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Relationship Between Body Mass Index and Anemia in Pregnancy and the Incidence of Primary Postpartum Hemorrhage at RSUD Blambangan Banyuwangi

[1]Izdihaar Yusriyyah*, [2]Purwo Sri Rejeki, [3]Andriyanti
[1] Midwife Education Study Program, Faculty of Medicine Universitas Airlangga, Indonesia*; email: Izdihaar.yusriyyah-2022@fk.unair.ac.id
[2]Department of Physiology, Sport Health Science Study Program, Faculty of Medicine Universitas Airlangga, Indonesia; email: purwo-s-r@fk.unair.ac.id
[3]Midwife Education Study Program, Faculty of Medicine Universitas Airlangga, Indonesia
*Correspondence

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Abstract
Introduction: *Primary PPH is a leading cause of maternal mortality, and maternal factors such as anemia and nutritional status measured by Body Mass Index (BMI) may influence its occurrence. However, existing evidence on the association between these factors and primary PPH remains inconsistent.* ***Objective:*** *This study aimed to analyze the relationship between BMI and anemia during pregnancy and the incidence of primary postpartum hemorrhage at RSUD Blambangan Banyuwangi.* ***Methods:*** *A retrospective case–control design was used involving 120 postpartum women, comprising 60 cases of primary PPH and 60 controls without PPH. Total sampling was applied using medical records from January to December 2024. Data analysis employed the Chi-Square test, and risk estimates were calculated using Odds Ratios (OR).* ***Results and Discussion:*** *The major causes of primary PPH included uterine atony (43.34%), cervical rupture (28.33%), retained placenta (20%), and perineal rupture (8.33%). Anemia showed a significant association with primary PPH ($p = 0.001$; $OR = 3.455$), indicating that anemic pregnant women had a 3.4-fold increased risk of experiencing PPH. Conversely, BMI did not demonstrate a significant relationship with PPH, suggesting that nutritional status may play a lesser role compared to hematological factors.* ***Conclusions:*** *Anemia during pregnancy is significantly associated with primary PPH, whereas BMI shows no significant association. Enhanced antenatal screening and effective management of anemia are essential for reducing the risk of PPH.*

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Introduction

Indicators of a population's health status can be assessed through maternal and infant mortality rates. Higher mortality rates reflect poorer national health quality (Kemenkes RI, 2023a). The Maternal Mortality Ratio (MMR) in Indonesia remains a major public health challenge. According to Kemenkes RI (2023b), the MMR is estimated at 305 per 100,000 live births, whereas the 2020 Population Census reported 189 per 100,000 live births. These figures position Indonesia as the country with the second-highest MMR among ASEAN nations (Kemenkes RI, 2024a). This stands in contrast to the Sustainable Development Goals (SDGs) 2030 target, which aims to reduce the MMR to below 70 per 100,000 live births (WHO, 2024).

This issue is reflected at the regional level in Banyuwangi Regency, which has experienced fluctuations and an overall increasing pattern of maternal mortality over the past four years: 18 cases (2020), 55 cases (2021), 25 cases (2022), and 28 cases (2023). These numbers place Banyuwangi as the district with the third-highest maternal mortality in East Java Province (Dinkes Jatim, 2024). Several maternal risk factors contribute to mortality, including anemia, chronic energy deficiency, obesity, comorbidities (such as cardiovascular disease and tuberculosis), and pregnancy complications. The leading causes of maternal death remain hemorrhage, hypertensive disorders of pregnancy, infection, and metabolic disturbances (Kemenkes RI, 2021).

Postpartum hemorrhage (PPH) is the most prevalent cause of maternal death, contributing to 30.3% of cases (Gitasari, 2019). Data from Dinkes Banyuwangi (2023) also indicate that hemorrhage accounts for 28% of maternal deaths. Primary PPH is defined as blood loss exceeding 500 mL within 24 hours after childbirth (Putra *et al*., 2020). Maternal hemoglobin status plays an essential role in influencing PPH outcomes. Watkins & Stem (2020) noted that hemoglobin levels below 10 g/dL increase the risk of uterine atony related hemorrhage by 20–25%. Additionally, a study conducted at DKT Gubeng Pojok Hospital in Surabaya found that anemic women had a 21-fold higher risk of experiencing PPH compared to non anemic women (Taqiyya *et al*., 2021).

Nutritional status, particularly Body Mass Index (BMI), is another important determinant of maternal health (Kemenkes RI, 2024b). The prevalence of obesity among pregnant women in East Java has reached 23.4% (Kemenkes RI, 2018). However, evidence regarding the association between BMI and PPH remains inconclusive. Kutchi *et al*. (2020) reported that obesity increases the risk of PPH by 2.21 times, whereas Moulana *et al*. (2019) identified no significant relationship. Research investigating the combined effect of BMI and anemia on PPH remains limited, and the role of BMI as a risk factor for primary PPH has yet to be clearly established.

In light of these considerations, this study employed an analytical observational design with a case–control approach to examine BMI and hemoglobin levels during pregnancy as risk factors for primary postpartum hemorrhage. The findings are expected to contribute to a better understanding of the interplay between these variables and the occurrence of primary postpartum hemorrhage.

