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Original Research Paper

An Overview of Anemia Cases Among Third Trimester Pregnant Women at *Puskesmas* Tegalrejo, Yogyakarta

Safira Nurul Aini*, Dewi Rokhanawati
Department of Midwifery, Faculty of Health, Universitas Aisyiyah Yogyakarta, Indonesia
safiranurul232@gmail.com

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Abstract
Anemia remains a significant contributor to the rising maternal mortality rate (MMR) in recent years. In the Special Region of Yogyakarta, the prevalence of anemia among pregnant women increased from 14.23% in 2017 to 16.5% in 2021. Previous studies have shown that anemia during pregnancy may result in adverse maternal and fetal outcomes, including fetal growth restriction, premature delivery, low birth weight, congenital anomalies, and elevated risks of neonatal and perinatal mortality. This study aims to analyze the relationship between maternal age, interpregnancy interval, and nutritional status based on Mid-Upper Arm Circumference (MUAC), and the case of anemia among third-trimester pregnant women at *Puskesmas* (Public Health Center) Tegalrejo, Yogyakarta. A retrospective case–control design was used, involving 86 pregnant women with anemia (cases) and 86 without anemia (controls). Statistical analysis showed significant associations between all three factors and the case of anemia. At a 0.05 significance level, 70 respondents (81.4%) were of high-risk maternal age (<20 years or >35 years) (p = 0.000; OR = 13.542; 95% CI: 6.508–28.179); 62 respondents (72.1%) had a short interpregnancy interval (<2 years) (p = 0.000; OR = 7.996; 95% CI: 4.046–15.802); and 56 respondents (65.1%) had Chronic Energy Deficiency (CED) indicated by a MUAC of <23.5 cm (p = 0.000; OR = 6.160; 95% CI: 3.157–12.020). These findings confirm that maternal age, short interpregnancy intervals, and poor nutritional status are significant determinants of anemia in the third trimester.

Keywords: anemia; pregnancy; third trimester

1. Introduction

Anemia is a pathological condition characterized by a decrease in hemoglobin (Hb) concentration, hematocrit levels, or red blood cell counts below the recommended normal range, thereby reducing the red blood cells' capacity to transport oxygen to body tissues. This condition affects nearly all age groups, with a particularly high prevalence among pregnant women (Ahmed et al., 2019). Hemoglobin requirements vary based on physiological factors such as sex, age, and pregnancy status.

The World Health Organization (WHO) recommends maintaining a hemoglobin level of ≥11.0 g/dL during pregnancy (Wright et al., 2017). In 2019, WHO reported a global anemia prevalence of 29.9% among women of reproductive age, equating to over half a billion women aged 15 – 49 years. The prevalence among pregnant women was even higher, reaching 36.5% (World Health Organization, 2019).

According to the 2018 Basic Health Research Report by the Indonesian Ministry of Health, the prevalence of anemia among pregnant women in Indonesia remained high at 48,9% (Dinkes Kota Yogyakarta, 2021). In the Special Region of Yogyakarta, the trend has continued to rise within five years, from 14.23% in 2017 to 16.5% in 2021 (Dinkes Kota Yogyakarta, 2022).Anemia during pregnancy is associated with numerous adverse maternal and fetal outcomes. The diminished oxygen supply to the placenta may lead to fetal growth restriction, low birth weight, and maternal malnutrition, and it may also heighten the risk of maternal infections (Azmi & Wulandari, 2023). According to Murtiningih et al.

(2019) the increased susceptibility to infection may result from the rapid fetal growth that typically occurs in late pregnancy. Iron deficiency may further disrupt fetal cellular and brain development and increase the risks of premature birth, congenital abnormalities, and neonatal complications (Swastika, 2024; Debella et al., 2022). In addition, pregnant women with hemoglobin levels below 10 g/dL will experience suboptimal oxygen delivery to the brain, uterus, and other vital organs. This oxygen insufficiency can hinder effective uterine contractions, potentially leading to uterine atony and severe postpartum hemorrhage (Aryani & Rokhanawati, 2017).

