Association between Maternal Nutritional Status Assessed by Mid-Upper Arm Circumference (MUAC) and Infant Birth Weight

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ABSTRACT

Introduction: In neonatal deaths, the WHO records an average of 18 neonatal deaths, maternal deaths in developing countries are related to pregnant women suffering from malnutrition such as KEK. Therefore, malnutrition in pregnant women must be avoided, making pregnant women a target group that requires special attention. There are countries experiencing KEK incidents in pregnant women that lead to maternal and child deaths, while Indonesia is one of the parameters for determining the nutritional status of pregnant women. Nutritional status greatly influences the growth and development of the fetus. Factors related to the nutritional status of pregnant women include maternal knowledge, maternal age, and economic status; these three aspects play a crucial role in meeting nutritional needs and making decisions related to nutritional status.

Objective: This study aims to determine the relationship between nutritional status in pregnant women based on LILA (Upper Arm Circumference) measurements and birth weight.

Method: This research uses a cross-sectional study approach. The population in this study consists of those who have given birth from 2021 to 2023 in the working area of Puskesmas Banggae 1. Sampling was conducted using the Total Sampling technique, with a sample size of 88 respondents. The instrument used for the independent and dependent variables was a checklist, specifically the Spearman Correlation test.

Result: The Spearman Correlation test yielded a significance value of 0.000, less than 0.05, indicating a relationship.

Conclusion: Thus, there is a relationship between Upper Arm Circumference and Birth Weight.

Keywords: Birth weight, nutritional status, upper arm

Introduction

The success of individuals in meeting their nutritional needs is identified through their nutritional status. The pregnancy period triggers an increase in energy needs and other essential nutrients that are crucial for fetal growth, the development of reproductive organs, and overall changes in the mother's body composition. Nutritional status during pregnancy can be measured through anthropometric examinations, including Body Mass Index (BMI) and Upper Arm Circumference (UAC), as well as biochemical tests such as hemoglobin (Hb) levels (Hardinsyah & Supariasa, 2017). According to WHO, in 2017, there were around 810 maternal deaths, surging to 295,000 by the end of the year, with 94% of these deaths occurring in developing countries. In 2018, the neonatal mortality rate was 18 per 1,000 live births. In Ndepende, indirect causes of maternal death include nutritional problems such as anemia (40% of pregnant women), chronic energy deficiency (37%), and inadequate energy intake in 44.2% of pregnant women. Low Birth Weight (LBW) contributes to 60%-80% of neonatal deaths, with a global prevalence of 15.5%, affecting around 20 million babies annually, 98.5% of which occur in developing countries. In developing countries like Indonesia, malnutrition remains a significant challenge, indirectly contributing to preventable maternal and infant mortality. Nutritional imbalances in pregnant women increase the risk of giving birth to a LBW baby, who is 10 to 20 times more likely to die than a baby of normal weight. Thus, monitoring the nutritional status of pregnant women and early detection is vital for fetal health.

In Indonesia, nutritional status in pregnant women is often assessed using Mid-Upper Arm Circumference (MUAC). Deficiencies in energy and protein can trigger Chronic Energy Deficiency (CED), particularly in pregnant women with MUAC measurements below 23.5 cm. CED raises the risk of LBW, which can lead to stunting if not addressed. CED arises from imbalances in nutrient intake where the body does not receive enough energy and protein (Indonesia, K.K.R., 2018). In 2020, the Ministry of Health data from 34 provinces recorded 4,656,382 pregnant women whose MUAC was measured. Among them, approximately 451,350 had MUAC measurements below 23.5 cm. Infant mortality in West Sulawesi decreased significantly over the past ten years, with a drop of more than 18 points. From 2010 to 2022, the rate fell by approximately 40%, from 48 per 1,000 births to 29.21, as announced by Mukrabin in a press conference on January 30, 2023.

According to data from Puskesmas Banggae 1, in 2021, there were 48 pregnant women with nutritional issues and 17 cases of low birth weight (LBW). In 2022, this increased to 72 women with nutritional issues and 26 cases of LBW, while in 2023, there were 81 cases of nutritional issues and 33 LBW cases. The data shows a rising trend in both the number of pregnant women and LBW cases over the past three years. A study by Suwarni and colleagues (2012) showed a significant correlation between maternal MUAC and infant birth weight in Pelaihari District, with a p-value of 0.001. The contingency coefficient of 0.382 indicates a low-strength relationship between maternal MUAC and birth weight. Maintaining optimal nutritional status throughout pregnancy significantly impacts fetal development, and appropriate maternal nutrition greatly influences a baby's health.

The nutritional condition of pregnant women can be monitored through the measurement of Upper Arm Circumference (LILA) because this method is simple, affordable, quick, and does not require age information, which can sometimes be difficult to obtain. LILA also provides insights into muscle and subcutaneous fat conditions. Evaluating LILA is crucial for pregnant women to assess the risk of Chronic Energy Deficiency (KEK). A low LILA score

can increase the likelihood of maternal anemia, premature birth, fetal brain development disorders, low birth weight (LBW), and stunting.

