

Factors Affecting the Event of Low Birth Weight Babies

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Abstract

Low Birth Weight Babies (LBW) are still a public health problem in many countries that cause infant mortality. More than 80% of the 2.5 million newborns in the world die each year with low birth weight. The 2018 Indonesian Health Research Report shows that the prevalence of LBW in East Nusa Tenggara Indonesia is 8%, higher than the national figure of 6.2%. This research is a case control study. Infants were divided into two groups, infants with birth weight <2500 grams as the case group, and 2500 grams as the control group. Babies with congenital abnormalities were excluded. Factors observed were maternal age, parity, gestational distance, anemia, disease during pregnancy and place of residence. A total of 114 infants were included in this study, consisting of 57 infants in the case and control groups. The results showed that there was no relationship between maternal age, mother's education and place of residence with the incidence of LBW ($p > 0.05$). However, there was a significant relationship between parity (OR = 3,423; 95% CI = 1,586-7,386), birth spacing (OR = 2,348; 95% CI = 1,069-5,158), maternal anemia (OR = 2.194; 95% CI = 1,036- 4,649) and chronic disease in pregnancy (OR = 2,194; 95% CI = 1,036-4,649) in the incidence of LBW. Parity, birth spacing, maternal anemia and chronic disease in pregnancy are factors that affect LBW

Keywords: Low birth weight infants, maternal age, education level, parity, gestational spacing, anemia status, chronic disease in pregnancy, place of residence

1. Introduction

Low birth weight is still a public health problem in many countries because it is considered as one of the factors causing infant mortality. More than 80% of the 2.5 million newborns in the world who die each year have low birth weight [1,2]. Morbidity and disability during infancy and childhood can negatively affect the lives of adults [3]. Infants with a history of low birth weight have a greater risk of stunting, poor cognitive development, impaired academic performance, and a higher risk for developing chronic diseases in later life including diabetes and cardiovascular disease [4]. A very high prevalence of low birth weight is also associated with preterm birth, leading to higher health-related costs that can pose a significant economic burden on society, as premature infants are at risk for immature organ systems, including intracranial hemorrhage, disorders respiratory tract, sepsis, blindness and gastrointestinal tract disorders [4,5]. Therefore, LBW is considered as one of the important indicators of public health status in a society.

Progress in reducing the prevalence of LBW is still limited in all regions. Neither region showed a statistically significant reduction in the frequency of low birth weight. At the global level, the average annual decline in the prevalence of LBW is only 1.2% in the last 15 years [1]. There is marked global and regional variation in low birth weight rates. An estimated 6% of babies with low birth weight are born in East Asia and the Pacific, 13% in sub-Saharan Africa and half of all LBW babies are born in South Asia. Neonatal mortality due to low birth weight and premature birth in Indonesia reaches 19% [5–7]. Based on the 2017 Indonesian Health and Demographic Survey, all women (98%) received antenatal care services provided by competent health workers at least once and 77% received four antenatal care during their pregnancy. However, nationally, East Nusa Tenggara Province still ranks the highest (36.8%) of pregnant women with chronic energy deficiency. This shows that the case of low birth weight babies is a serious problem that still needs to be handled thoroughly.

Several studies suggest that low birth weight can be caused by demographic factors, maternal biology, obstetric history, maternal morbidity during pregnancy, maintenance during pregnancy and exposure to toxins. Low birth weight due to growth inhibition can occur by three main factors, namely factors that cause the fetus, placenta and maternal factors [8]. The World Health Organization (WHO) states that the increased risk for low birth weight babies is malnutrition, anemia, mothers with high blood pressure, diabetes, infections, parity, pregnancy spacing, smoking, alcohol, and caesarean delivery methods [1].

The Indonesian government continues to make integrated efforts to prevent cases of low birth weight. Some of its primary activities include maternal and child health, family planning and reproductive health as well as increasing access and quality of health services [9]. Based on what has been stated previously, this study seeks to determine the factors that influence the incidence of LBW so that it can be an effective intervention in reducing the incidence of LBW and its impact.

