

Research Article

## Mid-Upper arm circumference in pregnant women and its correlation to birth weight

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### ABSTRACT

**Background:** During pregnancy, there is an increase in maternal metabolism, which affects the growth of the fetus and fetal organs. Pregnant women who cannot meet nutritional needs can risk experiencing problems with poor nutritional status. This adversely affects the baby and the mother. One of the anthropometric measurements commonly used to assess pregnant women's nutritional status is measuring the Mid Upper Arm Circumference (MUAC). Pregnant women with MUAC interpretation less than 23.5 cm are said to be at risk of chronic energy deficiency (CED). **Purposes:** This study aimed to determine the relationship between the MUAC of pregnant women and the baby's body weight. **Methods:** The research methodology used analytical observational with a cross-sectional approach to the medical records of 104 mothers at the Taman Baca Health Center, Pembina Health Center, and Plaju Palembang Health Center. Data were collected by purposive sampling. **Result:** The results of this study showed that MUAC for pregnant women was more than equal to 23.5 cm as many as 86 (82,7%) respondents, while pregnant women of MUAC were less than 23.5 cm as many as 18 (17,3%) respondents. Analysis with Fisher's Exact Test with p-value=1,000. **Conclusion:** there was no meaningful relationship between the MUAC of pregnant women and the body weight of babies.

**Keywords:** birth weight, chronic energy deficiency, mid-upper arm circumference, pregnant women

### INTRODUCTION

Pregnant women who cannot meet their needs for good nutrition can be at risk of experiencing nutritional status problems during pregnancy, this condition can adversely affect babies and mothers (1,2). Poor nutritional status experienced by mothers can also affect the baby, which causes Low Birth Weight (LBW), which is the baby's weight of fewer than 2,500 grams. In 2014 World Health Organization (WHO) found that the prevalence of LBW was about 15.5% of the 20 million births each year worldwide (3). Based on data from Riset Kesehatan Dasar (Riskesdas) in 2018, the proportion of LBW in Indonesia in children aged 0-59 months is around 4% of 37,524 babies who are weighted (4). Based on data from the Badan Pusat Statistik in South Sumatra Province (2021), there were 3,189 babies born with low birth weight (LBW), and the city of Palembang ranks highest with the number of LBWs as many as 2,015 out of the

babies born of 27,517 babies (5). This is one of the leading causes of neonatal deaths in Indonesia. Babies with low birth weight are at risk of death, health problems, and growth problems at the beginning of life (6).

One of the anthropometric measurements commonly used to assess the nutritional status of pregnant women is the measurement of Mid-Upper Arm Circumference (MUAC). It can be used to assess the nutritional status of pregnant women. Pregnant women who experience chronic energy deficiency (CED) have a Mid-Upper Arm Circumference (MUAC) of less than 23.5 cm (7). The prevalence in the world is around 14-47% in developing countries with chronic malnutrition (8). According to WHO (2018), African and Asian countries, specifically in the Southeast Asian region is a developing country with a chronic energy shortage rate of around 815 million in 2018, and it is estimated that at least 120 million women (60%) living in Southeast Asia experience chronic energy deficiency (9). In Indonesia, 13.6% of fertile women experience chronic energy deficiency (CED). In women of childbearing age, the prevalence of pregnant women aged 15-19 years was 33.5%, and the age of 20-24 years was 23.3%. Adolescents are prone to malnutrition because there is still physical growth at that age. Based on 2020 data in Indonesia, there are around 451,350 pregnant women who have MUAC more than 23.5 cm (CED risk) from 4,656,382 pregnant women who took measurements of upper arm circumference (MUAC) (8). In 2021 in South Sumatra Province, there were 10,663 pregnant women had chronic energy deficiency (CED) conditions (10). The high incidence of LBW and chronic energy deficiency (CED) conditions made researchers interested in researching the relationship between Mid-Upper Arm Circumference and birth weight.

## **METHODS**

This type of research was an analytical observational study with a cross-sectional design from December 2022- January 2023. The population of this study was babies at the Palembang Health Center. Samples were taken using purposive sampling techniques in infants which were examined and immunized at the Taman Baca Health Center, Plaju Health Center, and Pembina Health Center.

