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Original Research

Association Between Maternal Anemia During Pregnancy and Postpartum Hemorrhage in the Libano Public Health Center Area

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Abstract
Anemia during pregnancy is a common condition that significantly contributes to maternal and neonatal morbidity and mortality, particularly in developing regions. Postpartum hemorrhage (PPH) remains a leading cause of maternal death globally, with anemia identified as a major risk factor. This study aimed to examine the association between maternal anemia and PPH in the Libano Public Health Center area, Morotai Jaya District. A retrospective analytical observational design was applied to 100 pregnant women based on medical records from 2023. Data were analyzed using chi-square tests and logistic regression. The findings indicated that maternal anemia significantly increased the risk of PPH, with severe anemia showing the highest odds ratio (OR 6.8; p < 0.001), followed by moderate anemia (OR 4.5; p < 0.001). Additional contributing factors included maternal age <20 years (OR 2.1; p = 0.020), interpregnancy interval <2 years (OR 2.5; p = 0.010), and undernutrition (OR 1.6; p = 0.050). Overall, 38% of participants experienced PPH, with the highest prevalence observed among those with severe anemia (80%). Early detection of anemia, effective iron supplementation, and antenatal education are essential to reduce the risk of PPH. Integrated preventive and curative interventions are required to improve maternal health outcomes, particularly in high-prevalence settings.

1. Introduction

Anemia during pregnancy remains a major global health concern, particularly in developing countries such as Indonesia. According to the Riset Kesehatan Dasar (Riskesdas, 2018), the prevalence of anemia among pregnant women in Indonesia approaches 50%, with higher rates observed in remote areas with limited access to healthcare services, including Pulau Morotai. Maternal anemia not only affects maternal health but also increases the risk of obstetric complications, particularly postpartum hemorrhage. The World Health Organization (2021) identifies postpartum hemorrhage as a leading cause of maternal morbidity and mortality, accounting for approximately 25% of maternal deaths worldwide. It is defined as blood loss exceeding 500 milliliters after vaginal delivery or 1,000 milliliters following cesarean section (Khalid et al., 2020).

The association between anemia and postpartum hemorrhage is driven by complex pathophysiological mechanisms. Reduced hemoglobin levels impair oxygen delivery, leading to decreased uterine muscle tone and an increased risk of uterine atony (Sharma et al., 2022). Previous studies consistently demonstrate this relationship. Sharma et al. (2022) reported that anemic

pregnant women had a 2.5-fold higher risk of postpartum hemorrhage, while Khalid et al. (2020) found that severe anemia significantly increased the likelihood of obstetric complications, including postpartum hemorrhage (odds ratio = 3.4). These findings highlight anemia as an important predictor of postpartum hemorrhage, emphasizing the need for effective prevention and management strategies.

Despite national efforts, including iron supplementation programs, the high prevalence of anemia in Indonesia indicates persistent challenges related to dietary intake, health education, and access to iron supplements. Dewi et al. (2020) reported low adherence to iron tablet consumption among pregnant women in remote areas, largely due to gastrointestinal side effects and limited health education. Although iron supplementation is a key intervention recommended by the World Health Organization (2021), its effectiveness at the community level remains suboptimal.

Geographical barriers and limited healthcare accessibility in Morotai Jaya District further exacerbate this issue. Local studies indicate that shortages of healthcare personnel, inadequate medical facilities, and low utilization of antenatal care services contribute to the high prevalence of anemia among pregnant women (Hidayat et al., 2022). Moreover, the lack of locally specific data limits the development of targeted and effective interventions.

In the Libano Public Health Center area, preliminary data indicate that anemia prevalence among pregnant women exceeds 40%, with postpartum hemorrhage frequently reported, particularly among anemic mothers (District Health Office, 2023). However, no previous study has specifically examined the relationship between maternal anemia and postpartum hemorrhage in this setting. This gap represents a significant barrier to evidence-based policy development. Given that anemia during pregnancy is largely preventable, understanding its association with postpartum hemorrhage in this context is essential. Therefore, this study aims to investigate the relationship between anemia during pregnancy and the incidence of postpartum hemorrhage in the Libano Public Health Center area, with the goal of informing more effective, locally tailored health policies.

2. Research Method

Study Design

This study employed an analytical observational design with a retrospective approach. The data analyzed were secondary data obtained from the medical records of pregnant women in the Libano Public Health Center, Morotai Jaya District.

