

# Prevalence of Maternal Anemia at the Time of Delivery and its impact on the neonatal outcome

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## Abstract

Anemia during pregnancy poses a significant health concern that has been linked to negative effects for both the pregnant woman and the newborn.

**Objectives:** Our aims were to explore the prevalence of anemia at the time of delivery and its effect on maternal and neonatal outcomes.

**Methodology:** We conducted a retrospective study by reviewing records of 1873 pregnant women who had given birth at Prince Hashim Hospital in Zarqa, Jordan. The data included Hb levels at the time of delivery, mode of delivery, previous complications, and the need for blood transfusion. Birth-related outcomes included preterm deliveries and the need and indication for NICU admission. The prevalence of anemia at the time of delivery was 32.8%. 92.7% of newborns did not require NICU admission, and 6.3% required admission. The majority of mothers delivered at full term (55.6%), with 26.8% having a blood transfusion history. There was a significant relationship between Hb level and the history of blood transfusion. Additionally, no significant correlation was found between Hb levels and neonatal outcomes. These findings underscore existing research, emphasizing the critical management of maternal anemia and promoting awareness regarding anemia screening among pregnant women, recognizing it as a risk factor for intrapartum and postpartum blood transfusions.

In conclusion, a significant association between Hb levels and a history of blood transfusion emerged, with moderate anemia correlating with a higher frequency of blood transfusions compared to mild anemia, and no significance between Hb and neonatal outcomes. This suggests that while anemia may have implications for other aspects of maternal and neonatal health, it does not appear to be a predominant factor influencing the need for NICU admission. The lack of a significant correlation underscores the complexity of the relationship between maternal anemia and NICU admission, emphasizing the need for further exploration and understanding of the multifaceted factors contributing to neonatal health outcomes.

**Key words:** maternal anemia, anemia at the time of delivery, blood transfusion

## Introduction

Anemia emerges as a significant public health concern, particularly among women of reproductive age, exhibiting a prevalence rate of up to 30% [1]. This global health issue pertains to both high- and low-income countries, contributing to elevated risks and complications during pregnancy [1]. The primary etiological factor implicated in pregnancy-associated anemia is inadequate iron supplementation coupled with heightened physiological demands during gestation. Untreated anemia can lead to adverse outcomes, including reduced gestational age, diminished birth weights, restricted fetal growth, and an increased susceptibility to postpartum sepsis, posing substantial risks of maternal and child mortality [2].

Within the context of Jordan, prevalence rates of anemia have been reported as 56.7% among pregnant women in Amman and 34.7% among those residing in rural areas [3][4]. However, existing data lacks insights into the prevalence of anemia specifically at the time of delivery in the Jordanian context.

Defining anemia in pregnant women necessitates adjustments to threshold levels compared to non-pregnant women due to anticipated decreases in hemoglobin (Hb) concentrations during the antenatal period. The World Health Organization (WHO) characterizes maternal anemia by an Hb level below 11.0 g/dL, further classifying severity into mild (Hb 9-10.9 g/dL), moderate (Hb 7-8.9 g/dL), and severe (Hb < 7 g/dL) categories [5].

Anemia during pregnancy and at the time of delivery holds considerable implications for both maternal and neonatal health. Complications such as preplacental hypoxia elevate the risk of postpartum hemorrhage [7]. Moreover, anemia correlates with increased odds of preterm deliveries, low birth weights, and heightened rates of perinatal mortality [9]. Iron deficiency anemia upon admission for labor and delivery has been associated with an elevated likelihood of cesarean section, yielding unfavorable outcomes for both mother and infant [8][10]. Maternal anemia further amplifies risks of premature birth and infant mortality [11]. Importantly, refractory anemia in pregnant women underscores the necessity for vigilant monitoring of the response to iron therapy during pregnancy [12].

## Methodology

A retrospective analysis was conducted utilizing data derived from a cohort of pregnant women aged 18 to 44, who delivered at Prince Hashim Ibn-Alhussein Hospital in Zarqa, Jordan, spanning the period from January to December 2021. Prince Hashim Ibn-Alhussein Hospital, a secondary healthcare facility with 423 beds across various departments, served as the research setting for this investigation [13]. Situated in Zarqa, the second-largest city in Jordan, the hospital caters to a population of approximately 635,160 individuals [14].

