

PREVALENCE OF ANEMIA DURING PREGNANCY AND ITS ASSOCIATION WITH ADVERSE MATERNAL/NEONATAL OUTCOMES

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Abstract:

Background: Anemia is one of the most common conditions that affect all age groups especially women of childbearing age. Anemia during pregnancy has multiple adverse effects both for the mother and the fetus.

Objective: To find the prevalence of maternal anemia and its association with adverse maternal and neonatal outcomes.

Material and Methods: This prospective cohort involved 430 pregnant women. Data included socio-demographic & obstetrical history, general physical examination and obstetrical ultrasound. Blood samples were collected from each participant for estimation of hemoglobin. According to WHO 2011 criteria, women with hemoglobin concentrations of <11 g/dl were declared anemic. Pregnancy outcomes were assessed for both mothers and babies. All data was processed through SPSS version 22. p value 0.05 was considered the level of significance.

Results: Out of the 430 participants, 168 (39%) were anemic and 262 (61%) were non-anemic. Adverse maternal outcomes were significantly different in both anemic group and non-anemic group regarding pregnancy-induced hypertension (50% compared to 20%); eclampsia (4% compared to 2%); ante -partum hemorrhage (20% compared to 12%); postpartum hemorrhage (35% compared to 10%) and blood transfusions (30% compared to 15%) ($p < 0.05$). conversely, the non-anemic group had a 26% caesarean section rate as compared to 10% in the anemic group ($p = 0.005$). Adverse neonatal outcomes amongst the two groups such as abortions, preterm births small-for-gestational (SGA) and stillbirths were significantly associated with anemia ($p < 0.05$). Maternal mortality was not reported in any group.

Conclusion: Anemia in pregnancy is associated with adverse maternal and neonatal outcomes. Efforts are required to ensure awareness of effects of anemia on both mother and neonate along with improvement of maternal nutritional status.

Key words: Prevalence, Anemia, Pregnancy Adverse Maternal Outcomes, Adverse neonatal outcome

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Introduction:

Amongst the developed nations 19% population is anemic worldwide, while in developing countries this health problem has a prevalence of 43%¹. Anemia is defined as deficiency in the number of red blood cells/hemoglobin (Hb) concentration or the oxygen-carrying capacity of blood. The etiology of anemia includes disturbances in hemoglobin synthesis, hemorrhage, and hemolysis². Decreased synthesis of hemoglobin secondary to nutritional deficiencies of vitamin B12, folic acid, and iron are the most commonly identified factors³. Anemia in women of childbearing age is a significant cause of morbidity both in developed and underdeveloped countries. Menstrual loss of blood, childbirth, lactation, and poor

Nutritional status makes this age group vulnerable to developing anemia. Certain Infections either chronic or acute, autoimmune status, and various drugs are among the other causes⁴.

Women of childbearing age are at increased risk of developing anemia and present with variable symptoms. The clinical presentation of individuals with anemia includes palpitations, breathlessness, irritability, confusion, decreased IQ, and depression depending on the degree/ severity of anemia⁵. Anemia during pregnancy has multiple adverse effects both for the mother and the fetus. The maternal adverse outcomes reported in anemic mothers are; cesarean births, ante partum hemorrhages, postpartum hemorrhages,

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pregnancy-induced hypertension, eclampsia, abortions, blood transfusions maternal mortality. While, the untoward fetal or neonatal outcomes of maternal anemia include small for gestation (SGA), preterm births and stillbirths⁶.

Given the immense importance of normal hemoglobin levels during pregnancy and its associations with maternal and fetal outcomes, it is imperative to investigate the anemia in pregnant women of this region. This study aims to find the prevalence of anemia in pregnant women at different gestational age and its association with adverse maternal and neonatal outcomes.

Material and Method:

Study design & Setting: This prospective cohort study was conducted at the Gynecology & Obstetric Department of Khalifa Gul Nawaz Teaching Hospital (KGNTH) MTI, Bannu KPK.

Study Duration & Sample Size: The study was conducted between 15th May 2023 and 15th April 2024. A total of 430 pregnant women were recruited with 51% expected prevalence of anemia. G*power was used for sample size calculation.

Sampling Technique: Study participants were recruited through simple random sampling.

Inclusion & Exclusion criteria: All pregnant with a singleton pregnancy women were included. Patients who were non-consenting, with multiple gestations, presenting with obstetric emergencies and who had received a recent blood transfusion were excluded from the study.

