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Maternal Anemia During Pregnancy And Infant Birth Outcomes: A Retrospective Case Control Study In Tuban, Indonesia

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ABSTRACT

Anemia in pregnant women is still a serious public health problem in developing countries, including Indonesia. Although Indonesia is rich in food resources, the high rate of anemia is caused by a diet low in iron and habits that inhibit iron absorption, such as tea consumption after meals. This study aims to determine the relationship between anemia in pregnant women and the birth output of babies in Tuban Regency, East Java. This study is a retrospective case-control study based on medical record data of 96 postpartum mothers who gave birth from January to April 2025. The case group consisted of mothers with hemoglobin levels <11 g/dL, and control groups with Hb ≥11 g/dL. Externalities observed included low birth weight (BBLR), neonatal asphyxia, and infant body length. The analysis was carried out using the Pearson test. The prevalence of anemia in pregnant women was 50%. There was a significant association between anemia and the incidence of BBLR (77.1%; p < 0.05) and neonatal asphyxia (58.3%; p < 0.05). However, no significant association was found between anemia and infant body length at birth (p = 0.813). Anemia in pregnant women, especially in the second and third trimester, significantly increases the risk of BBLR and neonatal asphyxia due to chronic fetal hypoxia. Nutritional interventions, education on the consumption of iron-rich foods, and strict pregnancy monitoring are needed to prevent the adverse effects of anemia on mothers and babies.
Keywords: *anemia in pregnant women, pregnancy, BBLR, neonatal asphyxia, baby discharge.*

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INTRODUCTION

Anemia during pregnancy remains a serious public health problem in many developing countries, including Indonesia. Iron deficiency, mainly caused by inadequate food intake, is considered the most common nutritional deficiency leading to anemia. However, Indonesia has abundant food resources, including iron-rich animal foods such as liver, red meat, and sea fish. Despite this, the prevalence of anemia among pregnant women remains high (1). This condition is influenced by economic factors and eating habits. Iron-rich animal foods are often considered expensive or uncommon for daily consumption among lower-middle-class communities, who tend to consume staple foods such as rice with simple side dishes that lack sufficient iron content. Anemia during pregnancy not only affects the mother, but also significantly increases the risk of various serious complications in the baby, including low birth weight, preterm birth, and perinatal as well as neonatal mortality (2).

Women of reproductive age are particularly prone to anemia due to inadequate dietary intake and iron loss during menstruation and pregnancy. The World Health Assembly endorsed Global Nutrition (WHA), to achieve a 50% reduction in anemia among women of reproductive age by 2025. The Sustainable Development Goals (SDGs)also included the goal of anemia reduction among women of reproductive age by 50% by 2030. (4). Based on the results of the 2023 Indonesia Health Survey (SKI) conducted by the Health Development Policy Agency (BKPK) of the Indonesian Ministry of Health, the prevalence of anemia in Indonesia remains relatively high, at 23.7% nationally (5).

Based on the Tuban Regency Health Office, the prevalence of anemia is estimated to still be in the range of 40%, especially in areas with limited access to antenatal services and nutrition education. This suggests that anemia in pregnant women remains an urgent health problem to be systematically addressed, especially in high-risk areas (6). In a large

cohort study in South Asia, mothers with severe anemia had a stillbirth rate of 90.9 per 1,000 and a neonatal mortality rate (28 days) of 72.6 per 1,000, much higher than mothers without anemia (7).

The high prevalence of anemia among pregnant women in Indonesia is an irony amid the abundance of iron-rich food resources (8). This condition is influenced by social, economic, and cultural factors, as well as dietary habits that do not support iron intake, such as consuming low-iron foods and the habit of drinking tea or coffee after meals, which inhibits iron absorption(9). Anemia in pregnant women has serious impacts, increasing the risk of fatigue, infections, bleeding, preeclampsia, and complications in the fetus such as growth restriction, preterm birth, low birth weight (LBW), and even death(10). Efforts to overcome this problem require a comprehensive approach through nutrition education, strengthening the iron supplementation program, changing eating behaviors, and improving antenatal care (ANC) services with the support of healthcare workers and community health cadres (11).

Changes in eating behavior are essential in addressing anemia, such as avoiding iron-inhibiting drinks after meals and encouraging the consumption of vitamin C-rich fruits to enhance iron absorption. Long-term solutions also require socio-economic interventions through family empowerment and the use of local resources to improve access to nutritious food. In addition, antenatal care (ANC) services need to be strengthened in quality and coverage, including early detection of anemia, fetal growth monitoring, and integrated nutrition counseling. (12). This study aims to determine the relationship between anemia in pregnant women and the birth output of babies in Tuban Regency, East Java

METHODS

This study used a quantitative design with a case-control study retrospective approach to determine the relationship between the incidence of anemia in pregnant women and the outcome of the baby's birth. The research was carried out in several health service facilities in Tuban Regency, including the Tuban Health Center and the Semanding Health Center during the period from January to April 2025.