The data used is secondary data from the MCH book (Maternal and Child Health book) with the inclusion criteria, namely pregnant women whose medical record data contains MUAC measurements and the birth age of aterm. Exclusion criteria were twin pregnancy babies, babies with congenital malformations, mothers who smoke, alcoholism, infectious diseases, diabetes, preeclampsia, severe anemia, renal impairment, and cardiovascular disorders. The number of samples in this study was 104 respondents. After all the data was obtained, recording and grouping were then carried out. Data analysis on the variables of the Mid-Upper Arm Circumference of pregnant women and the body weight of the baby born was carried out using the SPSS-22 program computer software with the Fisher's Exact Test. This research has been approved by the ethics committee of the Faculty of Medicine, University of Muhammadiyah Palembang with no. 021/EC/KBHKKI/FK-UIMP/XI/2022.

## **RESULTS**

The respondents in this study were 104 people who had complied with the inclusion and

exclusion criteria in the Working Area of the Taman Baca Health Center, Pembina Health Center, and Plaju Health Center.

**Table 1.** The Relationship between the Mid-Upper Arm Circumference of Pregnant Women and the Weight of the Birth Baby

Mid-Upper arm circumference	Baby Birth Weight						p-value
	Low Birth Weight		Normal Birth Weight		Total		
	F	%	F	%	F	%	
< 23.5 cm	1	1%	17	16.3%	18	17.3%	1.000
≥ 23.5 cm	6	5.7%	80	76.9%	86	82.7%	
Total	7	6.7%	97	93.3%	104	100%	

This study showed that out of 104 respondents, namely mothers with mid-upper arm circumference at less than 23.5 cm with low birth weight babies as many as one babies (1%), normal birth weight babies with as many as 17 babies (16.3%). Meanwhile, pregnant women with mid-upper arm circumference at more than equal to 23,5 cm with low birth weight babies with as many as six babies (5.7%), and normal birth weight babies with as many as 80 babies (76.9%). The bivariate analysis using Fisher's Exact Test between the variable size of the mid-upper arm circumference of pregnant women and the newborn weight variable obtained a p-value of 1,000. The results of this analysis show that there is no meaningful relationship between the mid-upper arm circumference of the pregnant woman and the body weight of the baby.

## DISCUSSION

Based on the results of measurements of the upper arm circumference of pregnant women (table 1) showed that respondents with a MUAC more than equal to 23.5 cm and normal birth weight were the most respondents. The majority of pregnant women who were respondents to this study were not at risk of chronic energy deficiency (CED). Fisher's Exact Test showed a p-value of > 0.05 which showed that there was no relationship between the mid upper arm circumference of the pregnant woman and the weight of the baby. A study by Ariani's research (2020) reported the Spearman correlation analysis test showed that the MUAC of mothers during pregnancy did not have a meaningful relationship with the birth weight of babies in the Piyungan Health Center (11). Based on the results obtained from respondents at the Taman Baca Health Center, Plaju Health Center, and Pembina Health Center, there was no relationship between MUAC pregnant women and birth weight. There are several risk factors that can cause this result. Factors that can affect the weight of babies born include those from the mother, namely hypertension, cardiovascular disorders, kidney disorders, diabetes mellitus, smokers, alcoholism, drug addiction, malnutrition, uterine abnormalities, cervical incompetence, intrauterine infections, amniotic rupture of multiple pregnancies and anemia. Other factors derived from the placenta were placental abnormalities (abnormal placental insertion, fibrosis, infarction), placental abruption, and placenta previa. Fetal congenital factors consist of rubella infection, toxoplasma, cytomegalovirus, chromosomal abnormalities (trisomy 13, 18, and 21, turner syndrome), congenital defects, polyhydramnios, and twin pregnancies (12).

Anthropometric measurements in the form of MUAC can show a picture of the state of muscle tissue and the fat layer under the skin that mostly stores protein so that upper arm circumference measurements can be used in screening for protein malnutrition (13). Decreased protein was associated with an upper arm circumference size of less than 23.5 cm, but it did not rule out the possibility that other nutrients are still well fulfilled such as fats, carbohydrates, minerals, iron, and so on (14). The nutritional needs of mothers during pregnancy are influenced by the number of macronutrients and micronutrient intake. Micronutrient nutrients related to the baby's birth weight such as vitamin D, folic acid, zinc, calcium, and iron (15). Research conducted by Haque, et al (2020) mentioned several factors that can influence changes in maternal nutritional status, namely age, not routinely conducting ANC examinations, parity, not using contraception, domestic violence experiences, and poor Clean and healthy living behavior (16). Another factor that can influence the results of this study is that Hemoglobin (Hb) levels are less than 11 gr / dL. Deficient hemoglobin levels in pregnant women or anemic mothers can cause a lack of iron levels for the fetus. This condition can harm pregnant women and interfere with the growth and development of the fetus.

