RESEARCH PAPER

Prevalence of Anemia in Pregnancy in Second and Third Trimester at Beni-Suef Governorate

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ABSTRACT
Background: Anemia during gestation is a major public health problem with 40.1% of pregnancies worldwide suffering from the condition. Anemia can have serious adverse health consequences for the mother and child. Objectives: To evaluate the occurrence of anemia in the 2nd and the 3rd trimesters of gestation in Beni-Suef governorate. Methods: This cross-sectional observational research has been carried out on a total of 500 pregnancies who presented during the 2nd, or 3rd trimester of their pregnant women at hematology clinics or outpatient clinic in Beni-suef University hospital. Results: There were high occurrence of anemia (87.6%) among pregnancies in their second and third trimesters, with iron deficiency anemia (IDA) being the most common type (65.2%). The mean age of the study participants was 28.91±6.96 years. 49.0% of the study participants were in 2nd trimester while 51.0% were in the 3rd trimester. The mean HB, MCV, MCH, Iron level, ferritin, TIBC and T SAT showed high statistically significant variance among both groups (p value below 0.001). There were statistically insignificant variances among anemic pregnant females and non-anemic regarding Age, HR, TLC, PLT, liver and renal function, BMI or gestational trimester (p value above 0.05). Conclusion: High prevalence of anemia among pregnancies in their 2nd and 3rd trimesters. Iron deficiency is responsible for the majority of cases of anemia that occur through gestation.

Keywords: Prevalence, Anemia, Trimester, Pregnancy
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INTRODUCTION

Anemia during gestation constitutes a worldwide health issue. Although a certain level of dilutional anemia is a typical aspect of pregnant physiology, anemia can pose significant health risks for both the mother and the child. Therefore, it is essential to differentiate IDA from physiological anemia and to recognize other less prevalent causes of anemia that may necessitate therapy [1].

Definitions of anemia fluctuate during gestation than non-pregnant females, and the lower limit of normal hemoglobin concentration may vary across various populations [2].

Approximately 30 percent of females of reproductive age are anemic. Amidst The prevalence among pregnant females is significantly greater; the WHO estimates that over forty percent of pregnancies are complicated by anemia [3].

A 2022 study from the United States Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) indicated that the occurrence of pregnancy-associated anemia among Black females was twice that of non-Hispanic White females. The prevalence among Black pregnant individuals exceeded fifteen percent in the 1st trimester, approximately twenty percent in the 2nd trimester, and nearly fifty percent in the 3rd trimester [4].

Information from the United States between 1999 and 2006 indicated that iron deficiency, defined as serum ferritin levels below 12 ng/mL (or 12 mcg/L), was observed in twenty-five percent of pregnant individuals. The incidence of iron insufficiency rose from seven percent in the 1st trimester to twenty-four percent and thirty- nine percent in the 2nd and 3rd trimesters, respectively [5].

This research aimed to assess the occurrence of anemia in gestation throughout the 2nd and 3rd trimesters among cases in Beni-Suef Governorate.

PATIENTS AND METHODS

This was a cross-sectional observational research done on 500 pregnancies in their second or third trimester at the Hematology Clinic and Outpatient Antenatal Clinics of

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Beni-Suef University Hospital, Egypt over a one-year period, from 2024 to 2025.

Sampling Technique

A convenient non-probability sampling technique was used. Eligible participants were enrolled during their visits to outpatient clinics or during hospital admission. Each participant was informed about the study's purpose and procedures, and verbal and written informed consent has been obtained before inclusion**.**

Inclusion criteria: Pregnancies in the second or third trimester, age ≥18 years, attendance at Beni-Suef University Hospital outpatient or hematology clinics and provision of informed consent

Exclusion criteria: First-trimester pregnancy, known pre-existing hematological disorders (e.g., aplastic anemia, hemoglobinopathies diagnosed before pregnancy), chronic systemic diseases affecting hematological parameters (e.g., chronic liver disease, malignancy, chronic kidney disease), acute infection or inflammatory conditions at the time of sampling and history of blood transfusion during the preceding three months.

