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Original Article

Determinant Factors of Low Birth Weight in Loa Janan District: A Retrospective Cohort Study

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ABSTRACT

In Samarinda in the Loa Janan Ilir sub-district, 8.23% (93 cases) of babies were born with low birth weight in 2021, two times from the previous year. The research is needed to understand the risk factors of LBW during pregnancy, such as anemia, chronic energy deficiency (CED) and the appropriateness of weight gain, in order to determine prevention programs. This study used a retrospective cohort method by looking at exposure during pregnancy and the baby's birth weight. The data used in this research is secondary data using a total sampling technique on the population of mothers who gave birth from January to May 2023. Analysis was carried out by looking at causal relationships and relative risk (RR) using the Chi-Square test and multivariate logistic regression. There was no relationship between anemia (p-value= 0.634) dan CED (p-value= 0.794) and appropriate weight gain (p-value= 0.189) during pregnancy and the incidence of LBW. Based on a multivariate test, it was found that pregnant women < 20 years old had a 45.16 times greater risk of having a LBW child (p=0.017). Meanwhile, mothers with inappropriate weight gain have a 7.6 times risk of having LBW children compared to those with (p-value=0.054). This is likely to occur because the majority of pregnant women have applied double doses to anemic pregnant women, but have not yet determined the adequacy of maternal's diet based on inadiquate weight. Community health center is expected to carry out behavioral change interventions related to diet during pregnancy, apart from the importance of consuming supplements, as well as education regarding the impact of adolescent pregnancy.

Keywords: *LBW, Anaemia, Pregnant Women, Weight Gain, CED*

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INTRODUCTION

Low Birth Weight (LBW) is defined by the World Health Organization as a birth weight of less than 2500 grams[1]. The prevalence of LBW has been on the rise in Indonesia in recent years. In 2021, 12.27% of babies experienced LBW, marking an increase of 0.95% from 2019 (11.32%). The trend of LBW has also been observed at the provincial level in East Kalimantan from 2017 to 2019. Despite a decrease in cases in 2020, there were still 3,114 LBW babies[2–5]. The sub-district of Loa Janan Ilir in the city of Samarinda experienced a twofold increase in LBW cases in 2021 (93 cases or 8.23%) compared to the previous year [6]. LBW incidents in 2020 in Indonesia and East Kalimantan were identified as the leading cause of neonatal deaths (0-28 days) compared to other causes[4,7].

The impact of Low Birth Weight (LBW) on the risk of growth and development in children is evident in several meta-analyses of observational studies. For instance, in

Indonesia, LBW has been associated with stunting in children aged 12-23 months (OR= 1.74; 95% CI= 1.38 – 2.19; p<0.001)[8], language delay in children (aOR= 2.52; 95% CI= 1.90 – 3.35; p<0.001)[9], and an increased risk of adult-onset diseases such as high blood pressure, asthma, metabolic diseases, cancer, respiratory diseases, allergies, cerebral palsy, and heart diseases[10,11].

A systematic review conducted by Lestari et al., (2020) identified several significant risk factors for LBW, including maternal age (< 20 years), parity, low upper arm circumference, anemia, and gestational age <37 weeks[12]. Other factors influencing LBW include maternal nutritional status[13], maternal education, maternal age over 35 years, and economic status[14].

In Indonesia, there have been several observational studies examining the risk factors for LBW. However, there is a lack of research at the community level, particularly the absence of the use of a retrospective cohort design in the Samarinda City region. Based on the background and the importance of supporting data in policy recommendations, this study aims to explore the risk factors for LBW by examining the exposures experienced by pregnant women during pregnancy.

METHOD

This study employs a retrospective cohort study design by identifying exposures (risk factors) in the past. The research is conducted in the Loa Janan sub-district within the working area of the Harapan Baru Community Health Center. The population in this study includes all pregnant women whose data are recorded in the pregnancy and birth medical records at the Harapan Baru Community Health Center. These medical records contain basic respondent data (gender, father/mother's education, maternal age, address), maternal nutritional status before pregnancy, Hb levels, upper arm circumference during pregnancy, and maternal weight at each visit. There is no data on compliance with consumption, socioeconomic status, and only 2 mothers experienced complications such as hypertension. The sampling method in this study is total sampling, where 124 infants are sampled based on birth data within the timeframe from January to May 2023. Exclusion criteria in this study include mothers who gave birth prematurely (<37 weeks) and post-mature (>42 weeks), mothers giving birth to twins, and neonatal births with congenital anomalies.

The exposure variables observed in this study are Chronic Energy Deficiency (KEK) status in the third trimester, adequacy of weight gain based on the Institute of Medicine (IOM) from early pregnancy to the end, and maternal anemia status in the third trimester. The data type in this study is secondary data analyzed by determining the Relative Risk (RR). Statistical tests are conducted using the Chi-Square test.

