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Research Article

Prevalence and risk factors of iron deficiency anaemia with pregnancy at Minia University Hospital

Emad Mostafa [1], Hashem F. Mohammed[1], Enas M. Mohammed[1] and Asmaa S. Mohamed Ali[1]

[1] Department of Obstetrics and Gynecology, Faculty of Medicine, Minia University, Egypt

Abstract

Background; Anaemia in expectant women is a serious world-wide public health problem with adverse pregnancy outcomes. The study aim is to investigate prevelance, sosciodemographic characteristics, medical and obstetrical risk factors of iron deficiency anaemia during pregnancy at Minia maternity university hospital in one year, **Subjects and methods;** This study is A prospective analytical study, was conducted at the Minia university hospital for gynecology and obstetrics on all pregnant women with hemoglobin level less than 11 gm/dl in the first trimester and less than 10.5 gm/dl in the second and third trimester from November 2019 to October 2021, **Result;** this study was conducted on 5500 women; 2211 of them had iron deficiency anemia (40.2%), The only factors which emerged as statistically significant were rural residence, low education, Low Family income, Multi-para, low Pregnancy interval, insufficient meals per day, insufficient Meat intake, insufficient vegetables intake, insufficient egg intake, insufficient milk intake, and Parasitic infestation. **Conclusion;** Based on our findings, there was highly significant difference between the cases with iron deficiency anemia and cases without iron deficiency anemia regarding residence, education, family income, BMI, parity, gestational age, Pregnancy interval, and delivery mode. Iron deficiency anemia was significantly higher with cases took ‹ 3 times per day, meat intake less than 2 times per week, vegetables intake less than 2 times per week, egg intake and milk intake less than 2 times per week and cases that did not take iron supplementation,

Keywords; Anemia, Iron-Deficiency; Pregnancy; Pregnancy Complications, Prevalence; Risk Factors.

Introduction

Anaemia is defined as a condition in which Haemoglobin (Hb) level in the body is lower than normal, which results in a decreased oxygen-carrying capacity of red blood cells to tissues[(1)]. It affects all age groups, but pregnant women and children are more vulnerable. Stevens et al.,[(2)] reported that the global prevalence of anaemia in non-pregnant women, pregnant women and children is 29, 38 and 43%, respectively.

According to the WHO guidelines, anaemia in pregnancy is defined as a haemoglobin level < 11 g/dL in the first trimester and less than 10.5 g/dl in the second and third trimesters [(3)].The prevalence of anaemia is an important health indicator.

A study in 2013 showed that anaemia is more prevalent in developing countries (43%) than developed countries (9%)[(4)]. Previous studies have reported that the prevalence of anaemia in pregnancy varies in women with different socio- economic conditions, lifestyles, or health-seeking behaviors across different cultures [(5)].

Anaemia is one of the most prevalent complications during pregnancy. It is commonly considered a risk factor for poor pregnancy outcomes and can result in complications that threaten the life of both mother and foetus, such as preterm birth[6], low birth weight [7].

Physiologically, plasma volume expands by 25–80% of pre-pregnancy volumes between the second trimester and the middle of the third trimester of pregnancy [8]. This induces a modest decrease in Hb levels during Pregnancy which is called physiological heamodilution. Previous studies show that the best time to investigate any risk factors associated with anaemia maybe up 20 weeks of gestation [9]. Thus, in this study, we took the haemoglobin level estimated before the 14th week of gestation to determine risk factors that lead to anaemia in pregnant women. Considering the physiological changes in plasma volume, we used the third trimester's Hb level to assess the pregnancy outcomes of anaemia.

Patients and methods

This study was a prospective analytical study conducted at the Minia university hospital for gynecology and obstetrics from November 2019 to October 2021. This study was conducted on all pregnant women with hemoglobin level less than 11 gm/dl in the first trimester and less than 10.5 gm/dl in the second and third trimesters

Inclusion Criteria for study group: 5500 pregnant women presented to ANC clinic at Minia University Hospital during the study period who have their hemoglobin level less than 11 gm/dl in the first trimester and hb less than 10.5 gm /dl in the second and third trimester and women aged 20-35 years old.

