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Determinants of Low Birth Weight Occurrence in Bahteramas Regional General Hospital, Southeast Sulawesi Province, Indonesia

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Abstract

AIM: This study aims to identify the determinants of Low Birth Weight (LBW) in Bahteramas General Hospital, Southeast Sulawesi Province, Indonesia.

METHODS: This research uses an institutional-based Case-Control Study design from May to June 2021 at the Bahteramas Hospital, Southeast Sulawesi Province. Data were collected from 134 samples of mothers giving birth, with 67 of them having babies with birth weight <2500 g (cases) and 67 of them having birth weights >2500 g (controls) using secondary data, namely medical records. Data were analyzed by univariate, bivariate with odds ratio test, and multivariate analysis with multiple logistic regression to identify the determinants of LBW.

RESULTS: Based on the logistic regression analysis, it found that the mother's educational status variable was ≤12 years (Adjusted odds ratio [AOR] 0.19 [95% confidence interval (CI) 0.06–0.62]); mothers with parity one or >3 (AOR 0.06 [95% CI 0.01–0.21]); birth spacing <2 years (AOR 4.49 [95% CI 1.37–14.74]), mothers who had a history of hypertension during pregnancy (AOR 0.07 [95% CI 0.02–0.23]); and mothers who had a history of anemia during pregnancy (AOR 0.10 [95% CI 0.03–0.31]) with parameter significance in the partial test, each p < 0.05, shown to be associated with the incidence of LBW.

CONCLUSIONS: This study concludes that the mother's low educational status, parity, birth spacing, history of hypertension, and history of anemia were found to be predictors of LBW. It is necessary to improve the knowledge, maintain birth interval, and routinely carry out antenatal care visits for early detection of pregnancy complications.

Introduction

One of the Sustainable Development Goals aims is to provide a healthy life and promote well-being for people of all ages. Reduce the Neonatal Mortality Rate to 12/1000 live births in 2030 to decrease preventable and infant mortality. UNICEF data report that the Infant Mortality Rate in Indonesia in 2019 was 20.24 people. These causes include perinatal disorders and babies with low birth weight (LBW) [1].

A newborn with a birth weight of less than 2500 g, regardless of gestational age, is considered LBW [2]. LBW is responsible for 60–80% of all neonatal deaths [3]. The World Health Organization (WHO) has committed to monitoring the progress of global change and supporting global targets to improve maternal, infant, and child nutrition through 6 global nutrition targets by 2025. One of the targets is to reduce LBW by 30% by 2025, which corresponds to a relative reduction of 3% per year between 2012 and 2025, or a drop from roughly 20 million to around 14 million infants with LBW [1].

LBW is still a global issue, particularly in developing countries. Every year, more than 20 million children are born with LBW, according to the WHO. Over 95.6 percent of these occurred in developing countries with low socioeconomic level [4]. In Indonesia, LBW affects 6.2% of the population, whereas 5.8% of the population in Southeast Sulawesi has LBW. In Bahteramas Hospital, data on LBW diseases showed 294 LBW cases out of 395 deliveries, or 45.3% [5]. This, of course, generates a double burden of nutrition problems because it stifles human development, prolong intergenerational poverty, and inhibits economic growth.

LBW is a valuable public health indicator of maternal health, nutrition, health-care delivery, and poverty. Babies with LBW risk death >20 times greater than babies with birth weight >2500 g [6]. LBW infants have a compromised immune system, are more susceptible to disease, and are at risk of malnutrition. They are more likely to suffer from cardiovascular disorders, cognitive impairment, and lower IQs as they develop, which will affect their academic performance and economic prospects later in life [2]. Furthermore,

children with LBW are more vulnerable to infections in the lower respiratory tract, which can quickly make them unwell and even kill them [7]. Despite the fact that considerable efforts have been invested toward child health interventions to prevent LBW, the factors that lead to these child deaths still need to be addressed.

Infant birth weight is influenced by many factors, including medical health (low weight gain during pregnancy, hypertension, history of LBW, malnutrition, urinary tract infection, HIV infection, fetal factors, multiple births), mental and social health (ethnicity and race, low educational status, first-time pregnancy, gestational age, gestational age <18 months, chronic stress, low socioeconomic status; depression), lifestyle (cigarette consumption during pregnancy, alcohol consumption, cocaine consumption), environment (cigarette exposure, violence), and family history (family history of being born prematurely or prematurely) [8].

