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Maternal Anemia in the Third Trimester and Related Maternal and Fetal Outcomes: Results from a Study in Jember Regency

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ABSTRACT

Anemia in pregnant women is at risk of becoming one of the causes of poor maternal and fetal outcomes. Specific interventions to increase hemoglobin levels in anemic pregnant women may significantly influence maternal and fetal outcomes. Jember Regency is one area in East Java Province that is prioritized for reducing cases of poor maternal and fetal outcomes. This quantitative, analytical, and observational study used a cross-sectional design. The study population comprised third-trimester pregnant women from January to December 2022 in the Arjasa Health Center's working area, totaling 550 women. The sample size calculation yielded a sample of 115 third-trimester pregnant women by simple random sampling. The analysis test used in this study was the contingency coefficient test. Data collection used secondary data from the maternal and child health clinic register book, the pregnant women's cohort book, and the Arjasa Health Center laboratory examination book for 2022. The study results showed that the majority of respondents did not have a history of anemia, and those who did mostly had mild anemia (42.6%). The study revealed a correlation between anemia history in third-trimester pregnant women and maternal outcomes (*p-value* = 0.005, C = 0.291), categorized as a weak correlation, and low birth weight (*p-value* = 0.015, C = 0.220), also categorized as a weak correlation. The analysis of the history of anemia incidents in third-trimester pregnant women with the age of delivery and infant mortality did not show a significant correlation. Maternal anemia in third-trimester pregnant women is associated with a higher risk of poor maternal outcomes and low birth weight. Strengthening early anemia screening and adherence to iron–folic acid supplementation, integrated into maternal nutrition programs with robust referral systems, is essential to reduce adverse maternal outcomes and low birth weight in Jember Regency.

Keywords: Anemia; third trimester pregnancy; maternal outcome; fetal outcome

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INTRODUCTION

Anemia is one of the main issues during pregnancy and serves as an essential indicator of nutritional needs in the population.[1] According to WHO data in 2019, 37% or 32 million pregnant women aged 15-49 years were affected by anaemia. Anaemia in pregnancy is most prevalent in South-East Asian regions, where the prevalence exceeds 40%. Specifically, the prevalence of anaemia in pregnancy in 2019 was 48% in South-East Asia.[2,3] Based on the 2018 Riskesdas data, the prevalence of anemia in pregnant women in Indonesia increased from 37.1% in 2013 to 48.9% in 2018. This prevalence rate is quite high and approaches the threshold for a severe public health problem, exceeding 40%.[4] The prevalence of anemia is higher in developing countries because access to adequate nutrition and prenatal care may be limited. Anemia not only impacts the mother's health and well-being but also has long-term consequences for the pregnancy and the health of the newborn. Severe anemia during pregnancy can have short- and long-term consequences for the maternal and fetal outcomes.[5]

Anaemia during pregnancy can have multiple serious adverse outcomes for both the mother and the newborn.[6] Anemia in pregnant women can affect oxygen levels and reduce the oxygen-carrying capacity of maternal blood, limiting placental oxygen delivery and nutrient transfer to the fetus. Babies born to anemic mothers are at risk of experiencing oxygen deficiency while in the womb, leading to complications such as intrauterine growth restriction.[7] The study results show that pregnant women with anemia are at increased risk of obstetric complications, including increased risk of hypertension and diabetes during pregnancy, heightened susceptibility to infections, preterm labor, preterm premature rupture of membranes, postpartum hemorrhage, cardiac complications, fibroids, placental abruption, placental insufficiency and infarction, and chorioamnionitis.[8] Pregnant women with anemia are also at increased risk of more severe maternal morbidity, such as blood transfusions, hysterectomies, and Neonatal Intensive Care Unit (NICU) admissions, and unplanned surgical procedures. The impact of anemia during pregnancy on the fetus and newborn includes a higher risk of impaired fetal growth, preterm delivery, low birth weight, decreased neonatal iron stores, impairment of cognitive function, worse scores on IQ tests for newborns, and an increased risk of developmental delays and disorders in the child in the future.[9] Each complication can significantly impact the health and well-being of the mother and baby, thus underscoring the importance of early detection and effective management of anemia in pregnant women.[5]

