a useful tool for assessing the severity of the condition in expectant mothers who visit the clinic, as well as for assessing their general health and eating habits. The growing placenta and fetus during pregnancy cause a physiological increase in the mother's need for iron that is three times greater. Blood volume rises during the third trimester and reaches its peak in the second trimester [(5)]. IDA is a type of anemia caused by a sufficient depletion of stored iron. It should be distinguished from physiological anemia, which is a common condition during healthy pregnancy and is caused by an expanded plasma volume but a less significant increase in red cell mass [(6)]. In Egypt, 46% of pregnant women had IDA; the rate was greater in rural regions (63%) compared to urban areas (37%). The World Health Organization established four fundamental preventive measures: Dietary and nutrition modifications, iron-fortified food fortification, infection control, and iron supplementation [(7)]. According to Australian guidelines from 2017, a pregnant woman should consume an average of 27 mg of iron per day, with a total requirement of 1000–1200 mg [(5, 8)].

The aim of this study was to improve the pregnancy outcomes by determining the prevalence of IDA and associated risk factors in women undergoing prenatal treatment at Zagazig University Hospitals.

PATIENTS AND METHOD

This cross-sectional study included 354 pregnant females attending the Antenatal Care Clinic in Zagazig University Hospitals during the period from September 1st, 2019 to the end of April 2020.

Every individual involved underwent a comprehensive medical, surgical, and obstetric history taking. There was a general and local examination. For patients with microcytic hypochromic anemia and hemoglobin levels less than 10.5 gm/dl, investigations were conducted to measure the complete blood count (CBC), which included hemoglobin level, hematocrit percent %, RBCs count, mean hemoglobin concentration, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), and serum ferritin level [(9)]. For estimation of CBC; 2 mL venous blood were collected in EDTA tubes in the laboratory of the Outpatient Clinic in Zagazig University Hospitals.

After CBC results patients were divided according to Hb level, HCT %, MCV level, MCH level & MCHC level into patients with microcytic hypochromic anemia, patients with normocytic normochromic anemia and patients with normal CBC. Serum ferritin was done for patients with microcytic hypochromic anemia and Hb

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level less than 10.5 gm/dl. 2 mL venous blood were taken in tubes without EDTA and left to coagulate and serum was separated by centrifugation.

Ethical approval: The study protocol was approved by The Institutional Review Board (IRB) and The Ethics Committee of Medical Research, Faculty of Medicine, Zagazig University. Informed written consents were obtained from all participants. The Helsinki Declaration, World Medical Association was adhered through the research conduct.

Statistical analysis

Data were entered, checked, and processed using Epi-Info version 6 and SPP for Windows version 8 (Dean, 2006). The 5% level (p-value) was the fixed threshold of significance. Chi square, Kruskal Wallis test, one way ANOVA test and multivariate analysis were used.

RESULTS

Table (1) showed that age of the studied patients ranged from 17 to 41 years with a mean of 28.07 years. 48% of them aged < 28 years and 52% with age equal to or more than 28 years old and about 49% had low socioeconomic standard (SES), 46% had moderate SES and 4.6% had high SES. Gravidity ranged from 1 to 10 with median 3, parity ranged from 0 to 8 with median 1 and abortion ranged from 0 to 5 with median 0. About 57% of patients were pregnant for the third time or more, and 43 % were pregnant for 1st or 2nd time, while about 51% had parity less than twice. 35% of the studied patients had positive history of abortion.

Table (1): Distribution of the studied patients according to demographic and obstetric data

		N=354
Age (year):	• Mean ± SD	28.07 ± 5.982
	• Range	17 – 41
	• < 28 year	170 (48%)
	• ≥ 28 year	184 (52%)
Socioeconomic standard:	• Low	175 (49.4%)
	• Middle	163 (46%)
	• High	16 (4.6%)
	Obstetric data	
Gravidity:	• Mean ± SD • Median (Range)	3.13 ± 1.644 3 (1 – 10)
	• <3	152 (42.9%)
	• ≥3	202 (57.1%)
Parity:	• Mean ± SD • Median (Range)	1.71 ± 1.43 1 (0 – 8)
	• <2	181 (51.1%)
	• ≥2	173 (48.9%)
Abortion:	• Mean ± SD • Median (Range)	0.45 ± 0.697 0 (0 – 5)
•	• No	230 (65%)
•	• Yes	124 (35%)

Table (2) showed that hemoglobin level ranged from 7.8 to 14.7 g/dL with a mean of 10.911 g/dL while hematocrit level ranged from 24.8 to 42.1% with a mean of 33.02%. Red blood cells count ranged from 3.1 to 5.4 with a mean of 3.992 10^6/mm^3 and serum ferritin done for those with CBC findings showing microcytic hypochromic anemia ranged from 2 to 10 ng/mL with a mean of 5.66 ng/mL.