2. Material and Methods

2.1 Study design

The design of this study was a retrospective case-control study. The purpose of this study was to analyze the risk factors that influence the incidence of LBW

2.2 Subjects

The study population was LBW infants in Kefemenanu Hospital in 2019. The subjects were divided into case groups and control groups. The inclusion criteria for the case group were infants with birth weight <2500 grams. Infants with congenital abnormalities or having a birth weight 1000 g were excluded. Meanwhile, the inclusion criteria in the control group were babies with normal birth weight 2500 grams. We have calculated the minimum subject size for each group to be 57 infants. Mother/parents/other relatives provided informed consent about this study and have given their written consent. Confidentiality of participants is maintained. All data and information for this study were taken from the patient's medical record.

2.3 Statistical analysis

Statistical analysis was performed using SPSS 16.0 software. Univariate analysis was conducted to obtain descriptive data on maternal age, education level, parity, birth spacing, anemia status of chronic diseases in pregnancy and place of residence. Bivariate analysis using chi square test was conducted to determine the relationship between these factors and the case of LBW. Multivariate analysis was performed using logistic regression test.

3 Results

Table 1. Data characteristic of the risk factor of low birth weight

Characteristics	n	%
Maternal Age		
20-35 years	75	65.8
<20 or >35 years	39	34.2
Education		
Bachelor/diploma	10	8.8
Senior/Vocational high school	41	36.0
Elementary-Junior High school	63	55.3
Parity		
Not at risk (<5 parity)	57	50
At risk (≥ 5 parity)	57	50
Interval of birth		
≥ 2 years	73	64
<2 years	41	36
Anemia		
Yes	61	53.5
No	53	46.5

Chronic disease in pregnancy		
Yes	21	18.4
No	93	81.6
Residence		
Urban	36	31.6
Rural	78	68.4

In mothers with a higher education level (diploma and bachelor degree), the percentage of normal birth weight infants was same to the low birthweight infants (5%). It also showed in mothers who had secondary education level (high school or vocational high school) as 20.5% both in low and normal birthweight infants. Low educated mothers (elementary and junior high school education) gave birth to normal baby weight as many as thirty-two mother (31.5%). Overall, mothers with a lower education level more gave birth the low birthweight infants (63%). However, there was not significant difference between education and outcome of infants' birth weight ($p=0.980$)

In bivariate analysis between parity and outcome of infants' birthweight showed that mothers who their parity were not at risk (less than 5 parities), dominated by giving birth the normal birth weight infants (37 infants) compared to mother who had parity more than 5. There was a significant difference between total of parity and outcome of infant birthweight ($p= 0,001$). Mother with parity more than 5, had 3 times risk to give birth low birthweight infants ($OR=3, 423$; 95% CI 1,586-7,386) (table 2).

Table 2. Bivariate analysis of risk factor on low birth weight

Risk Factor	Low Birth Weight				Total		P value	95% CI	OR
	No	Yes	No	Yes	F	%			
	F	%	F	%	F	%			
Maternal Age									
20-35 years	39	37.5	36	37.5	75	75	0.554	0.58-2.74	1.26
<20 or >35 years	18	19.5	21	19.5	39	39			
Education									
Bachelor/diploma	5	5	5	5	10	10.5	0.960	-	-
Senior/ vocational high school	20	20.5	21	20.5	41	41.0			
Elementary-Junior High School	32	31.5	31	31.5	63	63.0			
Parity									
Not at risk (<5 parity)	37	28.5	20	28.5	57	100	0.001	1.58-7.38	3.423
At risk (≥ 5 parity)	20	28.5	37	28.5	57	100			
Interval of birth									
≥ 2 years	42	36.5	31	36.5	73	73.0	0.032	1.07-5.16	2.348
<2 years	15	20.5	26	20.5	41	41.0			
Anemia									
No (≥ 11 gr%)	32	26.5	21	26.5	53	53.0	0.039	1.04-4.65	2.194
Yes (<11 gr%)	25	30.5	36	30.5	61	61.0			
Chronic disease in pregnancy									
No	51	46.5	42	46.5	93	93.0	0.030	1.08-8.51	3.036
Yes	6	10.5	15	10.5	21	21.0			
Residence									
Urban	19	18.0	17	18.0	36	36.0	0.687	0.53-2.59	1.176
Rural	38	39.0	40	39.0	78	78.0			

The number of mothers with birth interval more than 2 years gave birth low birth weight infants as many as 31 (36.5%) infants. Meanwhile, in mother with risky birth interval, twenty-six (20.5%) mothers gave birth low birth weight. In bivariate analysis indicated that there was a significant difference between birth interval and outcomes of infant birthweight ($p = 0.032$; $OR= 2.348$; 95% CI 1.069-5.158).