Muthoharoh and Kartini (2022) added that additional risk factors for anemia during pregnancy include maternal age and pregnancy intervals. Women under 20 years or over 35 years are at increased risk, the former due to physiological and psychological immaturity and limited nutritional awareness, and the latter due to declining immune function. Irawati et al. (2021) also highlighted that pregnancy intervals of less than two years significantly contribute to the case of anemia. This is primarily because as they reduce the mother's opportunity to replenish nutrient stores and recover physiologically from pregnancy, delivery, and lactation.

A study by Lestari and Saptro (2022) reported that 21.28% of women in their third trimester were at risk of Chronic Energy Deficiency (CED), indicated by a Mid-Upper Arm Circumference (MUAC) ≤23.5 cm. CED may weaken maternal muscle strength during labor, increasing the risk of prolonged labor, postpartum hemorrhage, and even maternal mortality (Kemenkes RI, 2021). On the other hand, for infants, maternal CED can result in miscarriage, preterm birth, congenital anomalies, low birth weight, neonatal mortality, and growth abnormalities (Kemenkes RI, 2021; Lestari & Saptro, 2022). Maternal anemia, in further, can adversely affect neonatal outcomes, such as undernutrition that impairs the infant's growth. One contributing factor is insufficient iron intake during pregnancy, which hampers the formation of adequate hemoglobin concentrations necessary for fetal development (Azmi & Wulandari, 2023).

Anemia is further associated with elevated risks of preeclampsia, placenta previa, cesarean delivery, and increased rates of intrapartum and postpartum blood transfusion —5.1 per 1,000 in non-anemic women, with higher rates in anemic cases. It also contributes to primary postpartum hemorrhage (within 24 hours of delivery), alongside other risk factors such as maternal age, short birth intervals, fetal malposition or malformation, and a history of obstetric complications (Aryani & Rokhanawati, 2017). Neonates born to anemic mothers are at increased risk for low five-minute APGAR scores and face elevated risks of neonatal and perinatal mortality (Smith et al., 2019).

To address this issue, the *PERMENKES RI Nomor 21 Tahun 2021* (Indonesian Ministry of Health, through Regulation No. 21 of 2021), has implemented preventive measures including the provision of one iron tablet per day throughout pregnancy, with a minimum target of 90 tablets starting as early as possible and continuing into the postpartum period (Kemenkes RI, 2021).

A preliminary study conducted at Tegalrejo Health Center on July 6, 2023, indicated a sharp rise in the prevalence of anemia among third-trimester pregnant women: 29.84% in 2020, 63.31% in 2021, and 69.16% in 2022. This prevalence ranked second highest among health centers in Yogyakarta City (Dinkes D.I Yogyakarta, 2022). Based on the background and the findings of this preliminary study, the researcher was motivated to conduct a study entitled: "An Overview of Anemia Cases Among Third-Trimester Pregnant Women at Tegalrejo Health Center, Yogyakarta."

2. Research Method

An observational analytic method with a retrospective case–control design was implemented in this study, based on quantitative data. The objective was to identify the factors associated with anemia among third-trimester pregnant women. The analysis was conducted by comparing data from the case and control groups according to their exposure status.

The primary data source for this research was the cohort records documented in the maternal health registers at Tegalrejo Public Health Center, Yogyakarta, covering the period from January to December 2022. The case group consisted of 86 third-trimester pregnant women diagnosed with anemia, defined as having hemoglobin (Hb) levels below 11 g/dL. Meanwhile, a total of 86 control subjects were selected using purposive sampling, based on predefined inclusion and exclusion criteria.

Medical of third-trimester pregnant women were comprehensively documented in the cohort books and included the following variables: (1) maternal age (<20 years or 20–35 years), (2) interpregnancy interval (<2 years), and (3) Mid-Upper Arm Circumference (MUAC) <23.5 cm. These variables served as the inclusion criteria for participant selection, while incomplete medical records were set as the exclusion criterion. Data analysis was performed using the Chi-Square statistical test to determine the relationships between variables. Ethical clearance for this study was obtained from the Ethics Committee of Universitas 'Aisyiyah Yogyakarta, approved on December 22, 2023, under reference number No. 1849/KEP-UNISA/XII/2023.