Table (2): Distribution of the studied patients according to laboratory findings

	N=354
Hemoglobin (g/dL):	
• Mean ± SD • Range	10.911 ± 1.276 7.8 – 14.7
Hematocrit (%):	
• Mean ± SD • Range	33.02 ± 3.126 24.8 – 42.1
RBCs count (10^6/mm^3):	
• Mean ± SD • Range	3.992 ± 0.454 3.1 – 5.4
Serum ferritin (ng/mL) in patients with microcytic hypochromic anemia	
• Mean ± SD • Range	5.66 ± 1.98 2 – 10

Table (3): showed that about 40% of the studied patients had normal CBC, 44% had iron deficiency anemia and 17% had normocytic normochromic anemia.

Table (3): Distribution of the studied patients according to presence and type of anemia

	N=354 (%)
Normal CBC	140 (39.5%)
Iron deficiency anemia	155 (43.8%)
Normocytic normochromic anemia	59 (16.7%)

Regarding age and socioeconomic status, table (4) showed that about 67.8% of older pregnant females developed NNA and the difference was significant between normocytic normochromic anemia and each of the other groups. On comparing SES between the groups, about 56% of patients with low SES had IDA, while patients with high SES did not get IDA and the difference was significant between iron deficiency anemia and normal CBC group.

Table (4): Relation between demographic data and presence and type of anemia among the studied patients

	Iron deficiency anemia	Normocytic normochromic anemia	Normal	Test		Pairwise comparison
				χ^2	p	
	N=155 (%)	N=59 (%)	N=140			
Age (Years)						
<28 years ≥28 years	83 (53.5) 72 (46.5)	19 (32.2) 40 (67.8)	68 (48.6) 72 (51.4)	7.828	0.019*	P_1 0.034* P_2 0.005* P_3 0.393
SES:						
Low Middle High	87 (56.1) 68 (43.9) 0 (0)	28 (47.5) 31 (52.5) 0 (0)	60 (42.9) 64 (45.7) 16 (11.4)	27.837	<0.001**	P1 0.257 P2 0.099 P3 0.004*

*p<0.05 is statistically significant **p≤0.001 is statistically highly significant χ^2 chi square test P_1 the difference between normal CBC and iron deficiency anemia P_2 the difference between normal CBC and normocytic normochromic anemia P_3 the difference between iron deficiency and normocytic normochromic anemia.

Table (5) showed that there were statistically significant difference between the studied groups regarding gravidity, parity and abortion. Concerning parity, parity more than twice was associated with higher range of IDA and the difference was significant between IDA and both of the other groups. Regarding gravidity, the difference was significant between IDA patients and NNA patients [the more the gravidity (more than 3), the higher incidence of IDA than NNA]. Concerning abortion, the difference was significant between NNA group and each of the other groups.

Table (5): Relation between obstetric data and presence and type of anemia among the studied patients

	Anemia			Test		Pairwise comparison
	Iron deficiency anemia	Normocytic normochromic anemia	Normal CBC	KW	p	
	N=155 (%)	N=59 (%)	N=140			
Gravidity:						
Median Range	3 1 – 10	3 1 – 6	3 1 – 10	6.782	0.034*	P_1 >0.999 P_2 0.192 P_3 0.047*
Parity:						
Median Range	2 0 – 8	2 0 – 4	1 0 – 4	13.655	0.001**	P_1 0.102 P_2 >0.999 P_3 0.001**
Abortion:						
Median Range	0 0 – 3	1 0 – 3	0 0 – 5	19.894	<0.001**	P_1 <0.001** P_2 0.005* P_3 >0.999

*p<0.05 is statistically significant **p≤0.001 is statistically highly significant KW Kruskal Wallis test P1 the difference between normal CBC and iron deficiency anemia P2 the difference between normal CBC and normocytic normochromic anemia P3 the difference between iron deficiency and normocytic normochromic anemia.

