THE RELATIONSHIP BETWEEN MATERNAL WEIGHT GAIN DURING PREGNANCY AND COMPLIANCE WITH ANTENATAL CARE AND BABY'S WEIGHT AT BIRTH

Fitria Nur Kusuma[1], Shinta Riana[2], Tri Agustina[2], Erna Herawati[2]
[1,2] Fakultas Kedokteran, Universitas Muhammadiyah Surakarta, Indonesia
Email: rinuncantik@gmail.com

ABSTRACT

Newborn baby weight is an indicator of baby health because it is important to determine infant mortality and morbidity as well as the quality of human resources. One of the factors causing LBW is low weight gain during pregnancy. So that the mother and fetus in her womb are healthy, a pregnant woman is advised to have regular ANC check-ups at a health facility. Objective: To determine the relationship between weight gain in pregnant women and ANC compliance with the baby's weight at birth. Method: Using analytical observational designcross-sectional with a purposive sampling technique. Results: The total sample is 100 respondents. The results of the bivariate test between the weight gain of pregnant women and the baby's weight at birth showed a p value of 0.001 (p < 0.05), withThe prevalence ratio (RP) was found to be 5.038with 95% CI 4.333 − 43.873. And the relationship between ANC compliance and the baby's weight at birth was found to have a p value of 0.001 (p < 0.05)with a Prevalence Ratio (RP) obtained at 4.444with 95% CI 2.580 − 24.122. The results of the multivariate test of the relationship between the increase in pregnant women's weight and the baby's weight at birth showed an OR value of 12.016 with a 95% CI value of 3.470 - 41.607, and the relationship between ANC compliance and the baby's weight at birth obtained an OR value of 6.480 with a 95% CI 1.757 - 23.899. Conclusion: There is a relationship between the weight gain of pregnant women and ANC compliance with the baby's weight at birth.The increase in weight of mothers during pregnancy is more influential.

KEYWORDS	*Pregnant Mother Weight Gain, Antenatal Care Compliance, Baby Weight at Birth*

INTRODUCTION

Newborn weight is one of the health indicators for infants. Newborn weight is important for determining infant mortality and morbidity as well as the quality of human resources (HR) in the future (Arifin, 2023). Newborns can be grouped based on their weight, namely very low birth weight (BBLSR) with a body weight < 1,500 grams, low birth weight (BBLR) with a birth weight between 1,500 - < 2,500 grams, moderate birth weight (BBLC) with a birth weight between 2,500 - < 4,000 grams, and large birth weight (BBLB) with a birth weight > 4,000 grams. (Elviana *et al.*, 2019). Infants with LBW and LBW can cause *stunting* and other health problems, thus increasing the mortality and morbidity of neonates and children in general (DHO, 2021).

The World Health Organization (WHO) explains that the infant mortality rate caused by LBW is 60-80%. (Novitasari *et al.*, 2020).. According to the Indonesian Ministry of Health, the prevalence of infant mortality due to LBW reached 35.2% with a mortality rate of 4 out of 1000 live births (Health, 2020). In 2020 in Central Java out of 100% of newborn deaths, 35.2% of deaths were due to LBW and the mortality rate reached 4 out of 1000 live births (DHO, 2021). Meanwhile, in 2021 in Central Java out of 100% of newborn deaths, 37.44% of deaths were due to LBW and the mortality rate reached 4 out of 1000 live births and in Sukoharjo Regency the newborn mortality rate due to LBW was around 35% with a mortality rate of 4 out of 1000 live births (DHO, 2021).

In order for a baby to be born healthy and have sufficient birth weight, a pregnant woman should have regular *antenatal care* (ANC) checks at a health facility that provides these services. The purpose of *antenatal care* examination is to monitor the health of pregnant women and their fetuses so that if there is a health problem in the mother or fetus, it can be detected early and then intervene early as well. In addition to health checks, during *antenatal care* checks pregnant women also get education and counseling about maternal and fetal health, foods that must be consumed by mothers, knowledge about breastfeeding and its preparation, as well as safe and comfortable delivery. (Fatimah *et al.*, 2018). Standard *antenatal care* checks are carried out at least 6 times during pregnancy (Siahaan *et al.*, 2023)..