Maternal outcome refers to the mother's health during labor and the postpartum period. Maternal outcomes can include both good and poor conditions, such as morbidity, obstetric emergencies, life-threatening conditions (near miss), and mortality.[10] Other research found the highest prevalence of maternal cases of near misses, namely emergency cesarean deliveries of pregnant women, which increase the risk of death for both mother and baby. These results align with previous research that shows pregnant women go through a critical period due to severe health problems during pregnancy, childbirth, and postpartum.[11] Fetal outcome is a condition that reflects the development of a baby from pregnancy to birth. Anemia experienced by pregnant women can affect oxygen levels in the mother and

fetus. Babies born are at risk of oxygen deprivation in the womb, which can lead to complications during delivery.[7] Pregnant women with anemia are at risk of delivering Low Birth Weight (LBW), premature birth, Small for Gestational Age (SGA), and asphyxia. These complications can impact the baby's physical and mental development.[6] This is in line with research by Farhan et al. (2021), which states that the impacts on babies affected by maternal anemia include low birth weight (LBW), prematurity, and postnatal death.[12]

Jember Regency is one area in East Java Province that is prioritized for reducing cases of poor maternal and fetal outcomes. Data from 2022 show that the prevalence of anemia in Jember Regency is 77.5%, substantially higher than the national target of 50% set in the RPJMN 2020–2024.[13] High prevalence of anemia in Jember regency indicates a substantial public health burden that elevates the risk of poor maternal and fetal outcomes, including preterm delivery, low birth weight, and increased maternal and perinatal morbidity and mortality.[14,15] Maternal outcome data in Jember Regency consists of maternal morbidity, obstetric emergencies, and maternal mortality in 2022, amounting to 19.9%, 3.4%, and 0.5%, respectively. Fetal outcomes in 2022 included low birth weight (LBW), prematurity, and infant mortality, with rates of 5.3%, 2.1%, and 0.8%, respectively.[16] Anemia in pregnant women is a risk factor for poor maternal and fetal outcomes. The high prevalence of anemia in Jember regency, far exceeding national targets, indicates that Jember regency is one of the high-risk areas for poor maternal and fetal outcomes, and it is crucial to further investigate this condition within the local context. The elevated prevalence not only reflects a persistent public health challenge but also underscores a significant risk factor for adverse maternal and fetal outcomes.

Arjasa's Public Health Center is one of the areas in Jember Regency with the highest prevalence of anemia among pregnant women (80.07%) and among third-trimester pregnant women (29.46%). In 2022, the mortality rate in the working area of Arjasa Health Center was four pregnant women and nine infants, a decrease from the previous year.[13] The high prevalence of anemia in Arjasa, Jember regency, far exceeding national targets, indicates that Jember regency is one of the high-risk areas for poor maternal and fetal outcomes, and it is crucial to further investigate this condition within the local context. The elevated prevalence not only reflects a persistent public health challenge but also underscores a significant risk factor for adverse maternal and fetal outcomes. Based on this background, the aim of this study was to analyze the association between a history of third-trimester anemia and maternal and fetal outcomes using data from a maternal cohort collected in 2022 at Arjasa Public Health Center in Jember regency.

METHOD

This quantitative study used a cross-sectional design to examine the association between the independent variable (anemia) and the dependent variables (maternal and fetal outcomes). This research was conducted at the Arjasa Public Health Center in Jember Regency from March to April 2024. The study population comprised 550 pregnant women in their third trimester who were enrolled from January to December 2022 at the Arjasa Community Health Center in Jember Regency. The inclusion criteria