Table (6) showed that there was no statistically significant difference between the studied groups regarding gestational age.

Table (6): Relation between gestational age and presence and type of anemia among the studied patients

	Anemia			Test	
	Iron deficiency anemia	Normocytic normochromic anemia	Normal	F	p
	N=155 (%)	N=59 (%)	N=140		
Gestational age:					
Mean ± SD	32.14 ±7.927	32.25 ± 7.72	31.10 ± 2.06	2.23	0.11

*p<0.05 is statistically significant F One way ANOVA test

On binary regression analysis of factors significantly associated with IDA among pregnant females, table (7) showed that females with high and moderate SES had a decreased risk of developing IDA and females with parity less than twice had decreased risk of developing IDA among them. While, females with gravidity for 3 times and more had increased risk of IDA by 1.551 folds.

Table (7): Multivariate analysis for risk factors of IDA among the studied patients

	β	P	AOR	95% C.I.	
				Lower	Upper
Low SES		0.415			
Middle SES	-0.322	0.185	0.724	0.450	1.167
High SES	-21.468	0.998	0.000	0.00	
Parity (<2)	-0.689	0.147	0.502	0.198	1.275
Gravidity (≥3)	0.439	0.360	1.551	0.606	3.967

AOR adjusted odds ratio CI Confidence interval SES socioeconomic standard **p≤0.001 is statistically highly significant

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DISCUSSION

This cross-sectional study included 354 pregnant females attending Antenatal Care Unit with a mean age of 28.07 ± 5.98 ranging from 17 to 41 years and 52% of them were more than 28 years. 49.4% of the studied group were of low socio-economic class. Regarding obstetric history of the studied group in the present study, the gravidity of the studied group was 3.13 ± 1.6 ranging from 1 to 10 with 57.1% of them were pregnant for the third time or more. The average parity was 1.7 ± 1.43 ranging from 0-8 and 65% of them didn't have previous abortion. These demographic and obstetric data are in agreement with **Ajepe *et al.*** [10] whose study reported that the mean gestational age at delivery was 37.2 ± 8.8 weeks, whereas the participants' mean age was 31.5 ± 6.4 years. A considerable fraction (40.9%) of the women belonged to the upper socioeconomic class (Class 1 and 2), but the majority (70.0%) had only completed their secondary education. Sixty-seven percent of the women had parities more than one, and nearly four percent fell into the grand-multiparous (parity greater than five) group [10].

Concerning the laboratory investigations of the studied group, their Hb level was 10.9 ± 1.28 that ranged from 7.8 to 14.7 gm/dl and the hematocrit (HCT) was 33.02 ± 3.1 that ranged from 24.8 % to 42.1%. RBCs count was 3.99 ± 0.45 ranged from 3.1 to 5.4 10^6/mm^3 and serum ferritin level in patients with microcytic hypochromic anemia was 15.66 ± 3.67 ranged from 7 to 20 ug/L. Our most recent investigation revealed that the group under examination that had a high anemia prevalence was 43.8% with total number of 155 patients. 16.7% of the studied cases were found to be with normocytic normochromic anemia and 39.5% of the studied group were found to be with normal CBC. This is in similarity with **Salem *et al.*** [11] where IDA was more common in Egyptian pregnant mothers than 52.5%. **Salem *et al.*** [11] and **Dignass *et al.*** [12] said that the WHO reported National estimates of 41.8% [12].

According to the WHO definition, 17.7% of pregnant women in Croatia had either ID or IDA on a hemoglobin basis and 18.5% on a hematocrit basis. Clinical criteria revealed that even in the early stages of pregnancy, 32.8% of pregnant women exhibited either ID or IDA (transferrin saturation < 20.0%) [13]. In contrast, the prevalence of iron deficiency anemia (IDA) and anemia among patients was noted in **Ajepe *et al.*** [10] study were 20.0% and 12.3% respectively [10].