RESULTS

Out of 124 infant data, the majority were male (56.6%), and the parents' education level was predominantly equivalent to high school for both the father and mother of the infants. This indicates that only 18% to 23% of parents exceed the mandatory 12 years of education. Regarding the mothers' occupation, 79.8% of them were unemployed or housewives.

In Table 1, it is observed that before pregnancy, nutritional status issues were evident in 8% of mothers classified as undernourished and 34.7% of mothers classified as overweight. In terms of maternal age characteristics, mothers were categorized into ideal and non-ideal age groups for pregnancy. Two mothers were found to be pregnant under the age of 20, while 25 mothers, or 20.2% of them, were pregnant above the ideal threshold of 35 years.

Table 1. Characteristics of Respondents

Characteristics	Number	Persentase (%)
Gender		
Male	70	56.5
Female	54	43.5
Father's Education		
<= Junior High School	24	19.35
Senior high school	77	62.09
>= Diploma/graduate	23	18.54
Mother's Education		
<= Junior High School	23	18.54
Senior high school	63	50.8
>= Diploma/graduate	28	22.58
Mother's age		
< 20 years	2	1.61
20 - 35 years	97	78.2
>35 years	25	20.2
Mother's BMI before		

pregnancy		
Severe underweight	3	2.4
Mildly underweight	7	5.6
Normal	71	57.3
Mildly overweight	15	12.1
Severe overweight	28	22.6
Mum's occupation		
Employed	25	20.2
Not working	99	79.8

Comparison of the ratio of exposure and non-exposure of risk factors is presented in Table 2. This can explain the real condition of the population because it has used the total sampling technique. Of the 124 mothers, 29 (23.38%) were anaemic, which when compared to public health significance, is included in the moderate level of public health problems. The exposure ratio of pregnant women who were anaemic in the third trimester compared to those who were not was 1:4.5. The mean haemoglobin level of pregnant women was 11.33 ± 1.00 g/dL, which with a standard deviation of 1, is still considered normal in the first trimester.

In the nutritional status of mothers during pregnancy, there were only 118 data available in the medical records. There were 20 mothers (21%) who experienced CED during pregnancy, with an exposure ratio of 1:4.5. The mean upper arm circumference in the pregnant population was 26.5 ± 3.5 cm, which is considered normal. From the ratio data, it can be seen that there is still a lower number of exposures compared to non-exposed samples. Whereas in the discrepancy of weight gain during pregnancy from the beginning of pregnancy to the final trimester, there is a ratio of 3:1. This shows the high number of mothers who did not gain weight according to nutritional status (74.2%) compared to those who did.

Table 2. Sampling of exposure and non-exposure

Variable	Total (%)	Ratio	Mean
3rd Trimester Anaemia			
Yes	29 (23.4)	1:4.5	11.33 ±
No	95 (76.6)		1.00 g/dL
Chronic Energy Deficiency (CHD) (Trimester 3)			
Yes	20 (21)	1:4.5	26.5 ±
No	98 (79)		3.5 cm
Inappropriate weight gain (IOM)			
Yes	92 (74.2)	3:1	-
No	32 (25.8)		

The Relationship between Sample Characteristics and Pregnancy History with Stunting Incidence

Based on the results of the Chi-Square test, although the relative risk data indicate the presence of risk factors for the occurrence of anemia (RR= 1.35), Chronic Energy Deficiency (KEK) (RR = 1.256), and inappropriate weight gain (2.435) concerning Low Birth Weight (BBLR) occurrences, these results do not show a significant relationship with p-values > 0.05, which are 0.634, 0.794, and 0.162, respectively. However, when considering the prevalence of exposure, about 20% of the three variables have resulted in children with Low Birth Weight (Table 3).

Further investigation of respondent characteristics by the researchers revealed no relationship between the parents' education and the occurrence of Low Birth Weight. Similarly, with employment status, working mothers had an RR value of 1.32, meaning working mothers had a 1.32 times likelihood of having a child with Low Birth Weight, but this data is not significant.

Regarding the age characteristics that influence whether the mother's age during pregnancy is ideal or not, a significant relationship with Low Birth Weight occurrence was found (p-value = 0.039). However, in terms of the mother's nutritional status before pregnancy, there was no association with Low Birth Weight occurrences. This is supported by only 10 out of 124 individuals experiencing underweight, while the rest comprised 71 individuals with normal weight and 43 individuals classified as overweight.