Maternal mental and social health affect the incidence of LBW before giving birth. The study conducted by Shrestha *et al*. (2020) showed that educational status, occupation, and gestational age significantly influenced infant survival at Lumbini Hospital Nepal [20]. In comparison, several studies stated that educational status, occupation, and gestational age did not affect the incidence of LBW [10], [11], [12]. Likewise, a study conducted by Mahumud *et al*. (2017) that socioeconomic factors associated with LBW include the place of residence, occupation, education level, and wealth index [13], [14].

Similarly, maternal medical factors that influence LBW include preterm delivery, history of LBW, maternal age, height, Hb level, and frequency of antenatal care (ANC) consultations [14]. So that pregnancy requires examination and monitoring to provide quality ANC and early detection of pregnancy complications that can threaten the life of the mother and fetus. Meanwhile, a study conducted by Baye Mulu *et al*. (2020) reported that HB levels and maternal age did not affect the incidence of LBW [5]. Considering that previous studies only looked at several factors, this is a drawback. Further research is needed because basic knowledge about LBW predictors is essential to identify and provide appropriate attention to mothers at risk. Therefore, researchers are interested in conducting further research to know and analyze the risk factors for the incidence of LBW in Bahteramas Hospital, Southeast Sulawesi Province.

Methods

This research was observational analytics with a case–control study design in the Bahteramas Hospital, Southeast Sulawesi Province, from May to June 2021. The data source was secondary data,

namely medical records of mothers who gave birth at Bahteramas Hospital, Southeast Sulawesi Province, in 2020. The sampling technique used the purposive sampling technique, which consisted of 67 respondents as the case group (mothers who gave birth to babies <2500 g) and 67 respondents as control groups (mothers who gave birth to babies >2500 g) with a total of 134 samples. The instrument used is a checklist form. Data were analyzed using univariate analysis, bivariate analysis with odds ratio (OR) test, and multivariate analysis with multiple logistic regression.

Results

Table 1 shows that the proportion of mothers who gave birth aged <20 years or >35 years was higher in the case group, which was 25.4%, compared to the control group, which was 16.4%. Mothers with education status ≤12 years were higher in the case group (86.6%) compared to the control group (52.2%). Mothers who worked during pregnancy did not differ much between the case and control groups, namely in the case group by 40.3% and the control group by 41.8%. Mothers who had parity one or >3 were higher in the case group (67.2%) compared to the control group (31.3%). Mothers who had a history of preterm birth were higher in the case group (37.3%) compared to the control group (32.8%).

Table 1: Relationship of independent variables to the incidence of low birth weight in Bahteramas Hospital, Southeast Sulawesi Province in 2021

Variables	LBW occurrence		COR (95% CI)
	Case, *n* (%)	Control, *n* (%)	
Mother's age (years)			
< 20 or>35	17 (25.4)	11 (16.4)	1.731 (0.741–4.045)
20–35	50 (74.6)	56 (83.6)	
Educational status (years)			
≤12	58 (86.6)	35 (52.2)	5.892* (2.518–13.788)
>12	9 (13.4)	32 (47.8)	
Working status			
Employee (working)	27 (40.3)	28 (41.8)	0.940 (0.472–1.872)
Unemployee (not working)	40 (59.7)	39 (58.2)	
Parity			
1 or>3	45 (67.2)	21 (31.3)	4.481* (2.169–9.256)
2 or 3	22 (32.8)	46 (68.7)	
Preterm birth history			
Yes	25 (37.3)	22 (32.8)	1.218 (0.598–2.478)
No	42 (62.7)	45 (67.2)	
Birth interval (years)			
< 2	41 (61.2)	48 (71.6)	0.624 (0.303–1.287)
≥2	26 (38.8)	19 (28.4)	
Gestational age (weeks)			
< 37	20 (29.9)	23 (34.3)	0.814 (0.394–1.684)
≥37	47 (70.1)	44 (65.7)	
History of hypertension			
Yes	55 (67.9)	26 (32.1)	7.228* (3.265–15.999)
No	12 (22.6)	41 (77.4)	
History of anemia			
Yes	43 (71.7)	17 (28.3)	5.270* (2.506–11.079)
No	24 (32.4)	50 (67.6)	
ANC visits (kali)			
< 4	40 (59.7)	17 (25.4)	4.357* (2.088–9.093)
≥4	27 (40.3)	50 (74.6)	

*Statistically significant at *P* < 0.05. LBW: Low birth weight, COR: Crude odds ratio, CI: Confidence interval, ANC: Antenatal care.

