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Correlation between Upper Arm Circumference and Anemia Status in Third Trimester Pregnant Women at Margasari Community Health Center

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Abstract *Anemia during pregnancy remains a public health problem in many countries, including Indonesia, especially among pregnant women in their third trimester who have increased physiological needs for iron and supporting nutrients. Maternal nutritional status is one of the factors that influence the incidence of anemia, one of which can be measured through Mid-Upper Arm Circumference (MUAC) as a simple indicator of the body's energy and protein reserves. This study aims to determine the relationship between LISA and the incidence of anemia in third-trimester pregnant women in the working area of the Margasari Community Health Center (UPTD Puskesmas Margasari). This study used an observational analytical design with a cross-sectional approach. A sample of 30 third-trimester pregnant women was selected using purposive sampling. LISA measurements were taken using a non-elastic measuring tape, while anemia status was determined based on hemoglobin levels using WHO standards. Data analysis was performed using Fisher's Exact Test with a significance level of 0.05. The results showed a higher proportion of anemia in pregnant women with LISA < 23.5 cm compared to the group of women with LISA ≥ 23.5 cm. Statistical tests showed a significant relationship between LILA and the incidence of anemia (p = 0.004). The conclusion of this study is that maternal nutritional status based on LILA measurements is significantly related to the incidence of anemia in third trimester pregnant women. The LILA indicator can be used as an early screening tool in antenatal care services to prevent the risk of anemia and pregnancy complications.*

Keywords: *Anemia; Nutritional Status; Pregnant Women; Test For Hemoglobin; Third Trimester.*

1. INTRODUCTION

Anemia during pregnancy remains one of the global health issues that significantly impacts the health of mothers and fetuses. The World Health Organization (WHO, 2024) reports that approximately 37% of pregnant women worldwide experience anemia, with higher rates in low- to middle-income countries. Anemia during pregnancy is often associated with an increased risk of postpartum hemorrhage, preterm birth, low birth weight (LBW), cognitive developmental disorders in children, and increased maternal and neonatal morbidity and mortality. A UNICEF report (2023) confirms that iron deficiency anemia accounts for more than 60% of anemia cases in pregnant women, especially in South Asia and Southeast Asia. This illness demonstrates that anemia is a public health concern that calls for thorough and long-term intervention in addition to being a nutritional issue.

In Indonesia, anemia during pregnancy remains a serious challenge in efforts to improve the health of mothers and babies. According to the 2022 SDKI national survey report, the prevalence of anemia in pregnant women reached 48.9%, indicating that nearly one in two pregnant women experience anemia during pregnancy. Data from the Indonesian Ministry of

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Health (2023) shows that the highest prevalence of anemia occurs in the third trimester of pregnancy due to increased physiological needs for iron and plasma volume. In addition to micronutrient factors, social determinants and the mother's initial nutritional status also play an important role in the development of anemia during pregnancy. One of the nutritional status indicators widely used in midwifery practice is Upper Arm Circumference (UAC). Upper Arm Circumference (UAC) is a simple anthropometric indicator that reflects the mother's nutritional status before and during pregnancy. Pregnant women with a UAC value < 23.5 cm are at risk of Chronic Energy Deficiency (CED), a condition that can increase the risk of anemia, complicated childbirth, and intrauterine growth disorders (Rahayu & Fitriana, 2021). A study by Rukmana et al. (2022) showed that pregnant women with CEE are 2.8 times more likely to experience anemia than pregnant women with normal nutritional status. A similar study by Hasibuan and Dewi (2020) found that low LILA values were significantly correlated with subnormal hemoglobin levels in the third trimester of pregnancy, where increased nutritional needs were not matched by adequate intake.