One of the factors causing the birth of LBW babies is maternal factors, one of which is weight gain during pregnancy. Weight gain during pregnancy is an internal factor that can affect fetal development. In Indonesia, the average pregnant woman experiences weight gain of around 9-12.5 kg. (Kasmiati *et al.*, 2023).. Significant weight gain in pregnant women usually starts at week 20, namely in the second trimester to the third trimester. (Kasmiati *et al.*, 2023).. Pregnant women who are classified as underweight are expected to gain around 12.5 - 18 kg, for pregnant women with normal weight can experience an increase of around 10 - 12 kg, while for pregnant women who are overweight have an increase of around 7 - 11.5 kg (Kasmiati et al., 2023). (Kasmiati *et al.*, 2023).. Mothers who have a risk of giving birth to babies with LBW are mothers who during their pregnancy experience weight gain of less than 7 kg. (Wigianita *et al.*, 2020).. Pregnant women with an increase of less than 9 kg are categorized with low weight gain, while

pregnant women with an increase of 9-18 kg are categorized with normal weight gain.

Research conducted by Haryono in 2021 states that there is a relationship between maternal weight gain during pregnancy and birth weight with a *p-value* of 0.004 ($p < 0.05$). (Haryono, 2021). However, in a study conducted by Wigianita in 2020, it was found that there was no relationship between maternal weight gain during pregnancy and birth weight with a *p-value* of 0.06 (p> 0.05). (Wigianita *et al.*, 2020)..

Based on the above description, the researcher aims to identify the relationship between maternal weight gain during pregnancy and antenatal care adherence with infant weight at birth. In this study, the variable of antenatal care adherence was added as a possible influential factor, in addition to the variable of maternal weight gain during pregnancy. The formulation of the problem consists of three questions regarding the relationship between the two variables and the baby's weight at birth. The general objective of this study is to explore the relationship between maternal weight gain and antenatal care adherence with baby's weight, while the specific objectives are to identify antenatal care adherence, analyze maternal weight gain during pregnancy, and determine the frequency distribution of baby's weight at birth. The benefits of this study are divided into theoretical, practical benefits for researchers, the general public, and the environment/government.

RESEARCH METHOD

This type of research is analytic observational with cross-sectional research design. This research design was chosen to study the relationship between maternal weight gain during pregnancy and antenatal care compliance with the baby's weight at birth. (Widia, 2017; Hardani et al., 2020).. The study was conducted in the working area of Puskesmas Tawangsari Sukoharjo, Central Java, in November-December 2023. The target population included 978 mothers who gave birth with complete data from November 2022 to November 2023, while the actual population consisted of 100 mothers who met the inclusion and exclusion criteria. The sampling technique used was consecutive sampling, with a sample size calculated using the Slovin formula of 100 mothers. The dependent variable in this study was the baby's weight at birth, while the independent variables included maternal weight gain during pregnancy and antenatal care compliance. Data were collected from the medical records of Puskesmas Tawangsari and analyzed using statistical methods such as Chi Square test for bivariate analysis and logistic regression for multivariate analysis. (Hardani *et al.*, 2020). Research ethics were ensured by obtaining permission from the Health Research Ethics Commission and ensuring the confidentiality and security of the data used (Figure 4 Research Flow).

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RESULT AND DISCUSSION

Research Results

Description of the research

This study was conducted to see the relationship between maternal weight gain during pregnancy and *antenatal care* compliance with the baby's weight at birth at Puskesmas Tawangsari Sukoharjo, Central Java. This study was conducted in November - December 2023 with the subject of pregnant women at Puskesmas Tawangsari Sukoharjo, Central Java. Data obtained from the KIA book of pregnant women totaling 100 samples that have met the predetermined restriction criteria. Then the data will be processed using SPSS 27 application *software* on *Windows* 11.