for this study included pregnant women in their third trimester who were registered as residents or domiciled in Arjasa sub-district, Jember district, between January and December 2022, had data on hemoglobin (Hb) levels during pregnancy from medical records, Maternal and Child Health (MCH) books, or laboratory examinations at health facilities, gave birth in a health facility or had documented records of delivery outcomes, and had singleton pregnancies. The exclusion criteria in this study included pregnant women in the third trimester who suffered from chronic diseases before or during pregnancy (heart disease, chronic kidney failure, pregestational diabetes mellitus, chronic hypertension), experienced acute bleeding during pregnancy (placental abruption, placenta previa), pregnancies with major congenital abnormalities in the fetus, and incomplete medical record data in particular inavailable of hemoglobin data. The Lemeshow formula is used to calculate the minimum sample size required for the study. The research sample comprised 103 pregnant women in their third trimester from January to December 2022 at the Arjasa Community Health Center in Jember Regency. A sample correction was used to anticipate exclusions among study subjects, with a 10% dropout rate. Therefore, the study sample consisted of 115 pregnant women in their third trimester, selected using simple random sampling from January to December 2022.

Based on World Health Organization cutoffs for women in their first or third trimester of pregnancy, anemia was defined as Hb < 11 g/dL. Mild anemia was defined as Hb 10.0–10.9 g/dL, moderate anemia was defined as 7.0–9.9 g/dL, and severe anemia was defined as Hb < 7.0 g/dL.[3,14] Maternal outcome refers to the mother's health during labor and the postpartum period. Maternal outcomes are divided into five categories, namely full recovery, maternal morbidity, life-threatening conditions (obstetric emergencies), maternal near miss, and maternal death.[17] Full recovery refers to the reproductive system returning to normal after pregnancy and childbirth, which is a period that lasts approximately 6-8 weeks for the mother to fully recover after childbirth. Maternal morbidity, such as cesarean delivery and labor complications. A potentially life-threatening condition can be considered an obstetric emergency during pregnancy, during, or after delivery. This situation threatens the life of the mother, the baby, or both. Potentially life-threatening conditions include severe maternal complications, which require immediate and intensive treatment. A maternal near miss is a situation in which a mother is at risk of harm. The woman survives complications experienced during pregnancy, delivery, or the 42 days postpartum. Maternal near misses can occur due to complications related to pregnancy or delivery management, but deaths caused by incidents or accidents are not included. Maternal death is the death of a mother related to pregnancy or its management during pregnancy, childbirth, or within 42 days of delivery. Maternal deaths that occur due to incidental or accidental causes are not included in maternal deaths. Fetal outcome is the condition of the fetus at birth, consisting of the baby's weight at birth, whether the baby's birth weight is low or not, age of delivery (a term or premature birth), and neonatal death.[17]

The research used secondary data, the data obtained from the Maternal and Child Health Polyclinic register, the pregnant women cohort book, and the Arjasa Community Health Center laboratory examination book from January to December 2022. The data collected comprised all third-trimester pregnant women who met the inclusion and exclusion criteria. Data collection techniques included documentation studies of reports and notes in the pregnant women's cohort book and the MCH book at the Arjasa Community Health Center to obtain secondary data. A contingency coefficient was used to analyze the association between the independent variable (anemia in pregnant women in the third trimester) and the dependent variable (maternal and fetal outcomes) at the 95% confidence level, with a p-value <0.05. This research has received ethical clearance under number 451/KEPK/FKM-UNEJ/IV/2024 from the Health Research Ethics Commission at the Faculty of Public Health, University of Jember.

RESULTS

Based on the results of the study that has been conducted in the working area of the Arjasa Health Center, Jember Regency. Table 1 shows the identification of the history of anemia in third trimester pregnant women in Arjasa Public Health Center working area

Table 1. The history of Anemia in third-trimester pregnant women in the Arjasa Public Health Center working area in 2022

History of Anemia	n	%
Non Anemic	64	55.7
Anemia		
Mild Anemia	49	42.6
Moderate Anemia	2	1.7
Severe Anemia	0	0
Total	115	100

The history of anemia in pregnant women in the third trimester is shown in Table 1. It showed that 64 (55.7%) had no history of anemia, while 51 respondents did. Anemia is classified into three categories: severe anemia (<7.0 g/dL), moderate anemia (7.0-9.9 g/dL), and mild anemia (10.0-10.9 g/dL). Most respondents in this study had mild anemia (49 cases, 42.6%).