Data Collection Procedure: Ethical approval for the study was obtained from the institutional ethical committee. Written Informed consent was taken from all the study participants. All pregnant women of any age visiting the health care facility for the first time for antenatal check-ups were recruited. The data collected included baseline demographic information (age, weight, height, parity, residence), detailed obstetrical history, and general physical examination. Obstetrical ultrasound was done for the fetal well-being and confirmation of the period of gestation. Blood samples were collected from each participant and processed in the KGN Hospital laboratory for the determination of Hb level. According to WHO 2011 criteria, women with hemoglobin concentrations of <11 g/dl were declared anemic and the severity of anemia was additionally categorized as Mild 10 - 10.9 g/dl, Moderate 7 -9.9 g/dl, Severe 4 -6.9 g/dl and very severe <4 g/dl⁷. All the study participants were followed by the principal investigator by visiting participants in nearby areas while the participants living in far areas through telephone calls after 1 week postpartum for maternal and neonatal outcomes.

Data Analysis:

The data collected was analyzed by SPSS version 22. Descriptive statistics were presented as percentage and frequencies for the categorical variables. Mean and standard deviation were used for continuous data like age and Hb levels. A chi-square test was performed to

analyze the categorical variables BMI groups, residence, parity and trimester wise distribution of participants. A p-value of ≤ 0.05 was considered the level of statistical significance.

Results:

Sociodemographic and Obstetric Profile; Out of the total 430 enrolled subjects, 39% (n= 168) were found anemic and 61% (n= 262) non-anemic. Based on the presence and absence of anemia, the participants were grouped into an Anemic group (AG) and a Non-Anemic group (NAG). The mean age of the AG and NAG participants was 26 ± 1.5 yrs and 29 ± 1.3 yrs respectively. In AG, 51% were underweight, 16% normal weight, 19% overweight and 14% obese. While in NAG 23% were underweight, 50% were normal weight, 20% were overweight and 7% were obese (Table 1).

There was a significant difference in the prevalence of anemia during different periods of gestation in AG. p value < 0.01. Anemia in 1st trimester was found to be 31% (n=42), in 2nd trimester 45% (n=60), and in 3rd trimester 24% (n=32).

There was no statistically significant difference between the residences of AG and NAG. Amongst AG, 45% belonged to urban areas while 55% were from rural areas. On the other hand, 40% of NAG were from rural areas while 60% belonged to urban areas. Regarding parity, in the AG anemia was found to be 50% in primigravida, 24% in P2-3 while 26% of P4-5 were anemic. The mean Hb% of participants in different trimesters was significantly different p= 0.004 in both groups as shown in Table 1.

Pregnancy Outcome Measures

Out of the 430 enrolled subjects, 37 participants did not respond to the follow-up telephone calls for maternal and neonatal outcome measures. These subjects were excluded from the analysis of outcome measures. Of the 393 responded subjects, 34% (n=134) were from the AG and 66% (n=259) were from NAG. Amongst AG, 7% (n=9) had no adverse pregnancy outcomes, while 10% (n=26) of the non-anemic group did not report any adverse outcome.

A. Adverse Maternal Outcomes

A significant difference was observed in cases of PIH in both groups (p=0.04). PIH was reported by 50% (n=63) of the AG and 20% (n=47) in NAG. PIH progressing to eclampsia in AG was 4% (n=3) while, in NAG it was 2% (n=1). The frequency of APH and PPH amongst the AG was 20% (n=25) and 35% (n=44) The NAG reported APH 12% (n=28) and PPH 10% (n=24). (p=0.0003 & 0.0001) respectively.

GDM was developed by 3% (n=4) cases of AG while 10% (n=23) in NAG (p=0.002). 30% (n=38) of the AG were transfused with blood as compared to 15% (n=35) in NAG (p= 0.02). 10% (n=11) of the AG were delivered by C/section as compared to 26% (n=59) of the NAG (P0.005). (Table 2)

Table 1: Sociodemographic/Obstetric data of Anemic Group (AG) and Non-Anemic Group (NAG)				
Demographic characteristics		AG 39% (n= 168)	NAG 61% (n= 262)	P value
Mean age (Years)		26±1.5	29±1.3	.05
BMI (kg/m2)	Underweight (<18.5)	51% (n=85)	23% (n=61)	<0.0001
	Normal (18.5-24.9)	16% (n=27)	50% (n=131)	
	Overweight (25-29.9)	19% (n=32)	20% (n=52)	
	Obese(>30)	14% (n=24)	7% (n=18)	
Residence	Rural	55% (n=92)	53% (n=139)	0.1
	Urban	45% (n=76)	47% (n=123)	
Parity	P0	50% (n=84)	45% (n=118)	0.0001
	P2-P3	24%(n=40)	34% (n=89)	
	P4-P5	26% (n=44)	21% (n=55)	
Mean Hb (g/dl)	1st trimester	6.7±2.4	11.1 ±2.6	0.004
	2nd trimester	7.1±1.8	11.0 ±3.1	
	3rd trimester	7.2±1.2	12.2 ±1.9	
Distribution of participants (trimester)	1st trimester	30% (n=50)	40% (n=105)	0.1
	2nd trimester	45% (n=76)	42% (n=110)	
	3rd trimester	25% (n=42)	18% (n=47)	