3. Results and Discussion

3.1. Univariate Analysis Results

The subjects of this study consisted of all third-trimester pregnant women who visited *Puskesmas* Tegalrejo throughout 2022, totaling 172 participants. These were equally divided into two groups: 86 participants in the case group (with anemia) and 86 in the control group (without anemia). Table 1 presents the frequency distribution of key determinants of anemia among third-trimester pregnant women, including maternal age, interpregnancy interval, and nutritional status based on Mid-Upper Arm Circumference (MUAC) at *Puskesmas* Tegalrejo in 2022.

Table 1. Frequency Distribution of Anemia Determinants Among Third-Trimester Pregnant Women at Tegalrejo Public Health Center, 2022

Determinants	Anemia		Non-Anemia	
	(n)	(%)	(n)	(%)
Maternal Age				
At-risk (< 20 years or >35 years)	70	81.4	21	24.4
Not at-risk (20 – 35 years)	16	18.6	65	75.6
Interpregnancy Interval				
At-risk (< 2 years)	62	72.1	21	24.4
Not at-risk (≥ 2 years)	24	27.9	65	75.6
Nutritional Status (based on MUAC)				
CED (< 23.5 cm)	56	65.1	20	23.3
Not CED (≥ 23.5 cm)	30	34.9	66	76.7
Total	86	100	86	100

Source: Secondary Data, 2022

As shown in Table 1, out of 172 third-trimester pregnant women, the majority of respondents with anemia fell into the at-risk maternal age group (<20 years or >35 years), accounting for 70 individuals (81.4%). Additionally, 62 women with anemia (72.1%) had an interpregnancy interval of less than two years. Meanwhile, 56 anemic respondents (65.1%) were classified as having Chronic Energy Deficiency (CED).

3.2. Bivariate Analysis Results

The bivariate analysis in this study was conducted using the Chi-Square test, performed with IBM SPSS Statistics Version 26. A statistically significant relationship was identified when the p-value from the test was less than 0.05 (p-value < 0.05).

Table 2 presents the cross-tabulation results examining the relationship between key determinants—maternal age, interpregnancy interval, and maternal nutritional status as indicated by Mid-Upper Arm Circumference (MUAC)—and the occurrence of anemia among third-trimester pregnant women at *Puskesmas* Tegalrejo, Yogyakarta, in 2022.

Table 2. Bivariate Analysis of Anemia Determinants Among Third-Trimester Pregnant Women at *Puskesmas* Tegalrejo, Yogyakarta, 2022

Determinants	Case Group (Anemia)		Control Group (Non-Anemia)		*p-value*	*OR*	95% *CI*	
	N	%	N	%			*Lower*	*Upper*
Maternal Age								
At-risk (<20 or >35 years)	70	81.4	21	24.4				
Not at-risk (20 – 35 years)	16	18.6	65	75.6	0.000	13.542	6.508	28.179
Interpregnancy Interval								
At-risk (< 2 years)	62	72.1	21	24.4				
Not at-risk (≥ 2 years)	24	27.9	65	75.6	0.000	7.996	4.046	15.802
Nutritional Status (based on MUAC)								
CED (< 23.5 cm)	56	65.1	20	23.3				
Non CED (≥ 23.5 cm)	30	34.9	66	76.7	0.000	6.160	3.157	12.020
Total	**86**	**100**	**86**	**100**				