Maternal outcomes are divided into 4 variables: full recovery, maternal morbidity and maternal near miss, obstetric emergencies, and maternal mortality. In Table 2, the majority of maternal outcomes among third-trimester pregnant women were full recovery (57.4%). Among these, 38.3% were third-trimester pregnant women without anemia, and 19.1% were third-trimester pregnant women with anemia. The majority of non-anemic pregnant women experienced full recovery, while the majority of anemic pregnant women experienced maternal morbidity and maternal near miss, with 25 cases (21.7%).

Table 2. The history of Anemia and maternal outcomes in third-trimester pregnant women in the Arjasa Public Health Center working area in 2022

Maternal outcome	Non anemic (n=64)		Anemia (n=51)		Total (n=115)	
	n	%	n	%	n	%
Full recovery	44	38.3	22	19.1	66	57.4
Maternal morbidity/maternal near miss	13	11.3	25	21.7	38	33
Obstetric emergencies	7	6.1	4	3.5	11	9.6
Mortality	0	0	0	0	0	0
Total	64	55.7	51	44.3	115	100

Table 3. The history of Anemia in third-trimester pregnant women and birth weight in the Arjasa Public Health Center working area in 2022

Birth weight	Non anemic (n=64)		Anemia (n=51)		Total (n=115)	
	n	%	n	%	n	%
Normal birth weight	60	52.2	40	34.8	100	87
Low birth weight	4	3.5	11	9.5	15	13
Total	64	55.7	51	44.3	115	100

*Low birth weight if babies are born with a birth weight of less than 2500 grams
*Normal birth weight if babies are born with a birth weight of more than 2500 - 3999 grams

Based on third-trimester maternal anemia status, the majority of infants in anemic and non-anemic pregnant women were born with a normal birth weight. Among these normal-birth-weight infants, 52.2% were born to mothers without anemia, while 34.8% were born to mothers with anemia. However, the majority of low-birth-weight babies are born to mothers who have a history of anemia in the third trimester of pregnancy (9.5%).

Table 4. The history of Anemia in third-trimester pregnant women and the age of delivery in the Arjasa Public Health Center working area in 2022

Age of delivery	Non anemic (n=64)		Anemia (n=51)		Total (n=115)	
	n	%	n	%	n	%
Aterm	42	36.6	35	30.4	77	67
Premature	22	19.1	16	13.9	38	33
Total	64	55.7	51	44.3	115	100

*A term if babies are born between 38-42 weeks
*Premature if babies are born before or less than 37 weeks

Table 4 shows that 77 respondents (67%) delivered at term, and of these, 36.6% were mothers without third-trimester anemia, while 30.4% were mothers with third-trimester anemia. Meanwhile, 38 respondents (33%) experienced preterm delivery (<37 weeks of gestation). However, premature births occur more frequently in mothers without third-trimester anemia.

Table 1. The history of Anemia in third-trimester pregnant women and neonatal mortality in the Arjasa Public Health Center working area in 2022

Neonatal mortality	Non anemic (n=64)		Anemia (n=51)		Total (n=115)	
	n	%	n	%	n	%
No	63	54.8	50	43.4	113	98.2
Yes	1	0.9	1	0.9	2	1.8
Total	64	55.7	51	44.3	115	100

*No means there was no death of a live-born neonate until 28 completed days of life

*Yes means there was a death of a live-born neonate occurring within the first 28 completed days of life

As shown in Table 5, infant mortality occurred in two cases, with one case from a mother with a history of third-trimester anemia and one from a mother without anemia. Overall, 113 respondents (98.2%) delivered live infants, and of these, 54.8% were mothers without third-trimester anemia, while 43.4% were mothers with third-trimester anemia.

Table 2. The Correlation between the history of anemia in third-trimester pregnant women and maternal outcomes in the Arjasa Public Health Center working area in 2022

Maternal outcome	Non anemic (n=64)		Anemia (n=51)		*p-value*	*Coeff C*
	n	%	n	%		
Full recovery	44	38.3	22	19.1	0.005*	0.291
Maternal morbidity/maternal near miss	13	11.3	25	21.7		
Obstetric emergencies	7	6.1	4	3.5		
Mortality	0	0	0	0		
Total	64	55.7	51	44.3		

*95% confidence level, with a p-value <0.05

Based on Table 6, a statistically significant association was found between third-trimester maternal anemia and maternal outcomes (*p-value* = 0.005). The strength of this association, as indicated by the contingency coefficient (C = 0.291), suggests a weak correlation.