During the specified research timeframe, encompassing 1,873 deliveries, a retrospective analysis was executed on all pregnant women admitted to the hospital. However, due to the common practice of early discharge, a subset of data was incomplete, resulting in a refined dataset of 624 pregnant women with comprehensive records. Among this cohort, 205 individuals were identified as anemic at the time of delivery based on their Complete Blood Count (CBC) results. Particularly, these anemic mothers adhered to a protocol necessitating a minimum hospital stay of 24 hours after delivery, ensuring medical supervision of the newborns. Exclusions were made for mothers with chronic conditions and those previously diagnosed with anemia during pregnancy or undergoing treatment for low hemoglobin (Hb) levels.

Upon admission for delivery, the hospital routinely assessed the blood Hb levels of each participant. A comprehensive set of variables was systematically collected using a diligently implemented data collection sheet and the hospital's record-keeping system. The primary focus of the investigation was to scrutinize the impact of anemia at the time of delivery on maternal-fetal outcomes. To classify term status, the American College of Obstetricians and Gynecologists (ACOG) criteria were employed, categorizing pregnancies into early term (37-38 weeks), full term (39-40 weeks), late term (40-41 weeks), and post term (more than 42 weeks). Neonatal outcomes, such as preterm birth and admission to the Neonatal Intensive Care Unit (NICU), were recorded. The World Health Organization (WHO) definition of anemia in pregnancy was adhered to throughout the study [5], [15]. Data analysis was conducted using the SPSS version 25 program. Descriptive statistics (mean, percentages) were calculated to describe the study sample. Chi-square test of significance was carried out in order to establish relationship between the study variables and the level of anemia at time of delivery. The p-values indicate the level of significance of the association, with  $p < 0.05$  indicating a significant association.

## Results

In the present study encompassing a total of 624 mothers evaluated at the time of delivery, a noteworthy observation was made regarding the prevalence of anemia. Among this cohort, 205 mothers were identified as anemic, lacking prior diagnosis or treatment for their diminished hemoglobin (Hb) levels, resulting in an overall prevalence of 32.8%.

Table 1, provides a comprehensive overview of the frequency and percentage distribution of the study variables. The study sample, comprising 205 participants aged between 18 and 44 years, indicated that 93.7% of newborns did not necessitate admission to the Neonatal Intensive Care Unit (NICU), while 6.3% required such admission. Additionally, 26.8% of participants reported a history of blood transfusion. Notably, 73.2% of the participants exhibited moderate anemia, with Hb levels ranging between 7.0 and 9.9 gm/dl, as shown in Figure 1.

To distinguish the relationship between Hb levels at the time of delivery and various categorical variables, Table 2, illustrates the distribution of Hb levels across these parameters. The majority of infants born to mothers with mild anemia did not necessitate NICU admission. Utilizing the Chi-square test, we assessed the significance of the association, revealing no substantial differences between Hb levels and variables such as NICU admission, gestational age, mode of delivery, and maternal age. Intriguingly, a significant association was established between Hb levels and the history of blood transfusion ( $p$ -value = 0.02). Specifically, participants with moderate anemia exhibited a higher likelihood of having a history of blood transfusion compared to those with mild anemia.

This finding aligns with prior research by Biradar et al. and Edelson et al. emphasizing a significant correlation between maternal anemia and the necessity for blood transfusions during delivery. Notably, the prevalence of anemia in our study sample underscores the imperative for targeted interventions and heightened awareness to mitigate the impact of anemia on both maternal and neonatal outcomes [1],[22],[23].