Source: Secondary Data, 2022

In Table 2. the results of the Chi-Square test analysis on the three determinants show that the p-value <0.05 is 0.000, then Ha is accepted or there is a significant relationship between the three risk factors and the incidence of anemia in the third trimester pregnant women. From the results of the analysis, it was found that the variable of maternal age (OR = 13.542, 95% CI: 6.508 - 28.1790), with a risky age of <20 years and >35 years has a 13.542 times greater chance of experiencing anemia; compared to mothers who have an age range of 20-35 years. The variable of interpregnancy interval (OR = 7.996, 95% CI: 4.046 - 15.802), with a risky interpregnancy interval of <2 years has a 7.996 times greater chance of experiencing anemia compared to mothers who have a pregnancy interval of ≥2 years. Meanwhile, the nutritional status variable is based on MUAC (OR = 6.160, 95% CI: 3.157 - 12.020), with the nutritional status of CED mothers with a MUAC size of <23.5 cm, there is a 6.160 times greater chance of experiencing anemia compared to pregnant women who have good nutritional status or have no CED with a MUAC size of ≥23.5 cm.

3.3.Discussion

3.3.1.The Relationship Between Anemia and Maternal Age

The results of the analysis revealed that the odds ratio (OR) for the maternal age variable was 13.542. This indicates that women who become pregnant at a high-risk age (under 20 years or over 35 years) are 13.5 times more likely to develop anemia compared to those who conceive within the optimal reproductive age range of 20 to 35 years. These findings align with a study by Davidson et al. (2022), who emphasized that the biologically and psychologically ideal age range for pregnancy is between 20 and 35 years, during which reproductive functions are generally more stable and efficient, and the risk of complications is minimized.

Pregnancy in women under the age of 20 is generally classified as adolescent pregnancy, a developmental stage in which the female body is not yet fully mature either biologically or

psychologically to support a healthy gestation. At this age, critical reproductive organs such as the uterus and pelvis may not have reached anatomical maturity, thereby increasing the risk of pregnancy-related complications. This biological immaturity is supported by Dewi et al. (2021), who reported that pregnancies among individuals younger than 20 are associated with heightened medical risks, as the reproductive system may not yet be adequately prepared for conception and fetal development. From a psychological standpoint, adolescent pregnancies are also considered emotionally unstable, which may elevate the risk of postpartum mental health issues, such as baby blues and depression (Ramadhanty & Surjaningrum, 2022).

Furthermore, from a physiological perspective, adolescent girls still require adequate nutrition to support their own growth and development. When pregnancy occurs during this stage, nutritional demands increase substantially, as the mother must share her nutrient intake with the developing fetus. This situation significantly increases the risk of anemia, especially when the pregnant adolescent has limited awareness of the importance of prenatal nutrition. Inadequate intake may lead to nutrient competition between mother and fetus. In addition, pregnancy triggers considerable physiological changes, including a 20–30% increase in blood volume, which is essential for maintaining an adequate oxygen and nutrient supply to the growing fetus (Sari et al., 2021).

These findings are further supported by a study conducted by Muthoharoh and Kartini (2022), that advancing maternal age is associated with an increased probability of pregnancy-related complications, including anemia.

Similarly, Jusoh et al. (2015) reported that women aged 20–35 represent a biologically stable reproductive group, with well-functioning reproductive organs and a lower risk of anemia compared to those below 20 or above 35 years.

As previously discussed, pregnancies occurring after the age of 35 are often associated with the early stages of physiological degeneration, during which various bodily functions begin to decline. This degeneration may impair maternal health and increase vulnerability to complications. In particular, the muscles of the birth canal may lose elasticity, potentially complicating labor and elevating the risk of fetal abnormalities. Furthermore, pregnancies at advanced maternal age are associated with an increased risk of hypertensive disorders, preeclampsia, premature rupture of membranes, obstructed labor, postpartum hemorrhage, and low birth weight (<2,500 grams) (Komariah & Nugroho, 2019).

3.3.2. The Relationship Between Anemia and Interpregnancy Interval

The analysis of the interpregnancy interval variable produced an odds ratio (OR) of 7.996. This indicates that mothers with a short interpregnancy interval—defined as less than two years—are 7.996 times more likely to experience anemia compared to those with an interval of two years or more. These findings are consistent with the study by Deriba et al. (2020) which emphasized the role of birth spacing in determining maternal health outcomes. An interpregnancy interval of more than two years is considered ideal, as it allows sufficient physiological recovery following the cumulative demands of pregnancy, childbirth, and breastfeeding.