Study Setting and Period

The study was conducted over a six-month period, from January to June 2024, in the working area of the Libano Public Health Center, Morotai Jaya District, Indonesia.

Population and Sample

The study population included all pregnant women recorded in the medical records of the Libano Public Health Center during 2023. Sampling was conducted using purposive sampling. The inclusion criteria were pregnant women with complete data on hemoglobin levels and the incidence of postpartum hemorrhage. The exclusion criteria included women with significant comorbid conditions, such as coagulation disorders, and incomplete medical records.

Variables

The independent variable was anemia during pregnancy, categorized based on hemoglobin levels into mild anemia, moderate anemia, and severe anemia. The dependent variable was the incidence of postpartum hemorrhage. Potential confounding variables included maternal age, parity, interpregnancy interval, and nutritional status.

Instruments and Data Collection

The instruments used in this study included a data collection form, anemia classification guidelines based on standards from the World Health Organization, and medical record documentation protocols at the Libano Public Health Center. The data collected included hemoglobin levels, obstetric history, and documented cases of postpartum hemorrhage obtained from medical records.

Study Procedure

The study procedure began with obtaining permission from the Libano Public Health Center and approval from the ethics committee. Secondary data from the medical records of pregnant women in 2023 were then collected and screened according to the inclusion and exclusion criteria. Eligible data were coded and prepared for analysis of the independent and dependent variables.

Data Analysis

Data analysis was conducted using statistical software. Univariate analysis was performed to describe the frequency distribution of the study variables. Bivariate analysis was conducted using the chi-square test to determine the association between anemia during pregnancy and the incidence of postpartum hemorrhage. Multivariate analysis was performed using logistic regression to control for potential confounding variables.

Ethical Considerations

This study received ethical approval from the Ethics Committee of Institut Teknologi Sains dan Kesehatan RS dr. Soepraoen. All participants were provided with complete information regarding the study objectives and procedures. Informed consent was obtained prior to data collection, and confidentiality of patient data was strictly maintained.

3. Results and Discussion

3.1 Respondent Characteristics

A total of 100 respondents, consisting of pregnant women in the working area of the Libano Public Health Center in 2023, were included in this study. Respondent characteristics included maternal age, parity, interpregnancy interval, and nutritional status based on body mass index. These characteristics provide an overview of the study population.

Table 1. Respondent Characteristics

Characteristics	n	%
Maternal Age		
<20 years	15	15.0
20–35 years	70	70.0
>35 years	15	15.0
Parity		
Primiparous	40	40.0
Multiparous	50	50.0
Grand multiparous	10	10.0
Interpregnancy Interval		
<2 years	35	35.0
2–5 years	50	50.0
>5 years	15	15.0
Nutritional Status (Body Mass Index)		
Underweight (<18.5)	20	20.0
Normal (18.5–24.9)	60	60.0
Overweight (≥25)	20	20.0

Most respondents were aged 20–35 years (70.0%), representing the optimal reproductive age group. Half of the respondents were multiparous (50.0%), while primiparous and grand multiparous women accounted for 40.0% and 10.0%, respectively. Regarding interpregnancy interval, 50.0% had intervals of 2–5 years. In terms of nutritional status, 60.0% had a normal body mass index, while 20.0% were underweight and 20.0% were overweight.

3.2 Distribution of Postpartum Hemorrhage Incidence

Table 2. Distribution of Postpartum Hemorrhage Based on Anemia Status

Anemia Status	Postpartum Hemorrhage	No Postpartum Hemorrhage	Total	%
No anemia	5	35	40	12.5
Mild anemia	10	20	30	33.3
Moderate anemia	15	5	20	75.0
Severe anemia	8	2	10	80.0
Total	38	62	100	38.0

Postpartum hemorrhage occurred more frequently among women with anemia, particularly moderate anemia (75.0%) and severe anemia (80.0%). Women without anemia had the lowest proportion of postpartum hemorrhage (12.5%). Overall, 38.0% of respondents experienced postpartum hemorrhage, with an increasing trend corresponding to anemia severity.

3.3 Association Between Anemia During Pregnancy and Postpartum Hemorrhage (Bivariate Analysis)

Table 3. Association Between Anemia During Pregnancy and Postpartum Hemorrhage

Anemia Status	Postpartum Hemorrhage	No Postpartum Hemorrhage	Total	p-value
No anemia	5	35	40	0.001
Mild anemia	10	20	30	
Moderate anemia	15	5	20	
Severe anemia	8	2	10	
Total	38	62	100	

The chi-square test showed a statistically significant association between anemia during pregnancy and postpartum hemorrhage ($p < 0.05$). The proportion of postpartum hemorrhage increased progressively with anemia severity.