In regard to the difference on age basis, the current investigation revealed a statistically significant variation amongst patients with NNA and the other groups. 67.8% of normocytic normochromic anemia patients with age equal to or more than 28 years. Regarding the other two groups (IDA & normal CBC group), no statistically significant difference was seen. This is in line with **Salem *et al.*** [11] who reported that the age difference between Egyptian women with and without IDA was 29.46 ± 5.4 versus 29.09 ± 6.6 [11]. Also, **Ajepe *et al.*** [10] discovered that the mean age of women with IDA and those without any type of anemia did not differ statistically significantly (32.5±5.5 vs. 31.9±5.1 years, P = 0.540) [10].

Regarding socio-economic level between pregnant women with iron deficiency anemia and those who were not, there was a statistically significant difference with most of iron deficiency anemia patients (56.1%) were of low socio-economic level and 0.0% had high class. Also, 0.0% of normochromic normocytic anemia patients had high socio-economic level. While, 42.9% & 45.7% of patients with normal CBC were of low and moderate socio-economic level respectively and all high class women were with normal CBC. This is the same findings of **Salem *et al.*** [11] who reported that 68.1% of Egyptian women with IDA were of low socio-economic level versus 31.8% of Egyptian women without IDA. This could be because households at or below the poverty line may not be consuming enough iron-rich foods, poverty is a contributing factor to IDA [11].

Following a bivariate analysis, our study's findings regarding the relationship between socioeconomic class and IDA showed to be in line with those of multiple other studies [14].

Additionally, **Ajepe *et al.*** [10] revealed the same conclusion that the socioeconomic status of the subjects (P = 0.001) was significantly associated with the presence of IDA [10].

According to the current study, pregnant women without iron deficiency anemia and those with it differed statistically significantly regarding gravidity and parity with higher gravidity and parity among anemic (IDA & normocytic normochromic anemia) than among non-anemic pregnant females ((3.2 ± 1.6 versus 2.6 ± 1.3) and (1.7 ± 1.1 versus1.4 ± 1.03) respectively. But regarding history of abortion, there was statistically significant difference between normocytic normochromic group and the other both groups. This is in agreement with **Salem *et al.*** [11] who showed that parity of at least 3 seemed to be an important risk factor for anemia among Egyptian (69.1%) and Yemeni pregnant women (79%). This can be explained by the fact that iron stores get depleted and exhausted owing to frequent pregnancies and deliveries with no significant difference on history of abortion **[11].**

Also, between all the pregnant female study groups, there was no statistically significant difference relating gestational age at examination, which was 32.14 ± 9.9 and 32.25 ± 8.7 and 31.1 ± 12.06 weeks for iron deficiency anemia, normocytic normochromic anemia and normal CBC patients respectively. This is consistent with the finding of **Goodchild** [15]**.**

The current study found that the females' socio-economic class, parity and gravidity were the statistically significant risk factors affecting anemia occurrence among the pregnant females using the binary logistic regression with Odds ratio (95% CI) [(0.724(0.450-1.167), (0.502 (0.198-1.275) and (1.55 (0.606-3.967)**].** This is consistent with **Loy *et al.*** [16] who reported that using ordinal logistic regression, both univariate and multivariate analysis of maternal age was included in the multivariable model, which fit well > 25 years (OR 2.36; 95% CI 1.15, 4.84), Malay (OR 2.05; 95% CI 1.30, 3.24) and Indian (OR 1.98; 95% CI 1.14, 3.44) ethnicities, university qualification (OR 1.64; 95% CI 1.13, 2.38), multiparity (OR 1.73; 95% CI 1.23, 2.44) and lack of iron-containing supplementation during pregnancy (OR 3.37; 95% CI 1.25, 8.53) were linked to a notably higher risk of both mild and severe iron deficiency. The findings held true in the sensitivity analysis using women with complete data (n = 871).

CONCLUSION

These findings imply that as a preventive measure, widespread screening and supplementation of pregnancies at risk might be considered e.g. prenatal iron deficiency screening in order to start iron therapy on time. For the best possible health for mother and child, this population should consider coordinated efforts that include routine dietary advice (e.g., eating plenty of foods rich in iron and with a higher iron bioavailability, along with items containing vitamin C) and individual iron supplementation prophylaxis before and during pregnancy.

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