The population in this study is all mothers who gave birth at the health facility in 2023–2024. The research sample consisted of two groups, namely the case group and the control group. The case group was postpartum mothers who had a history of anemia during pregnancy, with a hemoglobin (Hb) level of less than 11 g/dL based on medical record data. Hemoglobin examination in pregnant women is conducted in the first trimester for early detection of anemia and repeated in the third trimester to monitor the increased iron requirements. Anemia, especially in the third trimester, can reduce the supply of oxygen and nutrients to the fetus, thereby increasing the risk of low birth weight (LBW); thus, hemoglobin monitoring is essential for prevention.

Meanwhile, the control group was postpartum mothers who did not have a history of anemia with Hb levels of ≥11 g/dL, based on medical record data. The population in this study amounted to 96 postpartum mothers during the period from January to April 2024. Sampling was carried out by consecutive sampling. With the number of samples in the control group 48 and the case group 48.

The inclusion criteria in this study include mothers who gave birth to single babies (not twins), having data on hemoglobin levels in the third trimester, and having data on the completeness of birth records, such as the baby's birth weight, gestational age at delivery, Apgar score, and the incidence of asphyxia or perinatal death. Meanwhile, the exclusion criteria are pregnant women with chronic comorbidities such as chronic hypertension and

gestational diabetes mellitus, as well as mothers with blood disorders other than iron deficiency anemia.

The independent variables in this study were the status of anemia in pregnant women (anemia or non-anemia), while the dependent variables included infant birth outcomes such as low birth weight (BBLR), prematurity, Apgar score, neonatal asphyxia, and perinatal mortality. In addition, other variables controlled (confounding) in this study included maternal age, parity, nutritional status, and history of antenatal care (ANC) visits.

Data were obtained from the medical records of pregnant women and childbirth records at the health facilities studied. Data collection was carried out using a checklist sheet containing information about maternal identity, third trimester hemoglobin levels, gestational age, birth weight, gestational age, Apgar score, and the occurrence of asphyxia or perinatal death.

The collected data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 25 program. The analysis was carried out with the Pearson test to determine the effect between anemia in pregnant women and the birth output of the baby with the significance level used in this study was $p < 0.05$.

This research has received approval from the Health Research Ethics Committee of the Nahdlatul Ulama Tuban Institute of Health Sciences with number 128/0084223561/LEPK. IIKNU/VI/2025. All patient data is kept confidential and is only used for the purposes of this study.

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RESULTS

Table 1 Respondent Characteristics

Characteristics Respondent	n	%
Age		
<21	2	2.1
21-35	77	80.2
>35	17	17.7
Parity		
Primipara	32	33.3
Multipara	64	76.7
Gestational Age		
Premature	15	15.6
Early term	33	34.4
Full term	48	50
Hb		
<11	48	50
>12	50	50
Baby Weight		
Low birth weight	37	38.5
Adequate baby weight	59	61.5
Gender		
Male	57	59.4
Female	39	40.6
Asphyxia		
Normal	68	70.8
Asphyxia	28	29.2
Baby Length		
Short	23	24
Normal	73	76

Source : Primary Data, 2025

Based on the results of the study on 96 respondents of postpartum mothers in Tuban Regency, the following characteristics were obtained: Most pregnant women were in the

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age range of 21–35 years (80.2%), Judging from parity, most of the respondents were multipara (66.7%), Based on the length of pregnancy, some respondents gave birth at full term gestation age (50.0%). The hemoglobin (Hb) levels of pregnant women in the case and control groups showed the same distribution, namely 50.0% had Hb <11 gr/dL and >12 gr/dL, respectively. Based on the birth weight of the baby, most babies are born with an adequate birth weight (BBLC) of 61.5%, The sex of the baby is mostly male (59.4%). In the condition of asphyxia, most babies are born in normal conditions (70.8%), Based on the length of the baby's body, almost all are born with normal body length (76.0%)

Table 2 Influence of Anemia

	Baby Weight		**Aphyxia**		**Baby Length**		**Total**
	Low birth weight	Adequate baby weight	Normal	Aphyxia	Short	Normal	
Case (Anemia)	37 (77,1%)	11 (22,9%)	20 (41,7%)	28 (58,3%)	12 (25%)	36 (75%)	48
Control (Non Anemia)	0	48 (100%)	48 (100%)	0	11 (22,9%)	37 (77,1%)	48
Total	37	59	68	28	23	73	96
Pearson 2 Tailed	0.000		0.000		0.813		