Table 3 The Correlation between the history of anemia in third-trimester pregnant women and birth weight in the Arjasa Public Health Center working area in 2022

Birth weight	Non anemic (n=64)		Anemia (n=51)		*p-value*	*Coeff C*
	n	%	n	%		
Normal birth weight	60	52.2	40	34.8	0.015*	0.220
Low birth weight	4	3.5	11	9.5		
Total	64	55.7	51	44.3		

*95% confidence level, with a p-value <0.05

The analysis examining the association between maternal anemia history and low birth weight in the Arjasa Health Center working area demonstrated a statistically significant relationship (*p-value* =

0.015). The strength of the association, as measured by the contingency coefficient (C = 0.220), indicates a weak correlation.

Table 4 The Correlation between the history of anemia in third-trimester pregnant women and age of delivery in the Arjasa Public Health Center working area in 2022

Age of delivery	Non anemic (n=64)		Anemia (n=51)		*p-value*	*Coeff C*
	n	%	n	%		
Aterm	42	36.6	35	30.4	0.734	0.320
Premature	22	19.1	16	13.9		
Total	64	55.7	51	44.3		

*95% confidence level, with a p-value <0.05

Table 8 presents the results of the analysis examining the association between third-trimester maternal anemia and gestational age at delivery in the Arjasa Health Center working area. The findings indicate that there was no statistically significant association between third-trimester maternal anemia and gestational age at delivery (*p-value* = 0.734).

Table 9. The Correlation between the history of anemia in third-trimester pregnant women and neonatal mortality in the Arjasa Public Health Center working area in 2022

Neonatal mortality	Non anemic (n=64)		Anemia (n=51)		*p-value*	*Coeff C*
	n	%	n	%		
No	63	54.8	50	43.4	0.871	0.015
Yes	1	0.9	1	0.9		
Total	64	55.7	51	44.3		

*95% confidence level, with a p-value <0.05

Table 9 presents the analysis of the association between third-trimester maternal anemia and infant mortality in the Arjasa Health Center working area. The findings indicate that there was no statistically significant association between third-trimester maternal anemia and infant mortality (*p-value* = 0.871).

DISCUSSION

Anemia in Pregnant Women Third Trimester

Anemia in the third trimester can be prevented through anemia screening of pregnant women conducted at least twice, specifically in the first and third trimesters. Most of the study respondents had a history of mild anemia. This aligns with other studies, which found that 68.8% of pregnant women experienced mild anemia.[18] Pregnant women with mild anemia typically do not experience clear and specific symptoms, often leading to it being ignored. If left untreated, mild anemia can progress to moderate or severe anemia during pregnancy. A vulnerable condition during pregnancy can cause obstetric complications leading to maternal morbidity and mortality.[19] The mother's physiological condition during pregnancy can affect pregnancy, labor, and postpartum outcomes. Physiological

changes during pregnancy can alter the number of normal blood cells, leading to a decrease in hemoglobin levels. Pregnant women in their reproductive years, between the ages of 20 and 35, have a lower risk of anemia.[2] Pregnant women who are not anemic have a lower risk of low birth weight, premature birth, infant death, and postpartum maternal care.[20] Another study found that 60% of pregnant women are anemic in the third trimester. Anemia in pregnant women can reduce the blood supply, thereby affecting oxygen levels in the blood. This condition can be life-threatening (near miss) for both the pregnant woman and her fetus. Anemia during pregnancy not only impacts the mother's health but also the fetus.[21,22]