The baby's condition can be assessed through their birth weight. Generally, pregnant women who receive adequate nutrition and maintain their health give birth to healthy babies. However, many pregnant women still experience nutritional problems, especially chronic energy deficiencies such as KEK. Birth weight (BW) refers to the weight recorded within the first hour after birth, serving as an indicator of whether the baby's weight falls within the normal range. If the birth weight is below the standard, it may indicate the risk of premature birth, fetal brain development disorders, LBW, and stunting. The complications of LBW include seizures, fever, shortness of breath, continuous moaning, pus-filled eyes, diarrhea, yellow skin, and redness around the navel extending to the abdominal wall.

Several factors influence a baby's birth weight, including the mother's age, pregnancy age, and nutritional condition during pregnancy. A healthy infant is typically born at a normal gestational age with a weight between 2500 and 4000 grams. Infants weighing less than 2500 grams are considered to have LBW, which can lead to higher rates of mortality, disease, and disability, as well as negatively affect the quality of life later. According to the national socio-economic survey (SUSENAS), approximately 24.2% of pregnant women with KEK are at risk of giving birth to LBW infants.

Based on data from various studies, the author is interested in researching "The Relationship between Maternal Nutritional Status Based on LILA Measurements and Birth Weight of Infants."

Objective

To determine the relationship between the nutritional status of pregnant women, based on Upper Arm Circumference (LILA) measurements, and the birth weight of babies in the working area of Banggae 1 Health Center.

Method

This study employs an analytical observational design, which describes commonly occurring phenomena and analyzes them using a cross-sectional approach. The total population consists of 188 pregnant women who gave birth in 2023 at Puskesmas Banggae 1, Majene, and a purposive sampling method was used, resulting in 88 samples. The study will take place in April 2024 at the Banggae 1 Health Center, located in Banggae 1 District, Majene Regency, West Sulawesi Province. Data collection involves secondary data, specifically information regarding pregnant women's Upper Arm Circumference (LILA) and infant birth weights, as recorded in the medical records at the Banggae Health Center. The research instrument is an observation form prepared by the researcher. Univariate analysis is used to present the distribution and percentage of each variable. Additionally, bivariate analysis is conducted to examine the relationship between the dependent and independent variables, focusing on the nutritional status of pregnant women and the birth weight of infants at Puskesmas Banggae 1.

Result

Univariate analysis

Table 1. Frequency Distribution of Upper Arm Circumference of Pregnant Women

No	Lila	N	F
1	Abnormal <23.5 cm	31	35.2%
2	Normal >23.5 cm	57	64.8%
	Total	88	100.0%

According to the data in Table 1, among the 88 participants, 31 mothers (35.2%) were found to have an Upper Arm Circumference (UAC) of less than 23.5 cm, indicating Chronic Energy Deficiency (CED). In contrast, 57 mothers (64.8%) had a UAC of more than 23.5 cm, placing them in the normal nutritional status category.

Table 2. Frequency Distribution based on birth weight history

No	Riwayat BBL	N	F
1	BBL Abnormal	34	38.6%
2	BBL Normal	54	61.4%
	Total	88	100.0%

Table 2 shows that out of the 88 respondents, 34 babies (38.6%) had a birth weight below 2500 grams, indicating low birth weight (LBW), while 54 babies (61.4%) had a birth weight within the normal range of 2500 to 4000 grams.

Bivariate analysis

Table 3.The Relationship Between Nutritional Status of Pregnant Women Based on Upper Arm Circumference and Birth Weight of Infants

LILA Mother	Birth Weight History of the Baby						p-value
	Abnormal		Normal		Total		
	N	%	N	%	N	%	
Abnormal	26	76.4	5	9.2	31	35.2	*0.000*
Normal	8	23.5	49	90.7	57	64.8	
Total	34	100	54	100	88	100	

Based on the presented statistical data, the test showed a Spearman's rho (r) value of 0.685 with a significance level (2-tailed) of 0.000. This indicates a significant correlation between Upper Arm Circumference (LILA) and Birth Weight (BBL).

Discussion

Based on the study titled "The Relationship Between Nutritional Status of Pregnant Women Based on Upper Arm Circumference (LILA) and Birth Weight of Newborns in the Banggae 1 Majene Health Center Area," data was obtained from 88 participants. Of these, 57 mothers (64.8%) had Mid-Upper Arm Circumference (MUAC) measurements greater than 23.5 cm, which is considered normal. However, this indicates that there are still pregnant women

experiencing malnutrition, as evidenced by LILA measurements. LILA is used to evaluate whether pregnant women are experiencing chronic energy deficiency (CED). The normal LILA threshold is above 23.5 cm, while LILA measurements below this figure indicate CED in pregnant women.

Addressing the nutritional status of pregnant women requires comprehensive healthcare for adolescent girls and pregnant women, which includes thorough antenatal care, improved nutritional intake, and the cessation of smoking and alcohol. The goal is to prevent chronic energy deficiency (CED) (Potu, 2017). Healthy and active adolescents may have large appetites, so it is crucial to consume balanced meals rather than excessive snacks high in fat, sugar, or salt. Adolescents require more nutrients than adults because this period is characterized by rapid changes; therefore, their nutritional intake must be carefully monitored to ensure optimal growth. Inadequate intake can lead to delayed sexual development and slower linear growth.