Based on the results of the analysis of the relationship between the incidence of anemia in pregnant women (case and control groups) and the outcome of the baby, it was found that most of the babies in the case group experienced a low birth weight (BBLR) of 77.1%. Based on Pearson's statistical test, a significance value of 0.000 ($p<0.05$) was obtained, which means that there is a significant relationship between pregnant women's anemia and the baby's birth weight. In the afphysia variable, most of the babies from the case group experienced afphyxia (58.3%). Pearson's statistical test showed a significance value of 0.000 ($p<0.05$), so there was a significant relationship between anemia in pregnant women and the incidence of phyphyxia in the baby. Meanwhile, in the infant body length

variable, almost all babies in the case group had a normal body length of 75.0%. Based on the Pearson test, a significance value of 0.813 (p>0.05) was obtained, which means that there was no significant relationship between the anemia of pregnant women and the length of the baby's body at birth.

DISCUSSION

The results of this study show that based on the medical records data of postpartum mothers in Tuban Regency, the prevalence of anemia in mothers during pregnancy reaches 50%. This figure indicates that pregnancy anaemia is still a significant maternal health problem in the region, and is in line with national data showing a high incidence of anaemia in pregnant women in Indonesia (13).

The results of this study show that the prevalence of anemia in pregnant women in Tuban Regency based on postpartum medical record data reaches 50%. This figure illustrates that anemia during pregnancy is still a significant maternal health problem in Tuban Regency. These findings are in line with national data reported in Basic Health Research in 2018, where the prevalence of anemia in pregnant women in Indonesia was recorded at 48.9%, an increase compared to 2013 which was 37.1%. Several regional studies also support this finding, such as a study in West Sumatra which showed the prevalence of anemia in the third trimester of 61.9%, and in Bali as much as 46.2%. The similarity of these prevalence figures shows that anemia during pregnancy is a widespread issue and needs special attention in efforts to prevent pregnancy and birth complications. This condition can have an impact on maternal and fetal health, including an increased risk of low birth weight, neonatal asphyxia, and other fetal growth disorders (Health Office 2023).

Researchers assume that one of the main factors contributing to the high prevalence of anemia in pregnant women is the low frequency of consumption of iron-rich foods, such

as red meat. Mothers during pregnancy often consume sea fish which is the main source of food for dimang. A diet that does not meet iron needs during pregnancy significantly increases the risk of anemia. In addition, the habits of pregnant women who consume tea, both after eating and when experiencing symptoms such as dizziness, also play a role in inhibiting the absorption of non-heme iron from food. The tannins contained in tea are known to bind iron and reduce its biological availability in the body. This combination of low iron intake and improper dietary behavior indirectly increases the susceptibility of pregnant women to anemia during pregnancy(15).

The incidence rate of BBLR (Low Birth Weight) in Tuban Regency was found to be very high in the case group, which was 77.1% (n = 37). The results of the statistical test using Pearson showed a significance value of p = 0.000 (p < 0.05), which indicates that there is a statistically significant relationship between anemia in pregnant women and the incidence of BBLR. These findings reinforce the suspicion that anemia during pregnancy is a significant risk factor for poor baby outcomes, especially related to birth weight. These findings reinforce the evidence that anemia during pregnancy is a major risk factor for the occurrence of BBL(16).

These findings are reinforced by various international studies that show similar patterns. The study by Lee et al. 2024 confirms that anemia, particularly in the second and third trimester, significantly increases the risk of BBLR. This indicates that the duration and severity of anemia during pregnancy are very decisive factors in fetal development (17).

Researchers assume that pregnancies with anemia are especially those that take place in the second and third trimester. It can cause disruption of oxygen and nutrient supply to the fetus due to reduced oxygen transport capacity by hemoglobin in the mother's blood. This condition has the potential to cause chronic fetal hypoxia, which has a direct impact on the intrauterine growth and development process. Chronic hypoxia in the fetus can lead to impaired cell proliferation, tissue differentiation, as well as disorders of the placental

vascular system, which ultimately decreases the fetal growth rate and increases the risk of BBLR. In addition, anemia can also be related to other obstetric complications such as preeclampsia and premature birth, which are also contributing factors to low birth weight(18).

The more severe the degree of anemia and the longer the anemia condition lasts during pregnancy, the more likely it is that the fetus will be impaired in intrauterine growth. This is due to the reduced capacity of the mother's blood to transport oxygen and essential nutrients needed for optimal fetal growth and development. A prolonged lack of oxygen and nutrient supply can lead to chronic fetal hypoxia, which has an impact on slowing cell and tissue growth. As a result, this condition can manifest in the form of babies born with a sub-normal weight or low birth weight (BBLR) (19).