Figure 1

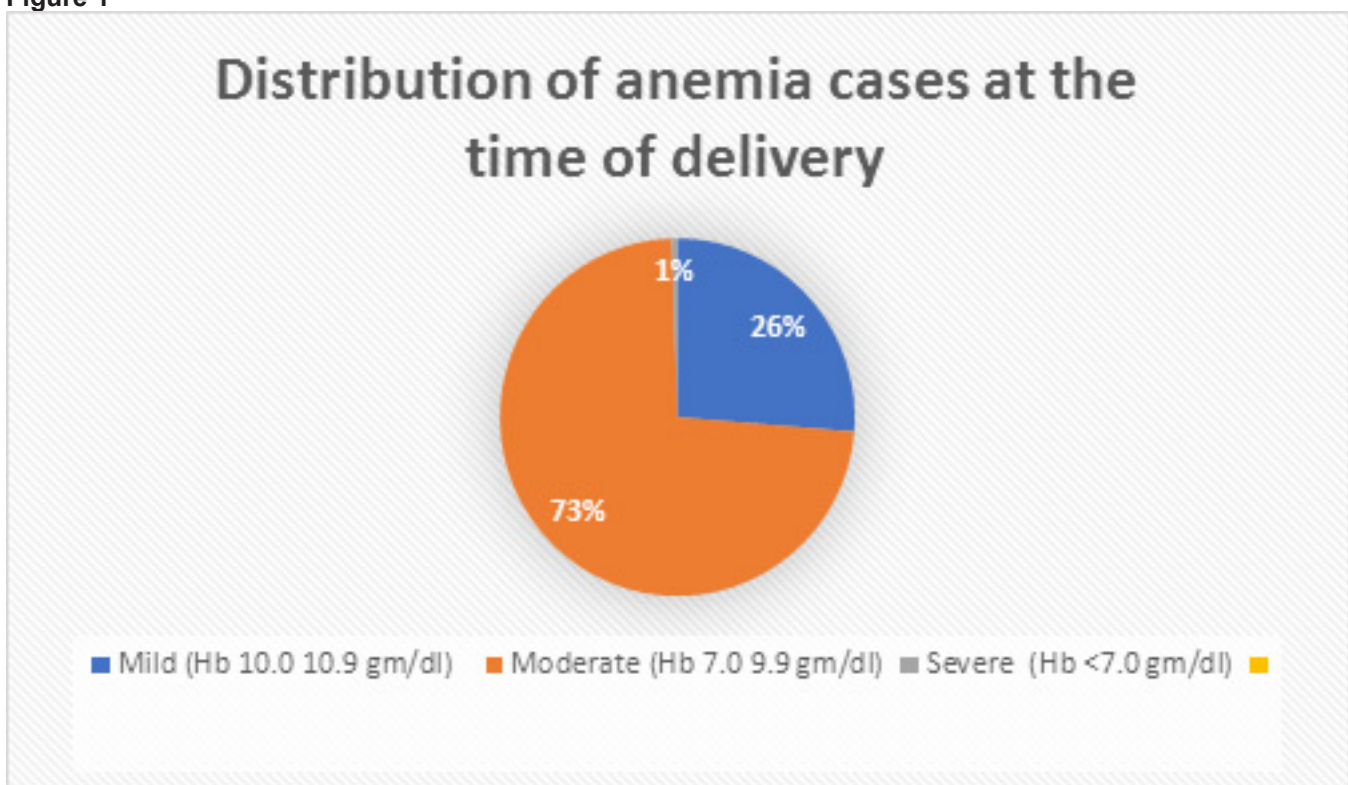


Table 1: Descriptive statistics of the study sample

Variable	Category	Frequency	Percent(%)
<b>Admission TO NICU</b>	No	192	93.7
	admission	13	6.3
<b>Gestational age at time of delivery (week)</b>	<37 week	16	7.8
	early term (37-38+)	67	32.7
	full term (39-40+)	114	55.6
	late term (41+)	8	3.9
<b>History of blood transfusion</b>	No	150	73.2
	Yes	55	26.8
<b>Mode of delivery</b>	NVD	151	73.7
	c/s	54	26.3
<b>Hb level at time of delivery (gm/dl)</b>	Mild (Hb 10.0-10.9 gm/dl)	54	26.3
	Moderate (Hb 7.0-9.9 gm/dl)	150	73.2
	Severe (Hb <7.0 gm/dl)	1	0.5
	Range (18-44)	Mean $\pm$ SD 27.78 $\pm$ 5.73	
<b>Maternal age (Years)</b>	<20	11	5.4
	20-30	137	66.8
	>30	57	27.8
<b>Total</b>		205	100