Exclusion Criteria for groups: Patients that are diagnosed or discovered to have another type of anemia rather than iron deficiency anemia, medical illness except anemia and fetal malformation or fatal death.

Methods

The eligible subjects included in this study were subjected to the following: Informed consent was obtained from the patient Women were interviewed with questionnaire including the information such as: Basic social and demographic data including: The age, gravidity, parity, residence, occupation, and Body Mass Index (BMI) as calculated by weight (kg) divided by height (m2), gestational age, body mass index (BMI) and the Inter-Pregnancy Interval (IPI).

Past history: Prior history of miscarriage, preterm birth, caesarean delivery, premature ruptures of membranes (PROM). Family income of the participants was categorized into three levels according to the net mean monthly household income during the past three years (low: ≤1000 LE; medium: 1001-2000 LE; and high: >2000 LE).

Current medical examination: History of treating some obstetric and medical disorders during the current pregnancy might be implicated as risk factors for anemia, mainly vaginal bleeding in early or late pregnancy.

Fertility characteristics: Family-planning method use, birth spacing (years) and antenatal care visits. Diet behavior: Animal origin and vegetables and fruits. Maternal haemoglobin and haematocrit concentrations were measured in fresh EDTA plasma samples in venous blood samples (STAR-MDC, Rotterdam, and the Netherlands). We defined anaemia and elevated haemoglobin levels according to the World Health Organization criteria for anaemia during pregnancy (haemoglobin concentration ≤11 g/dl or haematocrit ≤33%), which in our study population reflects the lowest 14%. Similarly, elevated haemoglobin level was defined as the upper 14% of the study population (haemoglobin ≥13.2 g/dl or haematocrit ≥39%) since there is no official cut off value to define elevated haemoglobin levels during pregnancy. We also constructed gestational age adjusted standard deviation scores (SDS) for haemoglobin and haematocrit levels and used these as continuous variables and as categorical variables (10 groups) to explore the associations of normal variation of haemoglobin and haematocrit levels with pregnancy outcomes [7].

Outcome: Factors that increase the risk of aneamia during pregnancy
Maternal age more than 35 years old and less than 20 years old, low socioeconomic status, high parity, short inter pregnancy intervals, no iron and folate supplement, history of parasetic infection detected by stool analysis and BMI less than 18.5 kg/m2.

Ethical Consideration: Study protocol had been submitted for approval by Institutional Review Board, Minia University (**ID**….). Informed verbal consent had been obtained from each participant sharing in the study. Confidentiality and personal privacy had been respected in all levels of the study.

Data management and Statistical Analysis: Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) **(**Statistical Package for the Social Sciences) software for analysis.

Results

About forty-percent patients had iron deficiency anemia while 59.80% patients not IDA, as control group who had anemia due to causes of anaemia during pregnancy in as micronutrient deficiencies of folate, and vitamins A and B12 and anaemia due to parasitic infections such as malaria and hookworm or chronic infections like TB and HIV as shown in figure (1).
There were no significant differences between the cases with iron deficiency anemia and cases without iron deficiency anemia regarding age and occupation (p>0.05). There was highly significant difference between the cases with iron deficiency anemia and cases without iron deficiency anemia regarding BMI as obese cases was significantly higher in iron deficiency anemia group. **Table (1)**

There was highly significant difference between the cases with iron deficiency anemia and cases without iron deficiency anemia regarding parity (p<0.001). There was highly significant difference between the cases with iron deficiency anemia and cases without iron deficiency anemia regarding gestational age (p=0.001). **Table (2)**

There was highly significant difference between the cases with iron deficiency anemia and cases without iron deficiency anemia regarding number of meals per day (p<0.001), meat intake (p<0.001), vegetables intake (p<0.001), egg intake (p<0.001), milk intake (p<0.001) and Iron supplementation (p<0.001). Iron deficiency anemia was significantly higher with cases took ‹ 3 times per day, meat intake less than 2 times per week, vegetables intake less than 2 times per week, egg intake and milk intake less than 2 times per week and cases that did not take iron supplementation. **Table (3)**

Hemoglobin level, Hematocrite level, MCV, MCH, MCHC, Ferritin and iron levels was highly significantly lower in cases with iron deficiency anemia compared to cases without iron deficiency anemia (p<0.001). **Table (4)**
Parasitic infestation was highly significantly higher in cases with iron deficiency anemia compared to cases without iron deficiency anemia (p<0.001).