Method

This study was conducted at RSUD Blambangan Banyuwangi from February to June 2025. An analytical observational design with a case–control approach was used. Respondents were divided into case and control groups and analyzed retrospectively. The sampling technique employed was total sampling, involving all postpartum women who experienced primary postpartum hemorrhage following vaginal delivery. The study

utilized secondary data obtained from maternal medical records at RSUD Blambangan Banyuwangi from January to December 2024. A total of 120 respondents met the inclusion criteria, consisting of 60 postpartum women with primary postpartum hemorrhage (case group) and 60 postpartum women without primary postpartum hemorrhage (control group), yielding a 1:1 ratio. Statistical analysis was conducted using the Chi-square test to compare differences in proportions between the two groups. Odds ratios (OR) were calculated to determine the strength of association between the variables examined and primary postpartum hemorrhage.

Results and Discussion

This study included postpartum women treated in the Delivery and Postpartum Wards of RSUD Blambangan Banyuwangi. A total of 120 participants were enrolled and classified into two groups: a case group with postpartum hemorrhage and a control group without postpartum hemorrhage. The study findings are presented below.

Table 1
Frequency distribution of postpartum women at RSUD Blambangan Banyuwangi from January to December 2024 based on sample characteristics

Characteristics	Category	Frequency (n)	Percentage (%)
Age	<20 years	13	10.83
	20-35 years	86	71.67
	>35 years	21	17.5
Education	Elementary School	27	22.5
	Junior High School	24	20
	Senior High School	53	44.17
	University	16	13.33
Worker	Housewife	91	75.8
	Farmer	5	4.2
	Private Employee	12	10
	Entrepreneur	3	2.5
	Civil Servant	4	3.3
	Teacher	5	4.2
Parity	Primipara	41	34.2
	Multipara	66	55
	Grande multipara	13	10.8
Interval of pregnancies	<2 years	48	40
	2-4 years	27	22.5
	>4 years	45	37.5
History of abortion	Never had an abortion	95	79.2
	1x	21	17.5
	>1x	4	3.3
Total		**120**	**100**

The results show that most postpartum mothers were aged 20–35 years (71.67%), representing the optimal reproductive age. Mothers younger than 20 years may have immature reproductive organs, whereas those older than 35 years typically experience decreased tissue elasticity and reduced uterine contractility, increasing risks of obstetric complications, including postpartum hemorrhage. Older maternal age is also associated with a higher prevalence of comorbidities such as hypertension, diabetes, and obesity (Hopisah *et al*., 2024; Putri *et al*., 2023).

Nearly half of the respondents had completed senior high school (44.17%). Higher educational levels are generally associated with improved awareness of pregnancy risks and greater utilization of health services (Rahmawati *et al*., 2023). The majority of respondents were housewives (75.8%), a condition that may influence physical workload and rest patterns, potentially contributing to maternal fatigue and impaired uterine contractility (Kumalasari & Widiastuti, 2022; Sumiati *et al*., 2023).

More than half of the respondents were multiparous (55%). High parity can lead to reduced uterine tone due to repeated stretching, increasing the likelihood of malpresentation, placental abnormalities, and postpartum hemorrhage. Conversely, primiparous women may experience increased resistance of the birth canal, which also contributes to complications (Dewie *et al*., 2020; Khotimah *et al*., 2024).

A notable proportion of respondents (40%) had a pregnancy interval of less than two years. Short interpregnancy intervals may lead to incomplete maternal nutritional recovery, suboptimal uterine function, and increased risks of anemia and postpartum hemorrhage (Khotimah *et al*., 2024; Ximenes *et al*., 2021). Most respondents (79.2%) had no history of abortion. However, previous abortions requiring curettage may cause endometrial scarring and reduced uterine contractility, predisposing to uterine atony (Lee *et al*., 2022; Wormer *et al*., 2024)

Table 2
Frequency distribution of postpartum women with primary postpartum hemorrhage at RSUD Blambangan Banyuwangi from January to December 2024 based on the causes of primary postpartum hemorrhage

Causes of PPH	Frequency (n)	Percentage (%)
Uterine atony	26	43.34
Placental retention	12	20
Perineal rupture	5	8.33
Portio rupture	17	28.33
Total	**60**	**100**

Among the 60 mothers who experienced primary postpartum hemorrhage, the most common cause was uterine atony (43.34%), followed by cervical rupture (28.33%), retained placenta (20%), and perineal rupture (8.33%). Primary postpartum hemorrhage typically results from uterine atony, placental abnormalities, genital tract trauma, or coagulation disorders (Sanjaya, 2015). These findings align with Nislawaty *et al*. (2024), who reported uterine atony, retained placenta, and genital tract lacerations as predominant causes of PPH.

The predominance of uterine atony is consistent with previous studies indicating that it accounts for 60–80% of PPH cases and remains a leading contributor to maternal mortality (Fatwaddin *et al*., 2022). Anemia further increases the likelihood of uterine atony due to reduced oxygen supply to uterine musculature (Dharmadi, 2017).