Medical Record Data of Pregnant Women at Tawangsari Community Health Center

Table 1. Medical Records of Pregnant Women Based on Age, *Antenatal Care* Examination Place, Education

Category		Frequency	Percentage	Total
Age	20-25 years old	23	23 %	
	> 25-30 years	41	41 %	100
	> 30-40 years	34	34 %	
	> 40 years	2	2 %	
Antenatal care examination center	Doctor	39	39 %	
	Midwife	61	61 %	100
Education	SD	7	7%	
	SMP	20	20%	
	HIGH SCHOOL	22	22 %	100
	D3	18	18 %	
	S1	33	33	

Based on medical record data, it is found that the age category of pregnant women is mostly > 25-30 years old with a percentage of 41%, while the category of *antenatal care* examination places is mostly midwives with a percentage of 61%, and the most education category is S1 with a percentage of 33%.

Data Analysis

a. Univariate/Descriptive Analysis

Frequency and percentage distribution analysis of patient characteristics based on maternal weight gain during pregnancy, *antenatal care* compliance, and infant weight at birth.

Table 2. Frequency and Percentage Distribution of Characteristics of Pregnant Women Based on Weight Gain During Pregnancy, *Antenatal Care* Compliance, and Birth Weight.

Category	Frequency	Percentage
Maternal Weight Gain During Pregnancy		
a. Low	24	24 %
b. Normal	76	76 %
Total	100	100%
Antenatal care adherence		
a. Non-compliant	20	20,0 %
b. Compliant	80	80,0 %
Total	100	100%
Baby's Weight at Birth		
a. Low	19	19 %
b. Simply	81	81 %
Total	100	100 %

From table 2, the category of maternal weight gain during pregnancy found the most results in 76 pregnant women have weight gain in the normal category (76%). Then in the category of *antenatal care* compliance, the highest number of 80 pregnant women complied with *antenatal care* (80.0%). The category of baby's weight at birth found the most results in 81 babies born with adequate birth weight category (81.0%).

b. Bivariate Analysis
1) Relationship of maternal weight gain during pregnancy to infant weight at birth

Table 3. Results of Bivariate Analysis of Maternal Weight Gain During Pregnancy with Infant Weight at Birth

Weight Gain in Pregnant Women	Baby Weight		Total	RP	*p-value*	95% C.I for RP	
	Low	Simply				Lower	Upper
Low	13 (68%)	6 (32%)	19 (100%)	5,038	<0,001	4,333	43,873
Normal	11 (14%)	70 (86%)	81 (100%)				
Total	24	76	100				

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Based on the table above, the results of 19 pregnant women who experienced low weight gain, the highest percentage of pregnant women gave birth to 13 babies (68%) with low birth weight. Then, of the 81 pregnant women who experienced normal weight gain, the highest percentage of pregnant women gave birth to 70 babies (86%) with sufficient birth weight.

The results of bivariate analysis with *Chi-square* to see the relationship between maternal weight gain during pregnancy with the baby's weight at birth, obtained a *p-value* of <0.001 ($p < 0.05$) and the Prevalence Ratio (RP) was found to be 5.038 with 95% CI 4.333 - 43.873, indicating that pregnant women with low weight gain have a 5-fold risk of giving birth to babies with low birth weight, which means that there is a significant relationship between maternal weight gain during pregnancy with the baby's weight at birth.

2) Relationship between *antenatal care* adherence and infant weight at birth

Table 4. Results of Bivariate Analysis of *Antenatal Care* Adherence with Infant Birth Weight

Antenatal care adherence	Baby Weight		Total	RP	p-value	95% C.I for RP	
	Low	Simply				Lower	Upper
Non-compliant	10 (50%)	10 (50%)	20 (100%)	4,444	<0,001	2,580	24,122
Compliant	9 (11%)	71 (89%)	80 (100%)				
Total	19	81	100				

Based on the table above, out of 20 pregnant women with non-compliant *antenatal care*, 10 pregnant women (50%) gave birth to babies with low birth weight, while 10 pregnant women (50%) gave birth to babies with adequate birth weight. Then of the 80 pregnant women who complied with *antenatal care*, the highest percentage was 71 pregnant women (89%) gave birth to babies with adequate birth weight.