The only factors which emerged as statistically significant from the adjusted logistic regression analysis model (Table 7) were rural residence (OR=2.9;95% CI: 2.3-3.6), low education (OR = 3.8;95% CI: 2.4-5.9), Low Family income (OR =15.9; 95%CI: 10.9-25.4), Multi para (OR 1.2=; 95% CI: 0.96-1.5), low Pregnancy interval (OR =16.2; 95%CI: 12.2-21.5), insufficient meals per day (OR=3.7; 95%CI: 2.5-5.3), insufficient Meat intake (OR = 28.3; 95% CI: 22.1-36.2), insufficient vegetables intake (OR = 4.9; 95% CI: 3.9-6.1), insufficient egg intake (OR = 8.3; 95% CI: 6.5-10.9), insufficient milk intake (OR = 4.5; 95% CI: 3.6-5.7), and Parasitic infestation (OR = 5.2; 95% CI: 4.1-6.7). **Table (5)**

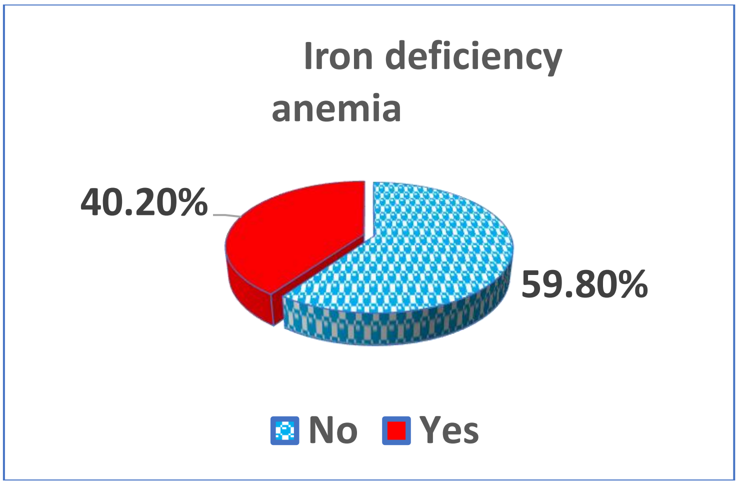

Figure (1): Iron deficiency anemia among the studied patients

Table (1): distribution of the studied patients regarding socio demographic data and Presence of Iron deficiency anemia

Data	**Iron deficiency anemia**		**P**
	No No=3289	**Yes No=2211**	
Age Range mean±SD	 20-35 27.8±4.7	 20-35 27.7±4.5	0.5
Residence Rural Urban	 1339(40.7%) 1950(59.3%)	 1542(69.7%) 669(30.3%)	0.0001*
Education Illiterate, primary education Secondary education High education	 2052(62.4%) 788(24%) 449(13.7%)	 1265(57.2%) 847(38.3%) 99(4.5%)	0.0001*
Occupation Not worker Worker	 2949(89.7%) 340(10.3%)	 2011(91%) 200(9%)	0.1
Family income High Satisfactory Low	 605(18.4%) 2684(81.6%) 0	 54(2.4%) 1872(84.7%) 285(12.9%)	0.0001*
BMI Normal Overweight Obese	 1982(60.3%) 904(27.5%) 403(12.3%)	 1488(67.3%) 577(26.1%) 146(6.6%)	0.0001*

P- value: level of significance

- **P > 0.05: Non-significant (NS).**
- **P < 0.05: Significant (S).**
- **P < 0.01: Highly significant (HS).**

BMI: body mass index

Table (2): distribution of the studied patients regarding obstetric data and Presence of Iron deficiency anemia:

Data	Iron deficiency anemia		P
	No No=3289	Yes No=2211	
Parity			0.0001*
Para 1	1035(31.5%)	595(22.4%)	
2-3	1181(35.9%)	984(44.5%)	
4-5	378(11.5%)	436(19.7%)	
Primigravidea	695(21.1%)	296(13.4%)	
Gestational age			0.001*
Range	4-37	4-37	
mean±SD	19.4±9.7	20.3±10.005	
Pregnancy interval			
Less than 2 years	281(8.5%)	1241(56.1%)	0.0001*
≥2 years	2313(70.3%)	674(30.5%)	
Delivery mode			
SVD	814(24.7%)	936(42.3%)	0.0001*
CS	1780(54.1%)	970(43.9%)	

P- value: level of significance

- **P > 0.05: Non-significant (NS).**
- **P < 0.05: Significant (S).**
- **P < 0.01: Highly significant (HS).**

SVD: spontaneous vaginal delivery**.**
CS: cesarean section.

Table (3): distribution of the studied patients regarding dietary pattern and Presence of Iron deficiency anemia:

Data	Iron deficiency anemia		P
	No No=3289	Yes No=2211	
Number of meals per day			0.0001*
‹ 3 times per day	154(4.7%)	323(14.6%)	
› 3 times per day	3135(95.3%)	1888(85.4%)	
Meat intake			0.0001*
‹ 2 times per week	828(25.2%)	1919(86.8%)	
› 2 times per week	2461(74.8%)	292(13.2%)	
Vegetables			0.0001*
‹ 2 times per week	856(26%)	1357(61.4%)	
› 2 times per week	2433(74%)	854(38.6%)	
Egg intake			0.0001*
‹ 2 times per week	1343(40.8%)	1894(85.9%)	
› 2 times per week	1946(59.2%)	317(14.3%)	
Milk			0.0001*
‹ 2 times per week	1685(51.2%)	521(23.6%)	
› 2 times per week	1604(48.8%)	1690(76.4%)	
Iron supplementation			0.0001*
No	2577(78.4%)	2211(100%)	
yes	712(21.6%)	0	

Table (4): CBC of the studied patients:

Data	Iron deficiency anemia		P
	No No=3289	Yes No=2211	
HB Range mean±SD	 11-13.4 12.9±0.7	 7.7-11 9.8±0.6	0.0001*
HCT Range mean±SD	 33.9-40.7 37.3±1.9	 28.8- 31.1±1.5	0.0001*
MCV Range mean±SD	 74.8-90.8 83.2±4.4	 68-79.4 73.6±3.3	0.0001*
MCH Range mean±SD	 24.7-29.9 27.2±1.4	 21.2-26.1 23.6±1.3	0.0001*
MCHC Range mean±SD	 30-34.2 32.06±1.2	 29.7-33.3 31.5±1.07	0.0001*
Ferritin Range mean±SD	 10.4-118.4 48.6±25.07	 8.7-19.6 14.4±3.2	0.0001*
Iron Range mean±SD	 46.4-131.6 87.8±24.6	 36-51.4 43.6±4.3	0.0001*

P- value: level of significance

- **P > 0.05: Non-significant (NS).** *** P < 0.05: Significant (S).**
- **P < 0.01: Highly significant (HS).**

HB: hemoglobin. **HCT:** Hematocrit
MCV: Mean corpuscular volume **MCH:** Mean corpuscular hemoglobin
MCHC: Mean corpuscular hemoglobin concentration **SVD:** spontaneous vaginal delivery.
CS: cesarean section.

Table (5): Multiple Regression analysis of risk factors for Iron deficiency anemia

	Odds ratio	95% CI	P
Rural Residence	2.9	2.3-3.6	0.0001*
Illiterate, primary education	3.8	2.4-5.9	0.0001*
Low Family income	15.9	10.9-25.4	0.0001*
Overweight and obese BMI	0.90	0.73-1.1	0.3
Multi para	1.2	0.96-1.5	0.09
Less than 2 years Pregnancy interval	16.2	12.2-21.5	0.0001*
Number of meals per day ‹ 3 times per day	3.7	2.5-5.3	0.0001*
Meat intake ‹ 2 times per week	28.3	22.1-36.2	0.0001*
Vegetables ‹ 2 times per week	4.9	3.9-6.1	0.0001*
Egg intake ‹ 2 times per week	8.3	6.5-10.9	0.0001*
Milk › 2 times per week	4.5	3.6-5.7	0.0001*
Parasitic infestation	5.2	4.1-6.7	0.0001*

Discussion

This is a prospective analytical study included 5500 subject's women who are pregnant with hemoglobin level less than 11 gm/dl in the first trimester and less than 10.5 gm/dl in the second and third trimester, that was carried out at Minia Maternity University hospital from November 2019 to October 2021.