Table 3. Factors associated with LBW incidence

Variable	LBW status		Relative Risk (RR)	95% CI	p-value
	Yes (%)	No (%)			
Anaemia					
Yes	7 (24.1)	22 (75.9)	1.35	0.62 – 2.93	0.634
No	17 (17.9)	78 (82.1)			
Severe					
Yes	6 (23.1)	20 (76.9)	1.256	0.555 – 2.843	0.794
No	18 (18.4)	80 (81.6)			
Inappropriate weight gain					
Yes	21 (22.6)	71 (77.4)	2.435	0.778 – 7.620	0.162
No	3 (9.7)	29 (90.3)			
Gender					
Male	15 (21.4)	55 (78.6)	1.286	0.610 – 2.712	0.663
Female	9 (16.7)	45 (83.3)			
Age					
< 20 years	2 (66.7)	1 (33.3)			
20 - 35 years	20 (20.8)	76 (79.2)	-	-	0.039*
>30 years	2 (8)	23 (92)			
Father's education					
<= Junior High School	4 (15.4)	22 (84.6)			
Senior High School	18 (23.4)	59 (76.6)	-	-	0.307
>= Diploma/Graduate	2 (9.5)	19 (90.5)			
Mother's Education					
<= Junior High School	8 (25.8)	23 (74.2)			
Senior high school	12 (18.5)	53 (81.5)			0.517
>= Diploma/graduate	4 (14.3)	24 (85.7)			
Mother's BMI before pregnancy					
Severe underweight	0 (0)	3 (100)	-	-	0.055
Mild underweight	4 (57.1)	3 (42.9)			
Normal	15 (21.1)	56 (78.9)			
Mildly overweight	1 (6.7)	14 (93.3)			
Severe overweight	4 (14.3)	24 (85.7)			
Mother's occupation					
Employed	6 (24)	19 (76)	1.32	0.585 – 2.977	0.573
Not working	18 (18.2)	81 (81.8)			

*Notes: * Significant relationship*

According to the requirements of logistic analysis data processing after candidate selection, there were only 3 variables, including: BMI before pregnancy (p=0.055), maternal age (p=0.039) and mismatch of maternal weight gain (p=0.162) that had a value below 0.25. However, other variables such as SEVERITY and anaemia were included in the analysis due to their importance as theoretical risk factors. Table 4 presents the estimates from the multivariate logistic regression analysis.

The model summary statistics show that the Nagelkerke R Square is 0.15, indicating that 15% of the variability in LBW can be explained by the mother's age at pregnancy.

Table 4. Multivariate regression analysis of risk factors for LBW.

Factors	B	S.E.	p-value	RR Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Weight gain mismatch	2.029	1.051	0.054	7.608	.970	59.67
Age of the expectant mother			0.022			
< 20 years	3.810	1.599	0.017	45.163	1.969	1036.17
Constant	-4.751	2.433	0.051	.009		

With weight gain during pregnancy. Although true, multivariate logistic regression cannot be calculated in the same way as multivariate linear regression.

Multivariate analysis showed that having a gestational age under 20 years was the most significant risk factor with an RR of 45.16, which means that pregnant women under 20 years of age are times more at risk than pregnant women over 20 years of age (p value = 0.017).

While in the weight gain mismatch, it was found that there was a decrease in the p-value to 0.054. The RR results showed that mothers with inappropriate weight gain during pregnancy had a 7.6 times greater risk of having a LBW child compared to those with appropriate weight gain during pregnancy (95% CI =0.97 - 59.6).

DISCUSSION

Data characteristics

Of all the respondent characteristics available in the medical record data, it is known that the age of the pregnant mother has the most significant risk factor. This result was also seen in several studies such as Liznindya (2023), who found that mothers at risk age had 15.89 times greater risk of giving birth to low birth weight babies compared to pregnant women at non-risk age (20-35 years)[15].

This study is also supported by a meta-analysis study by DeMarco, et al (2021) which found that adolescent pregnant women are at 1.5 times the risk of having LBW children compared to adult women. This is probably because the reproductive organs are still not fully developed. Likewise, nutritional needs are not yet optimally fulfilled due to competition for nutrients between mothers and babies who are simultaneously in the growth and development period [16].

In this study, parental education did not appear to have an association with LBW birth. This can also be seen in Arsyi and Bersal's (2020) study using data from the Indonesian Demographic and Health Survey in 2017[17]. This phenomenon may be explained by the accessibility of information sources using internet technology, so that mothers with low education can seek sources of knowledge or consult online with health workers.

Anaemia

In this study there was no association of anaemia during pregnancy with LBW, but if using public health indicators, then the prevalence of anaemia of 23.38% falls into the category of moderate public health problems[18]. This is in line with a similar study where the same number of anaemic and non-anaemic mothers (82 people) were found not to be associated with LBW (p value 0.148 > 0.05)[19].