**Table 2: Relationship of the study variables with the Anemia level**

Variable	Category	Hb level at time of delivery			$\chi^2$	p-value
		Mild (Hb 10.0-10.9 gm/dl) n(%)	Moderate (Hb 7.0-9.9 gm/dl) n(%)	Severe (Hb <7.0 gm/dl) n(%)		
Admission To NICU	No	51(94.44)	140()	1(100)	.151	0.927
	admission	3(5.56)	10(6.67)	0(0.00)		
Gestational age at time of delivery (week)	<37 week	4(25.00)	12(75.00)	0(0.00)	1.39	0.966
	early term (37-38+)	20(29.85)	47(70.15)	0(0.00)		
	full term (39-40+) late term (41+)	28(24.56) 2(25.00)	85(74.56) 6(75.00)	1(0.88) 0(0.00)		
History of blood transfusion	No	46(30.67)	104(69.33)	0(0.00)	7.823	0.02
	Yes	8(14.55)	46(83.64)	1(1.82)		
Mode of delivery	NVD	36(23.84)	115(76.16)	0(0.00)	4.85	0.088
	c/s	18(33.33)	35(64.81)	1(1.85)		
Maternal age (Years)	<20	3(27.27)	8(72.73)	0(0.00)	1.048	0.902
	20-30	38(27.74)	98(71.53)	1(0.73)		
	>30	13(22.81)	44(77.19)	0(0.00)		

\*P value calculated using Chi-square test of significance.

## Discussion

This study provides considerable insights into the considerable prevalence of maternal anemia at the time of delivery within the Jordanian population. The observed prevalence rate of 32.8% underscores the significant public health concern associated with gestational anemia in the region. This study underscores the imperative for targeted interventions and heightened awareness to address the profound impact of anemia at the time of delivery on both maternal and neonatal outcomes.

Unlike prior research that predominantly focused on the incidence of anemia during different trimesters of pregnancy, this study specifically examines hemoglobin (Hb) levels at the time of delivery. Notably, some studies, such as one conducted in a secondary hospital in India, reported a remarkably high prevalence of anemia at the time of delivery, reaching 78% [16]. Variations among nations may be attributed to differences in sample characteristics, iron supplementation during pregnancy, and awareness of anemia prevention.

The absence of a significant association between Hb levels and variables like admission to the Neonatal Intensive Care Unit (NICU), gestational age at delivery, and mode of delivery within our sample suggests that these factors may not be strongly influenced by the mother's hemoglobin levels at the time of delivery. This observation could be explained by the predominantly moderate range of anemia cases in the sample and the prevalence of normal vaginal deliveries. Severe cases of anemia, often requiring admission, are typically referred to tertiary hospitals [17].

Contrary to our findings, some studies associate anemia in pregnant women with prolonged and recurrent admissions, high rates of preeclampsia, cesarean sections, placenta previa, and increased blood transfusion rates. Anemia is also linked to adverse neonatal outcomes, including preterm birth, small gestational age live births, and fetal death [20].

Our study did not find a significant relationship between Hb levels and preterm labor, suggesting that hemoglobin levels might not be a primary determinant of preterm or term births within the studied population. This contrasts with studies suggesting a slightly higher risk of preterm delivery when anemia is detected during the early stages of pregnancy [18][19][21]. Early diagnosis of anemia, follow-up during pregnancy, and variations in study samples are critical factors to consider.

The lack of a significant association between Hb levels and NICU admission suggests that factors other than the mother's hemoglobin levels at delivery may influence neonatal outcomes within our sample. The low NICU admission rate and the common practice of early maternal discharge in the region may contribute to this observation, as problems requiring hospital attention may manifest after the immediate postpartum period.

Although not significantly different, moderate anemia may play a role, albeit not a decisive one, in the decision to perform a cesarean section. The history of blood transfusion was significantly related to Hb levels, with the moderate anemia group having a higher frequency of blood transfusions compared to the mild anemia group. This aligns with previous research indicating a significant association between maternal anemia and the need for blood transfusions during delivery [22][23][24].

## Conclusion

Our research underscores the significant public health concern posed by maternal anemia at the time of delivery in the region, with a prevalence rate of 32.8%. Targeted interventions and heightened awareness are essential to mitigate the effects of anemia on both maternal and neonatal outcomes. However, this study has limitations, including sample specificity and potential bias in NICU admission data due to early maternal discharge. Future research should consider larger and more diverse samples, incorporating factors such as early anemia detection and follow-up during pregnancy to refine our understanding of the complex relationships between maternal hemoglobin levels and pregnancy outcomes.

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