Thirty-two mothers who did not experience anemia gave birth normal birth-weight infants. However, mother who had anemia in pregnancy was dominated by giving birth low birth weight infants (36 infants). The statistical test results indicated that there was a significance association between anemia in pregnancy and outcomes of infant birth weight ($p = 0.039$). Mother who experienced anemia, had 2 times risk to give birth low birth weight infant ($OR = 2.194$; 95% CI 1.036-4.648).

In bivariate analysis between chronic disease in pregnancy and infant birth weight, majority of mother who didn't have any chronic disease was dominated by giving birth infant with normal birth weight (51 infants). Meanwhile, mother who suffered chronic disease was dominated with giving birth low birth weight infants. The results showed there was significance difference between the chronic disease in pregnancy and the incidence of low birth-weight infants ($p = 0.030$; $OR = 3.036$; 95% CI 1.083-8.512).

Mothers who live in urban areas more gave birth normal birth-weight than low birth weight infants. However, mother who live in rural area, forty mothers gave birth low birth weight infants. This value was slightly bigger than mother who live in rural area and give birth normal birth weight infants (38 infants). In bivariate analysis, there was not significant difference between residence and infant birth weight ($p = 0.687$; $OR = 1.176$; 95% CI 0.534-2.594)(table 2).

The final results of multivariate analysis performed by the backward method (table 3).

Table 3. Multivariate analysis of risk factor on low birth weight

Risk Factor	B	Sig.	OR	CI 95%	
				Lower limit	Upper limit
Parity	1.227	0.003	3.410	1.527	7.615
Interval of birth	0.920	0.033	2.509	1.080	5.831
Chronic disease on pregnancy	1.170	0.036	3.221	1.077	9.633
Constant	-1.147	0.001	0.318		

The result showed that the strength of the parity factor to the incidence of LBW was $OR=3,410$ (95% CI 1,527-7,615), the birth interval to the incidence of LBW was $OR=2,509$ (95% CI 1,080- 5,831) and the chronic disease to LBW was $OR=3,221$ (95% CI 1,077- 9,633). The probability of the low birth-weight infants with parity of one to four, birth interval more than 2 years and no chronic disease was 99%. The probability of the low birth-weight infants with parity more than 5, birth interval less than 2 years and chronic disease in pregnancy is 96%. The results of statistical tests show that the p value of the *Hosmer and Lemeshow* test was 0.939 It indicates that the logistic regression model used is sufficient to explain the data.

4 Discussion

The results of this study show that there was not significant difference between maternal age and incidence of low birth-weight infants at Kefamenanu Hospital in 2019. This study is in line with the research of (Mahdalena et al. 2017) [10] and (Jaya 2009) [11] which also showed the same result that there was not significance difference between maternal age and low birth-weight infants. Most of the mothers gave birth at their non-risk age (20-35 years). The other element that supports the incidence of low birth-weight is maternal nutritional status. Maternal malnutrition will reduce placental blood flow resulting suboptimal placental size and reducing nutrients transfer to the fetus, leading to low birth-weight infants [12]. Meanwhile, the different result showed at the study conducted by [13]. It showed that there was a correlation between maternal age and low birth-weight incidence, where mothers at risky age had a greater chance to give birth low birth-weight infants compared to non-risky age.

According to (Friedman & Herd 2010) [14] and (Bhaskar et al. 2015) [15] study, maternal education was an intermediary factor that caused a lack of nutritional status in pregnant women and resulted in low birth-weight, premature birth and neonatal mortality. A meta-analysis conducted in 12 countries in Europe revealed 48% of preterm births were associated with low maternal education [16]. The higher maternal education, she had more critical thinking to response the health problems. She was also easier to receive information and the more capable in preventing and caring for her infants. (Sumardino & Sunarto 2016) [17] research results show that health promotion with the mother and child health book had a correlation in increasing knowledge and behavior of the mother on antenatal care. (Notoatmodjo 2012) [18] argues that the main target of health education in fostering healthy behavior was to increase the knowledge in the health sector to change behavior in individuals, families and communities. It also important to support the individual to plays an active role in efforts of increasing optimal health status. In addition, maternal age and parity will affect the mother's knowledge through past pregnancy experiences. A young mother that has given birth before will have more knowledge than older mother who has never given birth.