Short interpregnancy intervals increase the risk of anemia because the reduced recovery time limits the body's ability to replenish essential nutrients. In such cases, the maternal body must once again meet the nutritional demands of a developing fetus, despite not having fully restored its own reserves. As a result, competition for nutrients between the mother and fetus becomes more intense, particularly when maternal nutritional stores remain insufficient (Sjahriani & Faridah, 2019).

The findings of this study are also aligned with findings by Irawati et al. (2021) and Ahmed et al. (2019), who similarly confirmed a significant association between short interpregnancy intervals and maternal anemia. Furthermore, birth spacing of less than two years not only elevates the risk of anemia but is also associated with other adverse outcomes, including a higher risk of miscarriage, low birth

weight (<2,500 grams), and suboptimal growth and development in early childhood (Zuliyanti & Krisdiyanti, 2022).

3.3.3. The Relationship Between Anemia and Nutritional Status Based on Mid-Upper Arm Circumference (MUAC)

The analysis of the maternal nutritional status variable based on MUAC yielded an odds ratio (OR) of 6.160. This indicates that pregnant women classified as having Chronic Energy Deficiency (CED), identified by MUAC measurements of less than 23.5 cm, were 6.16 times more likely to develop anemia compared to those with adequate nutritional status (MUAC ≥ 23.5 cm). This finding aligns with the results of Lestari and Saptro (2022), who reported that 21.87% of respondents with MUAC measurements below 23.5 cm were diagnosed with anemia. Maternal nutritional status during pregnancy is strongly influenced by dietary intake, as nutritional demands significantly increase to support both maternal metabolism and fetal development. Inadequate nutrient intake compromises maternal well-being and fetal growth. In this context, maternal undernutrition or CED can directly contribute to the development of anemia and has also been associated with higher risks of low birth weight and fetal mortality.

A similar pattern was observed in a study by Davidson et al. (2022) which found that among pregnant women with MUAC measurements below 23.5 cm, 45 cases of anemia were reported at Ampel Public Health Center, with a prevalence of 23.31%. Meanwhile, at *Puskesmas* Gladagsari, 62 anemic cases were identified among women with CED, yielding a slightly higher prevalence of 25.21%.

The elevated risk of anemia in women with MUAC < 23.5 cm may be attributed to reduced protein-energy intake and decreased bioavailability of essential micronutrients, including hematopoietic components such as folic acid and vitamin B12 (Proverawati, 2021).

Poor maternal nutritional status has also been linked to adverse neonatal outcomes, including impaired fetal growth and a heightened risk of childhood stunting. According to Setiyaningsih et al. (2023), maternal undernutrition during pregnancy that often leading to anemia is a major contributing factor to stunting in early childhood. This is supported by Engla Pasalina et al. (2022), who emphasized that insufficient nutrient intake during pregnancy may hinder optimal fetal growth and predispose infants to developmental delays. Among these essential nutrients, iron plays a central role in supporting both maternal physiological adaptation and fetal development. Hence, maternal iron status serves as a crucial determinant of neonatal growth and overall health (Setiyaningsih et al., 2023).

4. Conclusion

Third trimester pregnant women who are at greater risk of experiencing anemia are those who have a risky age (<20 years and >35 years) (81.4%), who have a risky interpregnancy interval (<2 years) (72.1%), and who have a nutritional of CED (Chronic Energy Deficiency) (MUAC) <23.5 cm) (65.1%). There is a statistically significant relationship between maternal age determinants (p-value: 0.000; OR=13.542; 95% CI: 6.508 - 28.179), interpregnancy interval (p-value: 0.000; OR=7.996; 95% CI: 4.046 - 15.802), and nutritional status based on MUAC (Upper Arm Circumference) (p-value: 0.000; OR=6.160; 95% CI: 3.157 - 12.020).

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