In this study, the incidence rate of asphyxia in newborns in Tuban Regency was found to be very high in the case group, which was 58.3%. The results of the analysis using the Pearson statistical test showed a significance value of $p = 0.000$ ($p < 0.05$). This indicates a statistically significant relationship between anemia in pregnant women and the incidence of asphyxia in neonates. These findings suggest that maternal anemia may be an important risk factor for respiratory distress in newborns due to lack of oxygen supply during pregnancy (20).

Research conducted by Mansukhani et al. 2023 in a study in India published in the Journal of Clinical and Diagnostic Research reported that the incidence of neonatal asphyxia was significantly higher in babies born to mothers with anemia. In the study, babies from mothers with anemia had a 2 to 3 times greater risk of developing asphyxia, compared to babies from mothers without anemia (21).

Researchers assume that the decrease in oxygen transport capacity in the mother's blood directly impacts the decrease in fetal oxygenation through the placenta. In anemia, low maternal hemoglobin levels reduce the ability of the circulatory system to deliver

enough oxygen to body tissues, including to the developing fetus. When this condition lasts for a long time, the fetus can experience chronic intrauterine hypoxia, which is a persistent lack of oxygen during pregnancy. This hypoxia can interfere with the normal development of the lungs, brain, and other vital organs of the fetus. As a result, the fetus becomes more susceptible to respiratory transition disorders at birth, which increases the risk of neonatal asphyxia, which is a condition of failure to breathe spontaneously and regularly after birth, characterized by low Apgar scores, cyanosis, hypotonia, and the need for resuscitation intervention (22).

In addition, maternal anemia can also lead to impaired placental function, such as placental insufficiency, which worsens the supply of oxygen and nutrients. The combination of chronic fetal hypoxia and stress during childbirth can increase the likelihood of perinatal asphyxia, especially in pregnancies with moderate to severe anemia that are not adequately treated (23).

In this study, there was a difference in the distribution of infant body length between the case and control groups, where 25% of the babies from the case group had a birth length less than normal, compared to 22.9% in the control group. However, the results of Pearson's statistical test showed a significance value of $p = 0.813$ ($p > 0.05$), which means that there is no statistically significant relationship between anemia in pregnant women and the length of the baby's body at birth. These findings indicate that although maternal anemia impacts several fetal growth parameters such as body weight, its effect on birth length has not been significantly demonstrated (24).

In a retrospective study conducted by Nyarko et al. 2024, pregnant women with severe anemia had a higher risk of stunted fetal growth in weight, but no significant difference in body length was found. This study concluded that body weight is the main indicator of intrauterine growth disorders due to anemia, while body length is more stable and is not much affected by mild to moderate anemia conditions(25). The study conducted

by Luewan et al. 2024 reported that anemia during pregnancy was strongly correlated with birth weight and the incidence of low Apgar scores, but no significant differences were found in the baby's body length or head circumference. These results support that the parameters of the baby's weight and respiratory status are more sensitive to the lack of oxygen and micronutrient nutrients during pregnancy (26).

Researchers assume that the length of the baby's body at birth is more influenced by genetic factors and gestational age than the mother's hemoglobin status during pregnancy. Although maternal anemia can disrupt the supply of oxygen and nutrients to the fetus, its impact is more pronounced on the growth of soft tissue mass (such as body weight) than linear growth (body length), which tends to have a more stable growth pattern and is less sensitive to short-term fluctuations in nutrition and oxygenation. anemia is not enough to affect fetal bone growth, especially if it is not accompanied by a deficiency of macronutrients or other important micronutrients, such as protein, calcium, or vitamin D. Some studies have also shown that body length is more influenced by long-term factors during pregnancy as a whole, not just by anemia status in a particular trimester. Therefore, although maternal anemia has a significant impact on low birth weight (BBLR) and asphyxia risk, infant body length is less likely to be significantly affected, as shown by the results of the study's meaningless statistical test (27).

CONCLUSIONS AND RECOMMENDATIONS

This study shows that the prevalence of anemia in pregnant women in Tuban Regency is quite high, which is 50%, and is still a serious maternal health problem. Anemia was shown to be significantly related to the incidence of BBLR (77.1%) and neonatal asphyxia (58.3%), but did not have a significant effect on the length of the baby's body at birth. Anemia, especially in the second and third trimester, has the potential to cause chronic fetal hypoxia that impacts fetal growth and development, especially birth weight. A diet low in

iron and tea consumption habits also worsen the anemia status of pregnant women. Therefore, nutritional interventions, education on the consumption of iron-rich foods, and stricter pregnancy monitoring are needed to prevent the adverse effects of anemia on mothers and babies.

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