The results of this study showed that infants' mothers who gave birth more than five times had a greater risk of giving birth LBW infant compared to mothers with one to four parity. According to Wiknjosastro in Pramono, repeated pregnancies will cause damage to the uterine blood vessel walls, affecting fetal nutrition in subsequent pregnancies and caused of growth disorders which result in giving birth low birth weight infants. The risk of Small for Gestational Age (SGA) has been identified occurring in multiparity in least developed countries [19,20]. The results of different studies conducted by (Gizaw & Gebremedhin 2018) [21] and (Natalina &

Legawati 2020) [22] stated that parity has no significant effect on the incidence of low birth-weight. There are other factors that influence the incidence of low birth-weight infants including poor maternal health and nutrition, a high prevalence of specific and non-specific infections, pregnancy complications, and physically demanding work during pregnancy that contribute to poor fetal growth [23].

Infants' mother with birth interval more than two years shown to be delivered more normal birth weight infant. Total of low birthweight infant in mother with birth interval more than 2 years was greater than mother with birth interval less than two years. The result of this study indicated that there was a significant difference between interval of birth (more and less than 2 years) and infant birth weight. This study is in line with research conducted by (Ferinawati & Sari 2020) [24] that found the percentage of mothers who gave birth low birth-weight infant with a non-risk birth interval was greater than the percentage of mothers who gave birth to low birth-weight with a risky birth interval. It stated that birth interval had significant effect on the incidence of low birth-weight. *World Health Organization* (WHO) recommends the current gestation interval for at least 24 months after previous birth. A gestation interval less than twelve months after previous birth were associated with low infant weight. One study explanation related to the nutritional depletion hypothesis stated that pregnancy succession and poor lactation period worsens the mother's nutritional status, giving mothers lacks time to restore energy and reserved nutrient needed to support fetal growth and development for following pregnancies. The narrow birth interval can be the cause of anemia because the mother's condition has not yet been recovered and the fulfillment of nutritional substances is not optimal and has to meet the nutritional needs of the fetus. Mother also is not psychologically ready for another pregnancy since the previous child still requires intense attention, mother's attention will be divided between the current pregnancy and the child she previously gave birth.

The results of this study proved that there was an effect of maternal anemia status on the incidence of low birth-weight. This study is in line with research by (Nur 2019) [25] which proved that anemia mothers were nine times more likely to have low birth-weight infants. Anemia during pregnancy has an impact on the production of red blood cells which causes low hemoglobin levels. Low hemoglobin levels during pregnancy interfere with the supply of essential nutrients to the developing fetus which can interfere with normal growth. Another factor that may be the cause is that the mother has had anemia since the beginning of pregnancy, which in early pregnancy the development of the fetus and placenta will run well if the oxygen content in the blood is high enough. Low haemoglobin concentration since early pregnancy leads to abnormal placental development and an increased risk of preterm birth. Countries with low human development indexes show an increase in the magnitude of the relationship between maternal anemia and low birth-weight [26]. The results of this study differ from research conducted by [27] which states that there is no relationship between maternal anemia and the incidence of low birth-weight.

This study also found that mothers who did not have chronic disease gave birth more low birth-weight infants. This is made possible by other factors such as mother's employment. The research of (Sukei et al. 2019) [28] and (Khader et al. 2018) [29] showed that the mothers with a history of severe preeclampsia have a 16.8 times chance of giving birth low birth-weight infants compared to those without a history of severe preeclampsia. Hypertension during pregnancy is associated with low blood perfusion through the placenta, a vital organ that supplies blood and other important nutrients to the fetus from its mother to achieve normal growth and development [30].

The statistical test in this study also shows that there is no influence between residence and the incidence of low birth-weight. This may be owing to the number of respondents from rural areas who give birth to low birth-weight infants is almost equal to respondents who give birth to normal weight infants. The availability of Indonesia's health coverage program, improve the quality of health services, especially at primary health care facilities [31]. This study is not in accordance with research conducted by Kaur et al (2019) which found that there was a significant relationship between residence and the incidence of low birth-weight.

5 Conclusions

We conclude that pregnancy parity, birth interval, anemia, chronic disease during pregnancy proven to influence for the incidence of low birth-weight at Kefamenanu General Hospital in 2019. Providing education about reproduction health especially about the effect of parity and birth interval during pre-marriage or ante-natal is very important to prevent the incidence of LBW. Treatment for underlying diseases before pregnancy (anemia or hypertension) can be attempted to prevent the incidence of LBW.

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