3.4 Factors Associated with Postpartum Hemorrhage (Multivariate Analysis)

Table 4. Factors Associated with Postpartum Hemorrhage

Variable	Odds Ratio (95% Confidence Interval)	p-value
Maternal age (<20 years)	2.1 (1.1–4.0)	0.020
Parity (grand multiparous)	1.8 (1.0–3.5)	0.045
Interpregnancy interval (<2 years)	2.5 (1.3–4.8)	0.010
Underweight nutritional status	1.6 (1.0–2.9)	0.050
Moderate anemia	4.5 (2.3–8.9)	<0.001
Severe anemia	6.8 (3.5–13.0)	<0.001

Multivariate analysis demonstrated that anemia during pregnancy, particularly moderate and severe anemia, was the most significant factor associated with postpartum hemorrhage. Other significant factors included younger maternal age, short interpregnancy interval, grand multiparity, and undernutrition.

The findings of this study confirm that anemia during pregnancy is a significant risk factor for postpartum hemorrhage, particularly among women with moderate and severe anemia. Reduced hemoglobin levels impair oxygen-carrying capacity, which adversely affects physiological functions, including effective uterine contraction (Smith et al., 2021). Consequently, the risk of uterine atony, the primary cause of postpartum hemorrhage, is substantially increased. These results are consistent with Gupta et al. (2022), who reported that women with severe anemia had a sevenfold

higher risk of postpartum hemorrhage compared to those with normal hemoglobin levels. Similarly, Kumar et al. (2021) demonstrated that anemia increases susceptibility to tissue hypoxia, leading to obstetric complications, including severe bleeding.

From a physiological perspective, anemia reduces uterine muscle elasticity due to inadequate oxygen supply. Chronic hypoxia in uterine tissues may result in ineffective contractions during labor and the postpartum period (Chen et al., 2020), explaining the higher risk observed in severe anemia cases. In addition, chronic iron deficiency may limit the body's capacity to regenerate hemoglobin following blood loss, further exacerbating the severity of postpartum hemorrhage (World Health Organization, 2021).

The identification of additional risk factors, such as younger maternal age (<20 years) and short interpregnancy intervals (<2 years), is also consistent with previous studies. Younger maternal age is associated with reproductive system immaturity, increasing vulnerability to obstetric complications (Hidayat et al., 2020). Meanwhile, short interpregnancy intervals limit maternal physiological recovery, thereby increasing the risk of both anemia and postpartum hemorrhage (Smith et al., 2021).

These findings highlight the importance of early detection and effective management of anemia during pregnancy as key strategies to prevent postpartum hemorrhage. Interventions should include iron and folic acid supplementation, along with strengthened antenatal education to improve adherence to iron intake (Dewi et al., 2020). Regular monitoring of hemoglobin levels is particularly crucial for high-risk groups, including younger mothers and those with short interpregnancy intervals. Improving access to maternal health services remains essential, especially in remote areas such as the Libano Public Health Center. Adequate healthcare resources and trained personnel are required to ensure early diagnosis and comprehensive management of high-risk pregnancies.

Furthermore, community-based approaches, such as education through integrated health service posts, can enhance awareness of optimal pregnancy spacing and anemia prevention strategies (Kumar et al., 2021). Despite these important findings, this study has several limitations. The retrospective design may introduce information bias, particularly due to incomplete medical records. In addition, socioeconomic factors were not included in the analysis, which may also influence the occurrence of anemia and postpartum hemorrhage. Future studies are recommended to explore these relationships in a broader and more comprehensive context.

4. Conclusion

Anemia during pregnancy was significantly associated with the incidence of postpartum hemorrhage, particularly among women with moderate and severe anemia. These findings highlight the importance of integrated preventive and curative interventions to reduce the risk of postpartum hemorrhage, including early detection of anemia, iron supplementation, and maternal health education. Additional risk factors, such as younger maternal age and short interpregnancy intervals, also require special attention within maternal and child health programs. With the implementation of appropriate strategies, the risk of postpartum hemorrhage can be minimized, contributing to a reduction in overall maternal mortality. This study provides a foundation for the development of more effective, evidence-based health policies, particularly in areas with a high prevalence of anemia.

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