Physiologically, the relationship between LILA and anemia is explained through the mechanism of long-term nutritional reserve deficiency. Low LILA reflects low muscle mass and body energy reserves, including iron and protein reserves needed for hemoglobin synthesis (Sakti et al., 2022). Pregnant women with poor nutritional status tend to have insufficient iron supplies to meet the increased physiological needs during pregnancy. This is reinforced by the maternal nutrition model proposed by Black et al. (2020), which explains that poor nutritional status before pregnancy will affect the body's ability to provide essential nutrients, including iron, folate, and vitamin B12. Various studies support a significant relationship between LILA and anemia in pregnancy. Sari & Pratiwi (2021) reported a significant relationship between LILA values and hemoglobin levels with a p-value < 0.05 in 112 pregnant women in West Java. Similar findings were reported by Atikah and Rini (2022) in a population of pregnant women in NTB, that mothers with LILA < 23.5 cm had a 3 times higher risk of anemia compared to mothers with normal LILA. In addition, research by Wulandari et al. (2023) showed that nutritional interventions in the form of increased consumption of animal protein and iron supplementation had a positive effect on increasing hemoglobin levels in mothers with low LILA.

However, several studies have shown a weak or insignificant relationship between LILA and anemia, especially in populations that consistently take iron supplements and have access to nutritious food (Utami et al., 2021). This inconsistency indicates a research gap regarding the role of LILA as a predictor of anemia in various demographic and geographic contexts.

Behavioral factors such as consumption, family support, food access, and supplementation compliance are mediating variables that can weaken or strengthen this relationship.

The context of this study is increasingly relevant given that many primary health care facilities in Indonesia, including the Margasari Community Health Center (UPTD Puskesmas Margasari), still face high rates of anemia in pregnant women despite the implementation of the Iron Tablet Supplementation (TTD) program. Non-compliance with consumption, low nutritional reserves prior to pregnancy, and a lack of anthropometric-based nutritional status screening are real challenges in the implementation of maternal health services. Based on this background, this study was conducted to analyze the relationship between Upper Arm Circumference (UAC) and anemia in third trimester pregnant women at the Margasari Community Health Center. The results of this study are expected to provide scientific evidence for health workers in the use of UAC as a predictor of anemia and to support early detection-based prevention strategies in primary care.

2. RESEARCH METHOD

Design

This study used an observational analytical design with a cross-sectional approach, in which measurements of Upper Arm Circumference (UAC) and anemia status were taken at the same time without intervention. This design was chosen to determine the relationship between maternal nutritional status based on UAC values and the incidence of anemia in third trimester pregnant women directly in the study population. This approach is appropriate when the research objective is to identify correlations or associations between variables in a specific population.

Research Location and Time

The study was conducted at the Margasari Community Health Center, a primary health care facility serving an area with a high population of pregnant women. The location was chosen due to the high rate of anemia reported by nutrition programs and the area's readiness to support research activities. The study was conducted from September 2025 to November 2025, covering the preparation stage, data collection, and final analysis.

Research Population and Sample

The population in this study included all pregnant women in their third trimester who were registered in the maternal health care program in the Margasari Community Health Center working area during the study period. Sampling was conducted using purposive sampling, considering the characteristics of respondents that were relevant to the research objectives.

Inclusion criteria included pregnant women in their third trimester with a gestational age of ≥ 28 weeks, who had a complete KIA book, and who were willing to participate by signing an informed consent form.

The exclusion criteria were established to avoid research bias, namely pregnant women with anemia-related comorbidities such as thalassemia or chronic hematological disorders, as well as respondents who were absent at the time of data collection or refused to undergo the examination procedure. Based on these criteria, a total of 30 eligible respondents were obtained, a number deemed adequate for analysis in a cross-sectional study design aimed at identifying relationships between variables.

Researh Variabel

This study consists of two main variables, namely independent and dependent variables. The independent variable in this study is Upper Arm Circumference (UAC) as an indicator of maternal nutritional status, which is measured in centimeters (cm) using standard anthropometric procedures. The dependent variable is anemia status, which is determined based on hemoglobin (Hb) levels through laboratory test results and classified according to WHO standards, where Hb levels < 11 g/dL are categorized as anemia.