The results of bivariate analysis with *Chi-square* to see the relationship between *antenatal care* compliance with baby's weight at birth obtained *p-value* <0.001 ($p < 0.05$) and Prevalence Ratio (RP) was found to be 4.444 with 95% CI 2.580 - 24.122, indicating that pregnant women with low weight gain have a 4-fold risk of giving birth to babies with low birth weight which means there is a significant relationship between *antenatal care* compliance with baby's weight at birth.

c. Multivariate Analysis

Logistic regression test is carried out to see which independent variable is the most dominant in influencing the dependent variable. The results of the logistic regression test in this study are as follows:

Table 5. Multivariate Test Results

Variables	Coefficient B	P-value	Exp(B)	95% C.I for EXP (B)	
				Minimum	Maximum
Weight Gain	2,486	<,001	12,016	1,757	23,899
Antenatal care adherence	1,869	,005	6,480	3,470	41,607
Constant	2,954	,032	19,176		

The results of data analysis using logistic regression techniques are as follows:

1) The OR or Exp (B) value of the variable of maternal weight gain during pregnancy is 12.016 with 95% CI 1.757 - 23.899, indicating that pregnant women with low weight gain have a 12-fold risk of giving birth to babies with low birth weight. With a range of confidence interval values that do not exceed 1, this result is statistically significant.

2) The OR or Exp(B) value of the *antenatal care* adherence variable is 6.480 with a 95% CI of 3.470 - 41.607, indicating that pregnant women who do not adhere to *antenatal care* have a 6-fold risk of giving birth to babies with low birth weight. With a range of confidence interval values that do not exceed 1, this result is statistically significant.

Hypothesis testing is based on the following decision making:

1) If the significant value is smaller (<) than *alpha (<0.05)* then there is a significant relationship between the independent variable and the dependent variable.

2) If the significant value is greater (>) than *alpha (>0.05)* then there is no significant relationship between the independent variable and the dependent variable.

The data processing results show that 2 variables have a value <0.05, so it can be stated:

1) The variable of weight gain during pregnancy has a *p* value = 0.001 which means that there is a significant relationship between weight gain during pregnancy and the baby's weight at birth.

2) *The antenatal care* adherence variable has a *p* value = 0.005 which means that there is a significant relationship between *antenatal care* adherence and baby weight at birth.

Discussion

Relationship between maternal weight gain during pregnancy and infant birth weight

Based on the results of the study, it was found that out of 19 pregnant women who experienced low weight gain, gave birth to 13 babies (68%) with low birth weight and the rest gave birth to 6 babies (32%) with adequate birth weight. Then, of the 81 pregnant women who experienced normal weight gain, gave birth to 11 babies (14%) with low birth weight, while most gave birth to 70 babies (86%) with

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adequate birth weight. *Chi-square* analysis showed a *p-value* of 0.001 ($p < 0.05$), which means that there is a significant relationship between maternal weight gain during pregnancy and the baby's weight at birth. The Prevalence Ratio (RP) was found to be 5.038 with a 95% CI of 4.333 - 43.873, indicating that pregnant women with low weight gain have a 5-fold risk of giving birth to babies with low birth weight, which means that there is a significant relationship between maternal weight gain during pregnancy and baby's weight at birth. The results of this study indicate that weight gain during pregnancy in pregnant women is one of the factors that affect the baby's weight at birth.

This result is consistent with research (Haryono, 2021) which states that there is a significant relationship between maternal weight gain during pregnancy and the baby's weight at birth as evidenced by the *p* value = 0.004. The difference with the research that the researchers made was that the researchers used univariate, bivariate, and multivariate analysis tests, while those tested in Haryono's research only used univariate and bivariate tests. Conversely, there are other studies (Wigianita *et al.*, 2020) stated that there was no relationship between maternal weight gain during pregnancy and the baby's weight at birth as evidenced by the *p* value = 0.06. The difference with the researcher's research is the result of the bivariate test, namely *p-value = <0.001* while in Wigianita *p-value* = 0.06.