In our study regarding socio demographic data and Presence of Iron deficiency anemia, there was no significant difference between the cases with iron deficiency anemia and control group regarding age and occupation (p>0.05), the mean age were 27.7±4.5 years ranged from 20 to 35 years in cases with iron deficiency anemia and 27.8±4.7 years ranged from 20 to 35 years in control group. On the other hand there was highly significant difference between the cases with iron deficiency anemia and control group regarding each of residence as 1542 (69.7%) cases were from rural area in iron deficiency group while 1950 (59.3%) cases were from urban area in the control group, education as high education was significantly higher in the control group, family income as high income was significantly higher in control group and BMI as obese cases was significantly higher in iron deficiency anemia group which can be explained by that overweight, particularly obesity, is associated with underlying systemic inflammation, and the resulting elevation of hepcidin and serum ferritin may decrease iron absorption from dietary and hemoglobin production. Thus, the overweight and obesity status may be associated with increased risk of IDA. (p-value=0.0001).

In agreement with our study [10] demonstrates the frequency distribution of sociodemographic characteristics of the study participants. Among the 280 pregnant women, the mean age of the respondents was 23.02 ± 3.40 years and majority (72.9%) of them belonged to age group of more than 20 years. Majority (72.2%) of the study respondents were Muslims and 40.4% had completed their secondary education. Nearly 91.8% were housewife and 57.5% belonged to upper-lower class. The mean gestational was 18.050 ± 3.541 weeks.

In a recent study [11] A total of 304 pregnant women were included in the study. The mean age of the study participants was 25.3 ± 5.1 (ranged from 18 to 41 years). Out of 304 participants, 217 (71.4%) were living in urban areas and the rest 87 (28.6%) were rural dwellers. More than Half, 235 (77.3%), of the study participants were housewife followed by self-employee, 39 (12.8%) and governmental employee, 30 (9.9%).

Our results show distribution of the studied patients regarding obstetric data and Presence of Iron deficiency anemia as following, there was highly significant difference between the cases with iron deficiency anemia and control group regarding parity (p<0.001), gestational age mean 20.3±10.005 in iron deficiency anemia group and 19.4±9.7 in control group (p=0.001), Pregnancy interval (p=0.0001) and delivery mode (p=0.0001).

In a previous study by Gebre and Mulugeta,[5] as obstetric characteristics of the Pregnant Women, The mean current gestational age (±SD) of the study participants was 26.7 ± 8.05 weeks. Above two-thirds of the participants were multi-gravida, more than half (52.2%) of the study participants were in their third trimester. Two-thirds of the participants did not have iron supplementation during pregnancy.

Along with our results Adam and Ali, [12] It is belived that women with high parity have low or no iron staorge as it hass been depleted by the repeated pregnaied hence parous women are more likely to be anemic.

In study conducted by Kassa et al., [13] recent meta-analyses showed that primigravidae were at lower risk for anemia compared with parous women.

Regarding dietary pattern and Presence of Iron deficiency anemia, there was highly significant difference between the cases with iron deficiency anemia and cases without iron deficiency anemia regarding number of meals per day (p<0.001), meat intake (p<0.001), vegetables intake (p<0.001), egg intake (p<0.001), milk intake (p<0.001) and Iron supplementation (p<0.001). Iron deficiency anemia was significantly higher with cases took ‹ 3 times per day, meat intake less than 2 times per week, vegetables intake less than 2 times per week, egg intake and milk intake less than 2 times per week and cases that did not take iron supplementation.

In agreement Asrie,[14] showed that according to Dietary habits of study participants, the dietary habits and nutritional analysis showed that 174(84.5%) of the study participants ate additional food during pregnancy, Eating animal products (Daily 11(5.4%), Every other day 63 (30.6%), Weekly 72(35.0%), Every 2 weeks 34(16.4%) and Once a month 26 (12.6%)); Eating green vegetables (Daily 12(5.8%), Every other day 60(29.1%), Weekly 99(48.1%), Every 2 weeks 20(9.7%), Once a month 15(7.3%)).