Research Instruments

The research instruments used included a non-elastic LILA tape measure to measure Upper Arm Circumference at the midpoint between the acromion and olecranon with an accuracy of 0.1 cm, a digital hematology analyzer or HB meter to check hemoglobin levels in accordance with laboratory standard operating procedures, and a checklist containing the respondent's identity, LILA measurement results, and hemoglobin values. All instruments used were verified for suitability by laboratory staff and Puskesmas nutrition surveillance personnel to ensure the accuracy and consistency of measurement results before the study was conducted.

Data Collections

Data collection was carried out through several systematic stages, beginning with coordination between the Community Health Center, midwife coordinator, and posyandu cadres to identify respondents who met the research criteria, followed by socialization and completion of informed consent by respondents. Next, LILA measurements were taken using a measuring tape according to standard procedures, namely with the respondent standing upright, arms relaxed, and measurements taken on the non-dominant arm. Hemoglobin levels were checked using a digital method in accordance with applicable laboratory procedures. All measurement data were then recorded on a checklist and re-verified to ensure accuracy and minimize the risk of input errors.

Data Analysis

The data were analyzed in several stages, beginning with descriptive analysis in the form of frequency distribution, percentages, mean values, and standard deviations to describe the characteristics of the respondents and the values of the research variables. Next, a normality test was performed using Shapiro–Wilk because the sample size was less than 50 respondents. Bivariate analysis was performed to test the relationship between variables using the Chi-square test if the data met the test assumptions, or alternatively Fisher's Exact Test if the data distribution did not meet the requirements of the Chi-square test. All tests were performed at a significance level of $\alpha = 0.05$ so that a $p\text{-value} < 0.05$ was interpreted as a statistically significant relationship.

3. RESULTS AND DISCUSSION

Result

Respondent Characteristics

This section presents an overview of the basic characteristics of the research respondents to provide context for the demographic distribution of the sample before further analysis of the research variables is conducted. The characteristics presented include age, parity, education, and history of iron tablet consumption.

Table 1. Distribution of Respondent Characteristics (n = 30).

Karakteristik	Kategori	Frekuensi (n)	Persentase (%)
Usia	< 20 tahun	5	16.7
	20–35 tahun	21	70.0
	> 35 tahun	4	13.3
Paritas	Primigravida	11	36.7
	Multigravida	19	63.3
Pendidikan	SD	4	13.3
	SMP	8	26.7
	SMA	13	43.3
	Perguruan Tinggi	5	16.7
Konsumsi Tablet Fe	Teratur	12	40.0
	Tidak teratur	18	60.0

Table 1 shows that most respondents were in the 20–35 age group (70.0%), which is the healthy reproductive age category. Based on parity status, the majority of respondents were multigravida (63.3%), while the rest were primigravida (36.7%). The highest level of education among pregnant women was high school (43.3%), indicating that most respondents had a secondary education. In addition, 60.0% of respondents did not consume iron tablets regularly, while 40.0% consumed iron tablets as recommended. This distribution provides an overview that most respondents have characteristics that could potentially affect their anemia status, especially related to iron tablet consumption habits during pregnancy.

Distribution of Upper Arm Circumference (UAC) of Respondents

This section presents the distribution of Upper Arm Circumference (UAC) categories among respondents as an indicator of the nutritional status of pregnant women. UAC categories are grouped into those at risk of Chronic Energy Deficiency (CED) and those not at risk according to anthropometric measurement standards for pregnant women.

Table 2. Distribution of Upper Arm Circumference (UAC) of Respondents (n = 30).