Maternal Outcomes in Pregnant Women Third Trimester

The most common maternal outcomes experienced by pregnant women with a history of anemia in the third trimester are maternal morbidity and maternal near miss. This study found several maternal morbidities and maternal near-misses, such as cesarean births and hypertension. Consistent with other research, maternal morbidity and maternal near-misses can be caused by maternal health factors, including the number of fetuses carried, the number of live births, pregnancy complications, lifestyle and nutritional needs, as well as environmental, social, and economic factors.[15] In another study, other conditions associated with maternal morbidity and maternal near-misses were identified, including premature rupture of membranes, large fetal size, and obstructed labor.[9] This is consistent with previous research that shows a significant relationship between anemia in pregnant women and maternal issues. Moderate or severe anemia can increase the risk of complications. Women with anemia are at higher risk of maternal morbidity, maternal near miss, and obstetric emergencies.[20] Obstetric emergencies encountered in this study include high-risk pregnancies experienced by pregnant women and their medical history. High-risk pregnancies and the mother's medical history can be caused by medical factors, including previous or current maternal illnesses, fetal diseases, umbilical cord disorders, and obstetric abnormalities.[23] This study did not find any cases of maternal death. According to another research, anemia in pregnant women can lead to severe impacts, including maternal death.[24]

Fetal Outcomes in Pregnant Women Third Trimester

Low birth weight is a risk faced by babies due to developmental and growth disorders while in the womb. This study found low birth weight babies born to mothers with a history of anemia third trimester. This is consistent with other research indicating that low birth weight babies are often born to anemic pregnant women.[25] Pregnant women with anemia have an increased risk of low birth weight due to restricted fetal growth. Low birth weight can be influenced by maternal factors, including anemia during pregnancy.[26] Anemia during pregnancy can reduce the oxygen levels and nutrient supply to the fetus through the placenta. This condition affects the baby's weight in the womb. If the oxygen and nutrient supply to the fetus is disrupted, it can result in low birth weight.[27]

Gestational age at delivery is categorized into term and premature births. Anemia during pregnancy can hinder oxygen distribution in the mother and fetus, leading to various complaints such as fatigue, palpitations, and shortness of breath. Unstable condition of the pregnant mother impacts to fetus,

potentially leading to preterm birth.[28] Besides maternal health factors, other factors also determine gestational age at delivery. These supporting factors include the mother's readiness, knowledge of pregnancy, commitment to antenatal care check-ups, birth preparation, and spousal support.[29]

Based on the research conducted, the neonatal deaths that occurred were one infant death in a mother with anemia and one infant death in a mother without anemia. Infant mortality in this study was caused by mothers undergoing cesarean sections and experiencing bleeding during delivery. In this study, infant mortality was caused by maternal cesarean delivery and hemorrhage during delivery. Other studies have shown that cesarean delivery is used to prevent maternal morbidity and near-misses in pregnant women. Cesarean delivery does not affect infant mortality because infant mortality is more often triggered by the socioeconomic conditions of the pregnant woman's family.[11,30] Maternal age, which puts them at high risk during pregnancy, can lead to birth defects, obstructed labor, and hemorrhage. These conditions are exacerbated if the pregnant woman is anemic. Anemic pregnant women are 3.2 times more likely to experience neonatal death than non-anemic pregnant women. According to another study, the largest proportion of infant mortality was associated with maternal parity. Other factors included gestational age at delivery, abortion history, hypertension history, and anemia history.[31] Another research explained that the risk of infant mortality increases if the pregnant mother experiences anemia and malnutrition (BMI <18 kg/m^2).[12]

The History of Anemia in Third Trimester Pregnant Women and Maternal Outcomes

Based on the results of this study, there is a weak association between a history of anemia in pregnant women in the third trimester and maternal outcomes. The most common maternal outcomes experienced by pregnant women with a history of anemia in the third trimester were maternal morbidity and maternal near-misses, at 49%. This is in line with previous research, which found that anemia in pregnant women is significantly associated with maternal problems. Moderate or severe anemia can increase the risk of complications. Anemic mothers are at increased risk of maternal morbidity, maternal near-misses, and obstetric emergencies.[20]