METHODS

All patients were subjected to the following:

Clinical Assessment

All participants had a comprehensive clinical evaluation that included detailed medical and obstetric history taking, assessment of gestational age and determination of pregnancy trimester, and documentation of comorbid conditions and medication use. A thorough general physical examination has been performed with particular attention to clinical signs suggestive of anemia and the presence of splenomegaly. Body mass index (BMI) has been calculated for each participant utilizing measured height and weight.

Sample Collection and Laboratory Methods

Venous blood samples were obtained from all participants under aseptic conditions. Laboratory investigations included a complete blood count (CBC) with total leukocyte count, hemoglobin concentration, red blood cell indices (MCV and MCH), and platelet count, conducted utilizing an automated hematology analyzer with routine internal quality control. Iron status has been evaluated by measuring total iron-binding capacity (TIBC), serum iron, transferrin saturation (determined as serum iron/TIBC × 100), and serum ferritin levels. Biochemical evaluation included liver and renal function tests. All laboratory analyses were conducted in the central laboratory of Beni-Suef University Hospital according to standardized protocols.

Definitions

Anemia has been defined regarding **World Health Organization (WHO)** criteria for pregnancy, utilizing trimester-specific hemoglobin thresholds. IDA has been identified based on low hemoglobin levels in association with reduced serum ferritin and/or abnormal iron profile parameters.

Outcome Measures

The 1ry outcome was the prevalence of anemia among pregnancies in the 2nd and 3rd trimesters. Secondary outcomes included: Distribution of anemia types and comparison of clinical and laboratory parameters among anemic and non-anemic participants

Ethical Considerations

The research protocol has been approved by the Ethical Committee of the Faculty of Medicine, Beni-Suef University. Written informed consent has been attained from all participants prior to enrollment, and confidentiality of data has been strictly maintained.

Statistical Analysis

The information has been encoded and examined utilizing the Statistical Package for the Social Sciences (SPSS). Continuous variables have been represented as mean ± standard deviation, whilst categorical variables have been displayed as frequencies and percentages. Comparative analyses among groups were conducted utilizing suitable statistical methods, with a p value below 0.05 being statistically significant.

RESULTS

Table (1): Ages of the research participants

	Mean	**SD**	**Minimum**	**Maximum**
Age (years)	28.91	6.96	18.00	44.00

The mean age of the research participants was 28.91±6.96years, ranging from 18 - 44 years. (Table 1)

Table (2): Occurrence of anemia, anemia type and related splenomegaly among study participants

		Count	**%**
Prevalence of anemia	**Anemia**	438	87.6%
	Normal	62	12.4%
Type of anemia	**iron deficiency anemia**	326	65.2%
	sickle cell anemia	6	1.2%
	sickle cell trait	21	4.2%
	thalassemia intermedia	16	3.2%
	thalassemia trait	26	5.2%
	B thalassemia	29	5.8%
	ITP	7	1.4%
	hgb c disease	3	0.6%

	hgb d disease	1	0.2%
	unexplained	3	0.6%
SPLEEN	**splenomegaly**	46	9.2%
	splenectomy	29	5.8%
	small size	6	1.2%
	normal	419	83.8%

87.6% of the study participants had anemia; Iron deficiency anemia compromise the main type in 65.2% of anemic females. 83.8% of the pregnant females had normal spleen, while small size spleen or splenectomy were minorities with 1.2% and 5.8% respectively. (Table 2)

Table (3): Iron profile among study participants

	Mean	**Standard Deviation**	**Minimum**	**Maximum**
Iron (mcg/dl)	70.61	34.07	17.00	168.70
Ferritin (ng/mL)	106.41	171.29	1.70	870.00
TIBC (mcg/dl)	350.00	73.39	139.00	496.70
T SAT (%)	0.22	0.15	0.04	0.80

T SAT: Transferrin saturation, TIBC: total iron binding capacity

The mean iron level was 70.61± 34.07, the mean serum ferritin level was 106.41 ± 171.629, the mean total iron binding capacity was 350.00± 73.39 and the transferrin saturation was 0.22 ± 0.15%. (Table 3)

Table (4): Comparison between anemic pregnant females and non-anemic concerning their clinical and laboratory data