Kategori LILA	Kriteria	Frekuensi (n)	Persentase (%)
Berisiko KEK	< 23,5 cm	11	36.7
Tidak Berisiko	≥ 23,5 cm	19	63.3
Total		30	100

Table 2 shows that most respondents were in the non-risk category for KEK with a LILA value ≥ 23.5 cm, namely 19 respondents (63.3%). In contrast, 11 respondents (36.7%) were identified as being at risk of KEK with a LILA value < 23.5 cm. This distribution indicates that more than one-third of pregnant women in their third trimester in this study had inadequate nutritional status based on the LILA indicator, thereby potentially increasing the risk of pregnancy-related health problems, including anemia and obstetric complications.

Respondents' Anemia Status

This section presents an overview of anemia status in pregnant women in their third trimester who participated in the study. Anemia status was determined based on hemoglobin (Hb) levels, with levels below 11 g/dL categorized as anemia according to WHO standards.

Table 3. Distribution of Anemia Status in Pregnant Women in the Third Trimester (n = 30).

Status Anemia	Kriteria Hb	Frekuensi (n)	Persentase (%)
Anemia	< 11 g/dL	14	46.7
Tidak Anemia	≥ 11 g/dL	16	53.3
Total		30	100

Table 3 shows that 14 respondents (46.7%) had anemia based on hemoglobin test results, while 16 respondents (53.3%) were in the non-anemic category. These findings indicate that nearly half of the third-trimester pregnant women in this study had anemia, suggesting that anemia remains a significant health issue among pregnant women in the Margasari Community Health Center working area. This condition indicates the need for attention to risk factors associated with anemia, including nutritional status and compliance with iron tablet consumption.

Analysis of the Relationship between Upper Arm Circumference (UAC) and Anemia Status

This section presents the results of bivariate analysis aimed at determining the relationship between Upper Arm Circumference (UAC) categories and anemia status in pregnant women in their third trimester. The analysis was performed using Fisher's Exact Test, because one of the frequency cells had a value <5, which did not meet the assumptions of the Chi-square test.

Table 4. *Relationship between Upper Arm Circumference (UAC) and Anemia Status*.

Kategori LILA	Anemia n (%)	Tidak Anemia n (%)	Total n (%)
< 23,5 cm (Berisiko KEK)	9 (81.8%)	2 (18.2%)	11 (36.7%)
≥ 23,5 cm (Tidak Berisiko)	5 (26.3%)	14 (73.7%)	19 (63.3%)
Total	14 (46.7%)	16 (53.3%)	30 (100%)

Uji Fisher’s Exact Test: $p = 0.004$

Table 4 shows differences in the distribution of anemia status based on Upper Arm Circumference (UAC) categories. Most pregnant women in the KEK risk category (UAC < 23.5 cm) experienced anemia, namely 9 respondents (81.8%), while only 2 respondents (18.2%) did not experience anemia. Conversely, in the group of pregnant women with LILA ≥ 23.5 cm, most were in the non-anemic category (73.7%) and only 26.3% had anemia. The results of Fisher's Exact Test showed a p-value of 0.004, indicating a statistically significant relationship between Upper Arm Circumference and anemia status in third-trimester pregnant women. These findings suggest that the lower the nutritional status of the mother based on the LILA indicator, the higher the risk of anemia during pregnancy.

Discussion

The results of this study indicate that there is a significant relationship between Upper Arm Circumference (UAC) and the incidence of anemia in pregnant women in their third trimester in the working area of the Margasari Community Health Center. Bivariate analysis shows that pregnant women with a UAC < 23.5 cm have a much higher proportion of anemia compared to women with a UAC ≥ 23.5 cm. Statistical testing using Fisher's Exact Test showed a p-value of 0.004, indicating a significant relationship between the two variables. These findings reinforce the understanding that poor maternal nutritional status, particularly that reflecting low body energy and protein reserves, is closely related to decreased hemoglobin levels during pregnancy.