Anemia can lead to primary postpartum hemorrhage due to the lack of iron reserves stored in the body. Pregnant women with a history of anemia have a strong potential for primary postpartum hemorrhage.[32] Hemorrhage can cause disruptions in the circulatory system of both mother and fetus, potentially leading to unforeseen conditions.[33] Pregnant women who experience pregnancy complications are more likely to undergo cesarean deliveries. Several health conditions experienced by pregnant women, such as pregnancies over 42 weeks, multiple pregnancies, and high-risk conditions associated with maternal age, significantly increase the likelihood of cesarean delivery. Obstacles encountered during delivery can cause maternal and fetal morbidity and mortality if not promptly addressed.[34] According to another research, anemic pregnant women have a higher potential to experience high-risk pregnancies. In addition to anemia, high-risk pregnancies are associated with maternal age, maternal education, and Chronic Energy Deficiency (CED).[23]

The History of Anemia in Third Trimester Pregnant Women and Fetal Outcomes

Based on the results of this study, there is a weak correlation between a history of anemia in pregnant women in the third trimester and low birth weight (LBW). According to other research, pregnant women with anemia have a higher risk of delivering low birth weight babies compared to non-anemic pregnant women.[35] This finding aligns with a study conducted at Mardi Waluyo Metro Hospital in 2018, which found that anemic pregnant women have a 3.610 times greater risk of having low birth weight babies compared to non-anemic pregnant women. Anemia can contribute to low birth weight by reducing oxygen levels in the body, which hampers nutrient transfer from the mother to the fetus through the placenta. However, in the other study, there was no correlation was found between anemia and low birth weight. Low birth weight may be more likely caused by the mother experiencing high-risk conditions during pregnancy. Other factors that can cause low birth weight in infants include hypertension, parity, and birth age.[36] The higher a pregnant woman's Hb level, the greater her blood production and oxygen transport. Pregnant women should be educated and undergo regular antenatal care visits for regular health checks to prevent conditions that could harm the mother and the baby's development.[11,21]

Based on the results of this study, there was no association between a history of anemia in pregnant women in the third trimester and the baby's delivery age. This is inconsistent with previous research, which found that pregnant women with anemia had a higher risk of preterm birth.[28] A similar study found that maternal hemoglobin levels were significantly associated with preterm birth, with a 3.273% greater risk. The association between anemia and prematurity may be caused by an unmet need for blood, which increases by 30-40%. This lack of oxygen in the blood triggers hypoxia, leading to stress in pregnant women. Changes in the amount of the hormone progesterone in the body will affect the condition of the uterus, which can lead to preterm birth.[23] Another factor that can cause premature birth is maternal parity. The risk of premature birth can also increase if the mother is too old or too young. Other research found a correlation between parity and premature birth. Pregnant women with a history of high parity may be at increased risk of anemia during pregnancy due to the use of iron stores in previous pregnancies. In other circumstances, premature delivery may be performed if premature rupture of membranes occurs. In cases of premature rupture of membranes, immediate delivery is required, even if the gestational age is not yet mature.[15]

The analysis showed no association between a history of anemia in pregnant women in the third trimester and infant mortality. This finding contradicts other studies that suggest that infant mortality is caused by a history of anemia. The severity of maternal anemia leads to infant mortality; the higher the severity, the higher the infant mortality rate.[12] Research conducted by Kusumawardani et al. (2018) found a relationship between a history of anemia in pregnant women and infant mortality. This study showed a 3,314% greater risk of infant mortality compared to pregnant women without anemia. Anemia in pregnant women causes oxygen deprivation in both the mother and the baby, which can then lead to

infant mortality. In other studies, infant mortality occurs in low birth weight (LBW) babies, both of which can be caused by a lack of hemoglobin.[31]

CONCLUSIONS AND RECOMMENDATIONS

This study concluded that the majority of third-trimester pregnant women with anemia presented with mild anemia. A significant association was identified between a history of anemia in the third trimester and adverse maternal outcomes, as well as low birth weight. However, no significant relationship was observed between third-trimester anemia and gestational age at delivery or infant mortality. Strengthening early anemia detection through routine hemoglobin screening at primary healthcare centers in the first and second trimesters, and optimizing adherence to iron–folic acid supplementation through targeted counseling and community-based monitoring, are essential steps to reduce adverse maternal outcomes and low birth weight in Jember regency. Integrating anemia prevention into existing maternal nutrition programs and reinforcing referral systems for high-risk pregnancies will enhance program effectiveness and sustainability at the district level.

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