Maternal weight gain has a direct influence on the baby's weight at birth. Weight gain during pregnancy is an internal factor that can affect fetal development. Pregnant women who gain less weight are at risk of having a smaller placenta size, which causes the supply of nutrients to also be less so that the risk of the fetus not growing properly. Babies are at risk of LBW if the mother's weight gain during pregnancy is less than it should be. (Nadiya and Fazira, 2021). Weight gain in pregnant women can also be used as one of the parameters in assessing the nutritional status of pregnant women. (Srimulyawati *et al.*, 2021)..

Relationship between Antenatal Care Adherence and Infant Birth Weight

Based on the results of the study, it was found that 20 pregnant women who were not compliant with antenatal care, 10 pregnant women (50%) gave birth to babies with low birth weight, while 10 pregnant women (50%) gave birth to babies with adequate birth weight. Then of the 80 pregnant women who adhered to antenatal care, 9 of them (11%) gave birth to babies with low birth weight and most of them, 71 pregnant women (89%) gave birth to babies with adequate birth weight. From the results of Chi-square analysis obtained a p-value of 0.001 ($p < 0.05$) which means there is a significant relationship between antenatal care compliance with the baby's weight at birth. The Prevalence Ratio (RP) was found to be 4.444 with a 95% CI of 2.580 - 24.122, indicating that pregnant women with low weight gain have a 4-fold risk of giving birth to babies with low birth weight, which means that there is a significant relationship between antenatal care compliance and baby's weight at birth. The results of this study indicate that antenatal care compliance in pregnant women is one of the factors that affect the baby's weight at birth.

This result is consistent with research (Astuti, 2020) which states that there is a significant relationship between antenatal care compliance and baby weight at birth as evidenced by p-value = 0.01. The difference from the research that the

researcher made was that the p-value = <0.001 while in Astuti's study the p-value = 0.001 and in Astuti's study there were 12 mothers (80.0%) who did not experience LBW and did antenatal care, while in this study there were 71 mothers (89%) who did antenatal care and did not experience LBW. In contrast, there are other studies (Madi et al., 2023) stated that there was no relationship between antenatal care compliance and the baby's weight at birth as evidenced by the p value = 1.00. The difference with the research that the researcher made was the result of the p-value <0.001 while in Madi's research the p-value = 1.00 and the research place in Tawangsari, Sukoharjo, while in Madi's research in Kotabunan.

Adherence to antenatal care has an indirect effect on the baby's weight at birth. Pregnant women who do routine antenatal care checks can prevent the risk of LBW in infants, such as insufficient maternal weight gain, increased maternal blood pressure, or signs of infection in the mother that affect the condition of the fetus she is carrying, so it is hoped that at the time of delivery the baby can be born healthy with a normal weight.

Relationship between maternal weight gain during pregnancy and antenatal care adherence and infant birth weight

From previous studies, it can be seen that maternal weight gain during pregnancy and *antenatal care* compliance experienced by pregnant women are still factors that affect the baby's weight at birth both directly and indirectly. From the results of the multivariate analysis in Table 7, it was found that the variable of maternal weight gain during pregnancy was more influential on the baby's weight at birth compared to *antenatal care* compliance by pregnant women. This is clarified by the OR value of weight gain during pregnancy of 12.016 with a 95% confidence interval value that does not go through the number 1, namely 3.470 - 41.607, which is smaller than the OR on *antenatal care* compliance of 6.480 with a 95% confidence interval value that does not go through the number 1, namely 1.757 - 23.899.

Research Limitations

The limitation of this study is the use of secondary data in medical records, which means that there is a possibility that the data is less accurate than the data collected directly from respondents by the researchers themselves.

CONCLUSION

The conclusion of this study shows that there is a significant relationship between maternal weight gain during pregnancy and antenatal care compliance with the baby's weight at birth. This study also found that maternal weight gain during pregnancy has a stronger influence than antenatal care compliance on newborn weight. Therefore, it is recommended to improve health facilities by adding more complete facilities and infrastructure to encourage respondents to be more diligent in conducting antenatal care checks. In addition, there needs to be educational efforts at health facilities about the importance of antenatal care to prevent the occurrence of low birth weight babies (LBW).

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