	Anemia				**Normal**				
	Mean	**SD**	**Minimum**	**Maximum**	**Mean**	**SD**	**Minimum**	**Maximum**	**P value**
age	28.79	6.96	18.00	44.00	29.79	6.91	18.00	42.00	0.290
Hgb	9.40	0.89	6.90	10.90	11.81	0.64	10.60	13.90	<0.001
MCV	70.43	7.64	53.00	95.40	85.34	8.42	65.00	98.30	<0.001
MCH	24.21	3.41	10.00	33.00	28.53	3.68	18.00	32.20	<0.001
Iron	66.19	32.83	17.00	168.70	101.85	25.39	60.00	167.70	<0.001
ferritin	106.98	176.84	1.70	870.00	102.35	126.36	2.60	764.00	<0.001
TIBC	357.23	73.94	139.00	496.70	298.94	43.21	222.00	414.10	<0.001
T SAT	0.21	0.15	0.04	0.80	0.35	0.09	0.20	0.56	<0.001
HR	88.44	13.94	65.00	110.00	85.73	13.37	65.00	109.00	0.150
TLC	7.44	1.99	4.00	11.10	7.60	2.01	4.10	10.90	0.540
PLT	289.56	79.29	43.00	650.00	279.37	76.22	156.00	394.00	0.342
ALT	30.88	8.54	15.00	45.00	31.65	8.54	15.00	44.00	0.511
AST	27.02	8.35	15.00	44.00	27.56	8.34	15.00	40.00	0.633
CREAT	1.02	0.24	0.60	1.40	1.02	0.24	0.60	1.40	0.904
Weight	69.72	10.10	40.00	99.00	70.13	11.24	57.00	99.00	0.767
Height	169.71	10.19	140.00	200.00	171.05	10.39	159.00	183.00	0.334
BMI	24.49	4.68	12.60	37.00	24.29	5.18	18.10	37.00	0.763

No statistically significant difference between anemic pregnant females and non-anemic concerning Age, HR, TLC, PLT, ALT, AST, Creatinine, Weight, Height, or BMI, (p value above 0.05). (Table 4)

Table (5): Comparative analysis between anemic pregnant females and non anemic concerning serum ferritin

	Anemia			**Normal**			**P value**
	Median	**1st quartile**	**3rd quartile**	**Median**	**1st quartile**	**3rd quartile**	
ferritin	44.00	21.40	90.60	89.00	66.00	94.00	< 0.001

Pregnant females who developed anemic had a significantly lower ferritin level [median 44.00 ng/ml, interquartile range (IQR) 21.40–90.60ng/ml] than those who remained non anemic (median 89.00 ng/ml, IQR 66.00–94.00 ng/ml, P below 0.0001). (Table 5)

Table (6): Comparison between anemic pregnant females and non-anemic concerning clinical data

		Anemia		Normal		P value
		Count	%	Count	%	
trimester	**2nd**	211	48.2%	34	54.8%	0.326
	3rd	227	51.8%	28	45.2%	
DM	**No**	438	100.0%	62	100.0%	------
HTN	**No**	438	100.0%	62	100.0%	------
Spleen	**splenomegaly**	46	10.5%	0	0.0%	<0.001
	splenectomy	29	6.6%	0	0.0%	
	small size	6	1.4%	0	0.0%	
	normal	357	81.5%	62	100.0%	

No statistically significant difference was between anemic pregnant females and non-anemic with the pregnancy trimester, (p value > 0.05). (Table 6)

DISCUSSION

Anemia during pregnancy significantly contributes to maternal mortality and negative gestation results, influencing the health of over 800 million women and babies globally. Research indicates that anemia during pregnancy elevates the possibility of numerous complications, including hypertension, postpartum hemorrhage, premature rupture of membranes, preeclampsia, and puerperal infection. Furthermore, offspring of anemic mothers exhibit a fifty percent higher probability of anemia, which correlates with an increased risk of stillbirth, premature birth, low birth weight, and perinatal mortality. [6].

In our research; the mean age of the study participants was 28.91±6.96 years, ranging from 18 - 44 years. No statistically significant difference between anemic pregnant females and non-anemic concerning Age (p value > 0.05). These findings were analogous to a prior multicenter retrospective research conducted in China. Maternal anemia was shown to be substantially correlated with maternal age of 35 years. [7].