Anemia in pregnant women can be caused by a lack of iron (Fe). Lack of Fe consumption can reduce hemoglobin (Hb) levels in pregnant women's blood which causes blood flow to the fetus to be hampered and causes oxygen flow and nutrient supply from the mother to the fetus to be disrupted. This will inhibit fetal growth and lead to the inhibition of fetal weight gain (17). Anemia in pregnancy was the cause of disruption of oxygenation and the supply of nutrients from the mother to the fetus. As a result, the fetus will experience weight gain disorders so that Low Birth Weight (LBW) occurs. Mild anemia will result in premature birth and LBW, while severe anemia during pregnancy will increase the risk of mortality and morbidity both in the mother and in the fetus (18). The age factor of pregnant women over 34 years or the age of mothers under 20 years is a high-risk pregnancy 2-4 times compared to women of old enough. The pregnancy distance according to the recommendations of the National Population and Family Planning Agency the ideal distance was two years or more because the short birth distance was not enough to restore the mother's condition from a previous delivery. Parity pregnancy affects the condition of the mother if she has more than three children, her health condition begins to decline, and she often experiences a lack of blood and bleeding through the birth canal. The parity pregnancy of mothers who have more than three children affects the condition of the mother due to decreased health and bleeding through the birth canal (19).

In this study, it was found that there were mothers who did not have routine antenatal care (ANC) examinations. Antenatal care examinations must be done periodically at least 6 times in normal pregnancy with details twice in the first trimester, once in the second trimester, and three times in the third trimester. Antenatal care services are carried out regularly to detect risky pregnancies so that appropriate actions can be taken immediately to overcome and plan and improve the pregnancy (19). Diseases during pregnancy that can affect the weight of the baby born include diabetes mellitus which can give birth to babies who have more birth weight, chickenpox can cause mental retardation and premature birth, fetal death and TORCH infection can have an impact on the fetus such as eye cataracts, deafness, organ growth disorders, and abnormal baby weight (19,20). Blood pressure factors in pregnancy influence

the baby's weight. Low blood pressure in pregnant women is related to vascular disorders which can result in low intake of nutrients and oxygen needed by the fetus, this of course can result in disruption of the normal fetal growth and development process (21). High blood pressure or preeclampsia occurs due to vasoconstriction of blood vessels in the uterus which causes an increase in peripheral resistance so that there was an increase in blood pressure. Vasoconstriction of blood vessels in the uterus can decrease blood flow so that the supply of oxygen and nutrients to the fetus is reduced. When it happens, it can cause intrauterine growth retardation (IUGR) and give birth to LBW babies (22).

In addition to measuring the mid upper arm circumference of pregnant women to see the good nutritional status of pregnant women, measurements can also be taken through weight gain during pregnancy, pre-pregnancy Body Mass Index (BMI), and measuring Hb levels (13). There were two indicators of maternal nutritional status that consistently show a positive relationship with the baby's weight, namely prenatal weight and weight gain during pregnancy. Although the mid upper arm circumference of pregnant women can be used as a factor, mothers who are early in pregnancy have normal MUAC and BMI but are not followed by proper weight gain, then the mother can be at risk of giving birth to an LBW baby (11). Good maternal nutritional status greatly affects the process of fetal growth and maternal health malnutrition conditions in pregnant women which causes blood volume to be less, blood flow to the uterus and placenta was reduced, the size of the placenta is reduced and the transfer of nutrients through the placenta is reduced so that the fetus grows slowly or was disturbed. Pregnant women with malnutrition tend to give birth prematurely or can also cause low birth weight, therefore pregnant women must achieve a balanced nutritional intake before pregnancy as well as during pregnancy (19,23). Mothers who have good nutritional status than the baby born will have a normal weight, not low birth weight. Poor nutritional status before and during pregnancy can be at risk of giving birth to low birth weight babies (24).

## **CONCLUSION**

In this study, the majority of respondents of pregnant women showed a MUAC more than equal to 23.5 cm, so there was no risk of CED and the weight of the baby born in the study found that the majority of the body weight of the baby was normal. This study shows that there is no relationship between the mid-upper arm circumference of pregnant women and the body weight of babies born at the Plaju Health Center, Pembina Health Center, and Taman Baca Palembang Health Center, where there are factors that can affect the baby's birth weight either from the mother or from the fetus. This showed the importance of ensuring that pregnant women choose nutritious food and regularly conduct regular ANC checks, to avoid giving birth to babies with Low Birth Weight (LBW).

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## **CONFLICT OF INTEREST**

The authors confirm there is no conflict of interest in this study.



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