Physiologically, this relationship can be explained through the theory of maternal nutrient metabolism. According to a study by Young et al. (2021), low LILA reflects low muscle mass and body protein reserves, which limits the raw materials for hemoglobin synthesis. Additionally, research by Mitchell and Stoecker (2020) shows that mothers with poor nutritional status have lower iron reserves before pregnancy, making them more susceptible to anemia in the third trimester when physiological needs increase sharply. This condition is exacerbated by increased plasma volume during pregnancy, which causes physiological hemodilution, especially in the third trimester, as explained by Owais et al. (2019). These findings are consistent with research conducted by Rahim & Lubis (2022), who found that pregnant women with LILA < 23.5 cm had a three times higher risk of anemia compared to women with normal LILA. A study in South Sumatra by Nurbaya and Ramadhani (2023) also reported a significant association between nutritional status based on LILA and hemoglobin levels in third-trimester pregnant women, with a pattern of anemia prevalence similar to the findings of this study. Consistent findings were demonstrated in a study by Konate et al. (2020) in Senegal, which reported that maternal anthropometric measurements, including LILA, are valid predictors of anemia and low birth weight.

In addition to studies supporting a significant relationship, there are several studies that found no meaningful relationship between anthropometric-based nutritional status and anemia. For example, a study by Alkaff et al. (2021) in the urban area of Samarinda reported no significant relationship between LILA and anemia in pregnant women. This difference is likely influenced by factors such as more optimal iron supplementation interventions, better compliance with iron tablet consumption, and access to foods high in animal protein. Similar findings were reported in a longitudinal study by Harding et al. (2022), which showed that nutritional interventions and pregnancy education were able to reduce the negative impact of low nutritional status before pregnancy on late-trimester anemia. Thus, the differences in results between studies indicate that the relationship between LILA and anemia is not only influenced by biological factors but also by contextual factors such as access to health services, maternal education, consumption habits, and social support. These findings are consistent with the model of maternal health social determinants by Blake et al. (2020), which explains that anemia is a multifactorial condition and does not depend solely on one biological indicator.

The clinical implications of this study are highly relevant to midwifery services in primary health care facilities. Given that LILA is a simple, inexpensive measurement method that can be performed by health workers at various levels, this indicator can be used as an initial screening tool for anemia risk during pregnancy. A study by Kim & Park (2022) emphasizes that anthropometric indicators such as LILA should be included in the antenatal care (ANC) algorithm as part of early prevention efforts for pregnancy complications. In addition, the results of this study reinforce the importance of nutrition promotion strategies and increased iron intake, including increased consumption of animal protein, non-heme iron sources, and education on compliance with iron tablets. Furthermore, continuous support programs such as classes for pregnant mothers and home-based monitoring have been shown to increase mothers' awareness and behavior regarding pregnancy health, as reported by Siregar & Oktaviani (2023). Overall, this study confirms that maternal nutritional status before and during pregnancy is an important factor influencing the incidence of anemia. Identifying at-risk mothers through simple indicators like LILA can help healthcare workers intervene earlier and more effectively. These findings contribute scientifically to the planning and optimization of maternal nutrition programs at the primary healthcare level.

4. CONCLUSION

This study aims to determine the relationship between Upper Arm Circumference (UAC) and the incidence of anemia in third trimester pregnant women at the Margasari Community Health Center. Based on the analysis results, it was found that maternal nutritional status as measured by UAC has a significant relationship with the status of anemia in pregnant women. Mothers with lower MUAC tended to have a higher risk of anemia compared to mothers with MUAC measurements in the normal range. This indicates that MUAC measurement can be used as a simple and effective indicator to detect the risk of anemia in pregnant women in primary health care services. Scientifically, these findings reinforce the theory that maternal nutritional status plays an important role in the physiology of hemoglobin formation and the provision of nutritional reserves needed during pregnancy. The clinical implications of this study emphasize the importance of screening nutritional status early in pregnancy using LILA as part of standard antenatal care (ANC) procedures. Promotive and preventive interventions such as nutrition education, increased iron tablet consumption, and regular nutritional monitoring need to be carried out continuously to prevent anemia and further pregnancy complications. This study is expected to serve as a basis for improving policies and practices for pregnant women at primary health care facilities

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