The Present research revealed that the occurrence of anemia among study participants was 87.6%. Our observation was similar to the findings of another research performed at "Karmouz family health unit" in Alexandria, which revealed a high occurrence of anemia (73.8%) [8]. Previous studies have been also performed in different governorates of Egypt. The occurrence of maternal anemia was sixty-seven percent at Fayoum governorate [9], 66% at Menofyia governorate [10], and fifty-five percent in rural areas of Belbis district, Sharkia governorate [11].

In our study; we found that iron deficiency anemia compromises the main type (65.2%) of anemic females. 88.8% of the pregnant females had normal spleen, while small size spleen or splenectomy were minorities with 1.2% and 5.8% respectively. The study also highlighted a significant variance in spleen status among anemic and non-anemic groups (p = 0.011). These findings were in agreement with Sachdeva et al., [12] as they found that IDA was the majority of prevalent kind of anemia, accounting for 73.7% of all patients. The prevalence of sickle cell anemia was recorded at 2.6%, thalassemia at 2%, and hemolytic anemia at 0.8%. IDA was associated with hepatomegaly in eight percent of cases and splenomegaly in 4.5 percent of cases. In cases of thalassemia, splenomegaly has been reported in 37.5 percent of cases. Thirty percent of cases with sickle cell anemia exhibited splenomegaly.

Concerning complete blood count among study participants in our study; the mean Hb was9.70±1.18, the mean MCV was 72.27±9.16, the mean MCH was 24.74±3.72, the mean TLC was 7.46± 1.99, while the mean PLT count was288.30±78.91. The mean HB, MCV, and MCH showed high statistically significant variance among both groups (p value below 0.001).

These outcomes were in constant with Anwar et al., [13] who revealed that out of 357 studied pregnant women, the hematological analysis revealed a mean serum Hb level has been found to be 9.89 ±1.42 g/dl, MCHC 32.03 ±1.29g/dl, HCT 31.46 ±2.57 %, WBC 7.84 ±1.85 x 103 /µL, and MCV 80.32 ±3.71 fl. A significantly lower level of MCHC (p-value below 0.001), WBC (p-value <0.001), HCT (p-value below 0.001), Hb (p-value below 0.001), and MCV (p-value below 0.001) has been observed in cases with anemia than non-anemic cases.

Concerning Iron profile among study participants, the mean iron level was 70.61± 34.07, the mean serum ferritin level was 106.41 ± 171.629, the mean total iron binding capacity was 350.00± 73.39 and the transferrin saturation was 0.22 ± 0.15%. Also, serum iron, ferritin, TIBC and transferrin saturation revealed high statistically significant variance among both groups (p value below 0.001).

The results aligned with the research conducted by Anwar et al. [13], which indicated that the biochemical analysis showed a mean Serum Ferritin level of 35.99 ± 25.53 ng/l, Serum Iron level of 116.51 ± 37.65 µg/dl, TIBC of 307.54 ± 74.47 µg/dl, and TS of 20.88 ± 6.70 %. All other biochemical indicators, including serum ferritin level (p-value 0.002) and serum iron (p-value below 0.001), were considerably lower in anemic cases than non-anemic cases.

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Our study also showed no statistically significant differences between anemic pregnant females and non-anemic regarding Age, HR, TLC, PLT, liver and renal function, BMI or gestational trimester (p value > 0.05). Similar to our findings, Ahenkorah et al., [14] revealed that there was statistically insignificant variance between the mean ages of anemic pregnancies (27.53 ±5.31 years), than non-anemic pregnancies (28.02 ± 4.97 years) (p = 0.309). Also, these results were in constant with Anjum et al., [15] who showed that out of 100 studied pregnancies, the No. of anemic women (seventy-five percent) were significantly higher (P below 0.001) than non-anemic case (twenty-five percent). The other socioeconomic factors including age, gravida, parity, and monthly income revealed insignificant association among anemic and non-anemic pregnancies.

CONCLUSION

High occurrence of anemia among pregnancies in their 2nd and 3rd trimesters which is a major public health problem. Iron deficiency is responsible for the most cases of anemia that occur through gestation. Therefore, the pregnancies should be monitored, and their hematological parameters properly interpreted to avoid and recognize gestation complications early.

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