However, a study by Wulandari (2017) found an association between anaemia during pregnancy and LBW (p=0.021, OR=3.66). In that study, the researcher used a sample with a ratio of exposure and non-exposure of 1:1 with a prospective design, while in this study the ratio was 1:4,5[20].

It was found that the mean haemoglobin level of the population in this study was 11.34 ± 1.005 g/dl, while the mean in the anaemia group was 10.09 ± 1.01 (normal data distribution). This could be related to the anemia intervention for pregnant women at Harapan Baru health centre which has provided double dose. So that even though there were anaemic pregnant women, the majority of haemoglobin levels were still around the anaemia threshold and had not yet reached the emergency limit. This may have caused the absence of a significant relationship.

Chronic Energy Deficiency (CHD)

The absence of an association between CED during pregnancy and LBW was also seen in other studies. Wijoyo's (2005) study, where out of 63 pregnant women with CED and 176 non CED mothers, there was no significant relationship between the incidence of CED and LBW[19].

In a study by Purboningtias (2021) using the case control method, there was also no relationship between SEEK and LBW. The study used a sample with a ratio of 1:3 where the number of non-exposure samples was greater than exposure, similar to this study[21].

Matos (2010), with a sample of 167 infants, found a significant association between LBW (p=0.000, OR=8.54)[22], as well as research by Sumiaty et al (2016) (p=0.000, RR=4.215)[23].

The absence of a significant relationship may be due to the fact that there were only 6 pregnant women out of 124 mothers who had a history of LBW. The mean upper arm circumference (Lila) in the group of pregnant women with CED was 22.5 ± 1.2 cm, this average is still close to the CED threshold of 23.5 cm. Meanwhile, the population mean for the upper arm circumference (LiLa) of mothers

was 26.56 ± 3.55 cm (normal data distribution).

Considering that there were only 10 out of 124 mothers who were malnourished before pregnancy, the majority of the mothers had normal or improved nutritional status. So it can prove that even though the mother's arms were detected to be small, it is likely that the pregnant woman's weight is not deficient. Several studies have proven that low pre-pregnancy BMI has a risk of LBW[24,25].

The pre-pregnancy BMI in this study had a p-value that was closer to significance than the upper arm circumference (p-value=0.055). So it is more likely that the mother's BMI before pregnancy is more influential than upper arm circumference during pregnancy. This is also evident from the more significant weight gain especially when using the regression model along with maternal age.

Discrepancy in weight gain during pregnancy

In the results of this study, although there was no significant association, the RR value in the variable of appropriateness of weight gain was the highest. There were only 3 pregnant women who did not experience appropriate weight gain who had LBW children. This was also seen in Sari's (2017) study with similar methods on 766 pregnant women also showed no association of weight gain during pregnancy with LBW[26]. Meanwhile, based on the research of R Khulafa'ur (2015), there is no relationship between the nutritional status of pregnant women and the incidence of LBW[27].

In Ningrum and Cahyaningrum's (2018) study, it was found that pre-pregnancy BMI had a significant relationship with birth weight. So if you look at the data of this study, there were only 8% of pregnant women who were underweight before pregnancy (Table 1), the majority of mothers were normal weight and overweight [28].

After using the multivariate test results, there was an increase in the significance of the p-value although it was not below 0.05. However, this proves the influence of the age of the pregnant women. There is an increase in the risk probability value of LBW when there is a mismatch in weight gain.

We can refer to the research of Putri (2023), with similar methods found that in 146 pregnant women, there was a significant relationship between weight gain and the incidence of LBW (p=0.027; OR=2.9) [29]. Likewise, Gunawan's research (2019), with the number of case and control groups of 37 people each, found a significant relationship (p=0.000; OR = 15.46) [30].

This incident can be explained by the mother's food consumption during pregnancy. If the mother does not meet the adequacy of food and insufficient body weight during pregnancy is at risk of giving birth to a low birth weight baby, while women who experience excessive weight gain are at higher risk of preeclampsia, giving birth to macrosomal babies, and gestational diabetes. Therefore, addressing low birth weight requires a more holistic and multi-sectoral approach such as behaviour change communication and comprehensive preconception care[31].

CONCLUSIONS

In this study, there was no significant association between pregnancy history of anaemia and LBW and the incidence of LBW. This is probably because in the study the number of mothers who were exposed and had children with LBW was small and the number of non-exposure was low. Another influencing factor is the average maternal Hb level which is still in the normal category due to the use of double dose anaemia at the puskesmas. Maternal BMI before pregnancy is a possible risk factor for LBW, supported by inappropriate weight gain during pregnancy and maternal age below ideal is a risk factor for LBW. There is a need for behaviour change communication interventions that help mothers improve their eating behaviour beyond supplementation.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

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