Cervical lacerations contributed significantly to hemorrhage, often associated with instrumental deliveries, precipitous labor, or macrosomic infants (Salazar *et al*., 2024; Suzuki, 2015). Retained placenta, identified in 20% of cases, is known to cause severe hemorrhage when placental detachment is incomplete or abnormal (Sunirah, 2021; Ximenes *et al*., 2021). Perineal rupture, though relatively infrequent, remains clinically important due to the potential for damage to major blood vessels (Ramar *et al*., 2025; Spinelli *et al*., 2021).

Table 3
Relationship between Body Mass Index (BMI) and the incidence of primary postpartum hemorrhage at RSUD Blambangan Banyuwangi from January to December 2024

BMI	Primary Postpartum Hemorrhage				*p-value*
	Cases		Controls		
	n	%	n	%	
Normal	6	10	14	23.3	
Overweight	14	23.3	10	16.7	0.130
Obesity	40	66.7	36	60	
Total	**60**	**100**	**60**	**100**	

The findings of this study indicate that the proportion of mothers with obesity was relatively high in both groups, specifically among those who experienced primary postpartum hemorrhage (66.7 percent) and those without primary postpartum hemorrhage (60 percent). The Chi-Square test showed that there was no significant association between BMI during pregnancy and the occurrence of primary postpartum hemorrhage ($p = 0.130$). However, the data trend suggests that higher BMI categories were associated with more severe postpartum bleeding in both groups.

This result is consistent with the study by Moulana *et al*. (2019), which also reported no significant relationship between BMI and postpartum hemorrhage. Similarly, Butwick *et al*. (2018) found that obesity did not increase the overall risk of primary postpartum hemorrhage, although class II and class III obesity were associated with a higher likelihood of severe bleeding of 1,000 mL or more. These findings indicate that obesity is not a direct precipitating factor of primary postpartum hemorrhage but may worsen bleeding severity through physiological mechanisms such as reduced uterine contractility, increased circulating blood volume, and altered hemostatic function. Evidence presented by Sayed *et al*. (2023) supports this interpretation, highlighting the ways in which obesity may contribute to obstetric complications through its effects on uterine atony and coagulation pathways.

The lack of a significant association in this study may be related to confounding factors that could not be assessed due to limitations in secondary medical record data, including incomplete documentation of labor duration, obstetric interventions, and prior bleeding history. BMI measured in late pregnancy may also not reflect nutritional status throughout gestation, and the high prevalence of obesity in both groups may have reduced detectable differences in risk. Nevertheless, elevated BMI remains clinically important due to its potential to worsen postpartum hemorrhage, and should therefore continue to be considered in risk assessment and intrapartum management.

Table 4
Relationship between anemia and the incidence of primary postpartum hemorrhage at RSUD Blambangan Banyuwangi from January to December 2024

Anemia	Primary Postpartum Hemorrhage				*p-value*	OR (95%)
	Cases		Controls			
	n	%	n	%		
Without anemia	22	36.7	40	66.7	0.001	3.455 (1.630-7.320)
Anemia	38	63.3	20	33.3		
Total	**60**	**100**	**60**	**100**		

The findings of this study indicate that anemia during pregnancy was more prevalent among mothers who experienced primary postpartum hemorrhage compared to those who did not. The Chi-Square test showed a significant association between anemia and the occurrence of primary postpartum hemorrhage ($p = 0.001$), with an odds ratio of 3.455, indicating that pregnant women with anemia had approximately a three point four times higher risk of developing primary postpartum hemorrhage.

These findings are consistent with the study by Omotayo *et al*. (2021), which reported that anemia increases the risk of postpartum hemorrhage by more than three times, and with the study by Ariyanti *et al*. (2022), which found a similar risk among pregnant women at the Juata Public Health Center. This consistency strengthens the evidence that anemia is an important risk factor for postpartum hemorrhage.

Physiologically, anemia reduces the ability of hemoglobin to transport oxygen to tissues, including the uterine muscles, resulting in less effective contractions after placental separation. Inadequate uterine contraction increases the risk of uterine atony, which is the leading cause of postpartum hemorrhage. Anemia also decreases maternal blood reserves, making mothers more prone to hypovolemic shock during bleeding. Hemostatic disturbances further worsen the condition, as iron deficiency and altered platelet function may impair blood clot formation. Decreased levels of thrombin and fibrinogen, as reported by Bukhari *et al*. (2022) and Vermeulen & Van de Velde (2022), also increase susceptibility to severe bleeding.

In summary, anemia in pregnancy contributes significantly to the occurrence of primary postpartum hemorrhage through mechanisms involving reduced uterine contractility, impaired hemostasis, and decreased tolerance to blood loss.

Conclusion

This study identified 60 cases of primary postpartum hemorrhage at RSUD Blambangan Banyuwangi, with uterine atony, retained placenta, cervical rupture, and perineal rupture as the leading causes. BMI during pregnancy showed no significant association with the occurrence of primary postpartum hemorrhage. Conversely, anemia was found to significantly increase the risk of primary postpartum hemorrhage, emphasizing the importance of early detection, prevention, and management of anemia during pregnancy as part of routine antenatal care to reduce the risk of hemorrhagecomplications.

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