According to CBC of the studied cases, there was highly significant difference between the cases with iron deficiency anemia and control group. Hemoglobin level, Hematocrite level, MCV, MCH, MCHC, Ferritin and iron levels was significantly lower in cases with iron deficiency anemia compared to control group (folate, and vitamins A and B12 were causes of anemia in this control group) (p<0.001), means in cases with iron deficiency anemia were 9.8±0.6, 31.1±1.5, 73.6±3.3, 23.6±1.3, 31.5±1.07, 14.4±3.2 and 43.6±4.3 respectively.

In a recent study by Berhe et al.,[11] among 304 study participants, 24 (7.9%) were anemic (Hgb: < 11g/dl). The general distribution of anemia was 15(62.5%) microcytic hypochromic, 6(25.0%) normocytic hypochromic and 3(12.5%) macrocytic hypochromic based on the morphology of red blood cells.
Similar results by Vindhya et al.,[10] as Trends in hemoglobin level concentration; the mean hemoglobin level of all the participants was 11.33 ± 1.460 g/dl. The mean hemoglobin level concentration showed a steady increase during 15–20 gestational weeks and slightly decreased during 21–24 weeks.

Regarding parasitic infestation and Presence of Iron deficiency anemia, parasitic infestation in the form of helminths ova (Ascaris, Trichuris and hookworm) was significantly higher in cases with iron deficiency anemia 993 (44.9%) compared to 395(12%) in control group (p<0.001).
In agreement with our study Asrie, [14] noted that there was a past medical history of intestinal parasitosis in 20 (36.36%) of the study participants, 16 (7.9%) of all patients had intestinal parasitic infections (10 (4.9%) Hookworm, 3(1.5%) Ascaris lumbricoid, 3(1.5%) Enterobius vermicularis and 5(2.4%) were positive for HIV.

The only factors which emerged as statistically significant from the adjusted logistic regression analysis model were rural residence (OR=2.9;95% CI: 2.3-3.6), low education (OR = 3.8;95% CI: 2.4-5.9), Low Family income (OR =15.9; 95%CI: 10.9-25.4), Multi para (OR 1.2=; 95% CI: 0.96-1.5), low Pregnancy interval (OR =16.2; 95%CI: 12.2-21.5), insufficient meals per day (OR=3.7; 95%CI: 2.5-5.3), insufficient Meat intake (OR = 28.3; 95% CI: 22.1-36.2), insufficient vegetables intake (OR = 4.9; 95% CI: 3.9-6.1), insufficient egg intake (OR = 8.3; 95% CI: 6.5-10.9), insufficient milk intake (OR = 4.5; 95% CI: 3.6-5.7), and Parasitic infestation (OR = 5.2; 95% CI: 4.1-6.7).

In agreement Gebre and Mulugeta, [5] in the multivariable logistic regression analysis level after controlling the effect of confounders revealed that variables that were independent predictors for maternal anemia among the pregnant women were maternal residence (AOR = 1.75, 95% CI = 1.01–3.04), educational status (AOR = 1.56, 95% CI = 1.03–2.37), iron supplementation during pregnancy (AOR = 3.76, 95% CI = 1.92–8.37), and meal frequency per day (AOR = 2.18, 95% CI =1.06–4.91).

Asrie,[14] showed that, no significant association between anemia and maternal age, housewives, monthly income, level of education; iron supplement but significant association was reported in previous studies); previous reports and the present study may be due to differences in monthly income and educational level.

Conclusion

The prevalence of maternal anemia during pregnancy was 40.2%. However, more than one-third of the women exhibited iron deficiency. rural residence, low education, Low Family income, low Pregnancy interval, insufficient meals per day, insufficient Meat intake, insufficient vegetables intake, insufficient egg intake, insufficient milk intake, and Parasitic infestation were the most important risk factor of anemia. Enhancement of dietary practices, iron supplementation, promotion of family planning and treatment of intestinal parasites are specially increased efforts should be made to increase the coverage of anthelmintic treatment among pregnant women in this community.

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