Chronic energy deficiency (CED) can be prevented in adolescents and pregnant mothers by maintaining a healthy lifestyle. Several strategies can address CED in adolescents and pregnant women, including:

1. **Balanced Nutrition**: Teenagers and pregnant women should consume healthy foods, such as eggs, fish, chicken, meat, vegetables, fruits, rice, tubers, legumes, and milk. Pregnant women can also consume additional foods (PMT).
2. **Regular Physical Activity**: Engaging in regular exercise is beneficial for both teenagers and pregnant women.
3. **Adequate Rest Patterns**: Ensuring sufficient rest is essential for teenagers and pregnant mothers.
4. **Education**: Providing education about balanced nutrition and CED is crucial. Schools can periodically educate teenagers, while pregnant women can receive information during antenatal visits starting from 12 weeks of pregnancy. CED can lead to suboptimal fetal growth, resulting in low birth weight babies.

This study explores the relationship between Upper Arm Circumference (UAC) in pregnant women and the Birth Weight (BW) of their infants. The sampling technique employed was total sampling, analyzing secondary data collected from the LILA records of pregnant women and the Birth Weight (BBL) recorded in the maternal cohort register in 2023, specifically for mothers who have given birth. Data analysis using the Spearman correlation test reveals a significance value of < 0.000, indicating a significant relationship between the LILA of pregnant women and the BBL of their infants.

In this study, which involved 88 participants, the sample selection utilized a purposive sampling technique. The results of the statistical analysis using Spearman's Correlation showed a significance value of 0.000, which is less than 0.05. This indicates a correlation between Upper Arm Circumference (UAC) and the Birth Weight of infants at the Banggae 1 Health Center in Majene.

According to Yuliana (2017), it is crucial to avoid nutritional deficiencies or excesses, as these can lead to undesirable health issues. Therefore, monitoring the nutritional status of pregnant women is vital. Body measurements, such as Upper Arm Circumference (UAC) and hemoglobin (Hb) levels, are commonly monitored during pregnancy to evaluate nutritional status. A UAC of at least 23.5 cm is considered indicative of good nutritional status. If a

pregnant woman's UAC falls below this threshold, there is an increased risk of delivering a Low Birth Weight (BBLR) baby.

It is hoped that pregnant women with an Upper Arm Circumference (LILA) measurement below 23.5 cm will improve their diet by selecting better nutrition options. Measuring Mid-Upper Arm Circumference (MUAC) in women of childbearing age is a simple method to detect the potential for Chronic Energy Deficiency (CED) early on, and it can be performed by the general public to identify the risk of CED (Kamariyah, 2015). Research by Karima and Achadi (2014) indicates a relationship between nutritional status and newborn birth weight. This is supported by the theory stating that monitoring weight during pregnancy is crucial; malnutrition can increase the risk of delivering a low birth weight baby, premature birth, and complications for both mother and child.

The findings of this study are consistent with previous theories and research, indicating a correlation between Upper Arm Circumference (UAC) and Birth Weight (BBL). Measuring LILA is essential for detecting potential malnutrition that can lead to Chronic Energy Deficiency (CED), which in turn affects fetal growth and increases the likelihood of Low Birth Weight (BBLR) babies. Adequate nutritional intake is therefore critical for pregnant women to prevent complications for both the mother and the baby. In conclusion, there is a significant relationship between LILA and BBL in the Banggae 1 Majene Health Center area.

Conclusion

Based on the evaluation results and discussions, it can be concluded that among the 88 pregnant women studied, 31 women (35.2%) experienced Chronic Energy Deficiency (CED), while 57 women (64.8%) had Upper Arm Circumference (UAC) measurements greater than 23.5 cm. Additionally, 34 babies (38.6%) were born with Low Birth Weight (LBW), defined as below 2500 grams, while 54 babies (61.4%) were born with Normal Birth Weight, ranging from 2500 to 4000 grams. The bivariate analysis using the Spearman's Correlation test showed a significance value of 0.000, indicating a significant relationship between LILA and BBL. To improve service quality at the research site, enhancements are needed in the Maternal and Child Health (KIA) room, and health workers should prioritize reminding pregnant women to meet their nutritional needs. This approach is essential to prevent malnutrition leading to Chronic Energy Deficiency (CED), which can adversely affect fetal development and growth, thereby reducing the risk of Low Birth Weight (BBLR) babies.

Conflict of interest

The researchers stated that there is no conflict of interest related to the implementation and publication of the results of this research. The entire research process, from planning, data collection, analysis, to report preparation, was carried out independently without any influence or pressure from any third party. A commitment to research ethics is upheld throughout the research process, ensuring transparency, accuracy and honesty in reporting results. Respondents' participation was voluntary with informed consent, and their confidentiality and privacy were maintained in accordance with applicable research ethics standards. With this statement, researchers hope that the research results can be trusted and used as a valid reference for the development of science and health practices related to ethnomedicine and reproductive health.

Authors' contribution

Each author contributed equally in all the parts of the research. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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