Table 2: Maternal pregnancy outcome measures of AG and NAG.			
Pregnancy outcome	AG (n=134) 34%	NAG (n=259) 66%	p-value
Normal outcome	(n=9) 7%	(n=26) 10%	0.001
PIH	(n=63) 50%	(n=47) 20%	0.04
Eclampsia	(n=3) 4%	(n=1) 2%	0.1
APH	(n=25) 20%	(n=23) 12%	0.0003
PPH	(n=44) 35%	(n=24) 10%	0.0001
GDM	(n=4) 3%	(n=23) 10%	0.002
C/section	(n=11) 10%	(n=59) 26%	0.005
Blood transfusion	(n=38) 30%	(n=35) 15%	0.02

B. Adverse Fetal/Neonatal Outcomes

The rate of abortions in AG was significantly different than in NAG. 15% (n=19) as compared to 2% (n=5) respectively (p =0.002).The frequency of stillbirths in AG & NAG was (n=6)&(n=0)p0.05, Preterm births (n=10)&(n=3) p0.001& and SGA (n=6)&(n=4)(p0.06) in AG and NAG respectively. Shown in Table 3.

Table 3: Fetal outcome measures of AG and NAG			
Fetal outcome	AG (n=134)	NAG (n=259)	p-value
Normal outcome	69% (n=93)	93% (n=240)	0.0003
Abortions	15% (n=19)	2% (n=5)	0.002
Still births	4.5% (n=6),	0% (n=0)	0.05
Preterm births	7% (n=10)	4% (n=10)	0.001
Small for gestational age (SGA)	4.5% (n=6).	1% (n=4).	0.06

Discussion:

Maternal anemia is a common problem in the management of pregnancy especially in developing countries. In the present study, we aimed to find an association between anemia in pregnancy and adverse maternal and neonatal outcomes. In developing countries such as Pakistan, anemia is major health problem with a prevalence of 29 and 50%⁸. Anemia has several causes, and the associated risk factors vary widely across different regions, populations, and communities.

In our study, the prevalence of anemia was 39%. Our results are consistent with reports from other developing countries. Studies show the prevalence rate of anemia ranging from 35% to 81%among pregnant women in other developing countries^{9,10}. While studies from the developed world reported variations in prevalence in different stages of pregnancy from 20% and 18%^{11,12}.

We found the lowest Hb% levels in anemic mothers during the first trimester 6.7±2.4g/dl. This might be the reason behind the highest rate of abortions in AG as compared to NAG,15% vs2% respectively.

Similar results were reported in studies conducted in other parts of Pakistan, India, and China^{13,14,15}. In our study 2nd-trimester anemia was in the range of 7.1±1.8g/dl, levels reported by studies done in the past were similar^{16,17}. This might be due to the reason that volume expansion occurs more rapidly than the red cell mass during 2nd trimester¹⁸.

In our study, AG had a lower mean BMI than NAG p <0.0001 in the first trimester. Our results are consistent with reports from studies showing low BMI in anemic women¹⁹.

Anemia in any trimester affects maternal and neonatal outcomes. Although the NAG in our study also reported adverse pregnancy outcomes, the overall prevalence of these events in NAG was significantly low as compared to AG as shown in Table 2. Our study shows more SGA, preterm births, and stillbirths.Syafiqoh *et al*; and Kumari *et*

al; reported (32%) low birth weight babies and (34%) preterm births in anemic mothers^{17,20}. PIH, APH, PPH, and rates of blood transfusion in AG were higher in our study. Studies have reported increased rates of PPH (6.2 to 11.2% based on the severity of anemia), PIH and perinatal mortality in anemic mothers^{21,22,23}. The risk of APH, PPH, blood transfusion, postpartum infections, and maternal mortality was reported in a prospective cohort²³. In our study, births by C-section in AG were lower as compared to NAG 10% vs 26% respectively. In contrast to our findings, higher C-section rates (36%) in anemic pregnant women²⁴. This difference in the rate of C-section might be because of the higher incidence of abortions, stillbirths, and preterm births in our study in AG. Further studies involving larger sample sizes, and more detailed protocols covering larger aspects of anemia including genetic predispositions are recommended.

Conclusion:

Anemia during pregnancy is associated with adverse maternal and neonatal outcomes. It is imperative to identify women at risk of developing anemia and, ensure that sufficient and timely care, proper and adequate maternal nutrition is provided. Regular antenatal checkups will reduce the adverse preventable outcomes leading to anemia.

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