In addition, mothers who had a birth interval of fewer than 2 years were lower in the case group (61.2%)

than the control group (71.6%). Mothers who had a gestational age of fewer than 37 weeks were lower in the case group by 29.9% than the control group, 34.3%. Mothers who had a history of hypertension were higher in the case group, which was 67.9%, compared to the control group, which was 32.1%. Mothers who had a history of anemia were higher in the case group, which was 71.7%, compared to the control group, which was 28.3%. Finally, the ANC examination showed that mothers who had ANC examinations less than four times during pregnancy were higher in the case group by 59.7% than in the control group 25.4%.

Table 2 shows that pregnant women aged <20 years or >35 years will increase the risk of the LBW incidence by 1,731 times greater than pregnant women aged 20–35 years (OR = 1,731; 95% confidence interval [CI] = 0,741–4,045). Pregnant women with education status ≤12 years will increase the risk of the incidence of LBW by 5.892 times greater than mothers with educational status of more than 12 years (OR = 5.892; 95% CI = 2.518–13,788). Pregnant women who worked during pregnancy avoided the incidence of LBW by 0.940 times greater than those who did not work (OR = 0.940; 95% CI = 0.472–1.872). Mothers with parity one or >3 will increase the risk of the incidence of LBW by 4.481 times greater than parity mothers with 2 or 3 (OR = 4.481; 95% CI = 2.169–9.256). Pregnant women who have a history of preterm birth will increase the risk of the incidence of LBW by 1.218 times greater than pregnant women who do not have a history of preterm birth (OR = 1.218; 95% CI = 0.598–2.478).

Table 2: Determinants of low birth weight Incidence in Bahteramas Hospital, Southeast Sulawesi Province in 2021

Variables	LBW occurrence		AOR (95% CI)
	Case, *n* (%)	Control, *n* (%)	
Educational status (years)			
≤12	58 (86.6)	35 (52.2)	0.197 (0.062–0.621)
>12	9 (13.4)	32 (47.8)	
Parity			
1 or>3	45 (67.2)	21 (31.3)	0.062 (0.018–0.212)
2 or 3	22 (32.8)	46 (68.7)	
Pregnancy interval (years)			
< 2	41 (61.2)	48 (71.6)	4.495
≥2	26 (38.8)	19 (28.4)	(1.371–14.741)
History of hypertension			
Yes	55 (67.9)	26 (32.1)	0.074 (0.023–0.233)
No	12 (22.6)	41 (77.4)	
History of anemia			
Yes	43 (71.7)	17 (28.3)	0.102 (0.033–0.313)
No	24 (32.4)	50 (67.6)	

LBW: Low birth weight, AOR: Adjusted odds ratio, CI: Confidence interval.

Pregnant women with birth intervals <2 years avoided the incidence of LBW by 0.624 times greater than mothers with parity more than two years. The risk factor for birth spacing was obtained (OR = 0.624; 95% CI = 0.303–1,287). Mothers with gestational age <37 weeks avoided the incidence of LBW by 0.814 times greater than mothers with gestational age >37 weeks (OR = 0.814; 95% CI = 0.39–1.684). Mothers who have a history of hypertension will increase the risk of the incidence of LBW by 7.228 times greater than mothers who do not have a history of hypertension during pregnancy (OR = 7,228; 95% CI = 3,265–15,999). Mothers who have a history of anemia will increase the

risk of the incidence of LBW by 5.270 times greater than mothers who do not have a history of anemia during pregnancy (OR = 5.270; 95% CI = 2.506–11.079). Mothers with ANC examination <4 times will increase the risk of the incidence of LBW by 4.357 times greater than mothers with a history of ANC visits more than four times (OR = 4.357; 95% CI = 2.088–9.093).

Factors related to the incidence of LBW were generated from multiple logistic regression analysis models, namely maternal education status, parity, birth spacing, history of hypertension, and history of anemia as predictors of LBW. The odds of LBW increased significantly with low educational status (AOR 0.19 CI 0.06–0.62); parity of one or more (AOR 0.06 CI 0.01–0.21); birth intervals of fewer than two years (AOR 4.49 CI 1.3–14.74); mothers who had hypertension during pregnancy (AOR 0.07 CI 0.02–0.23); and mothers who had anemia during pregnancy (AOR 0.10 CI 0.03–0.31).

Discussion

The frequency of LBW in Bahteramas Hospital, Southeast Sulawesi Province, was found to be unrelated to mothers aged from 20 to 35 years who gave birth. Mingude and Gebretsadik (2020) also performed research in Ethiopia and discovered no link between maternal age and LBW incidence [15], which supported the findings of this study. The safe age for pregnancy, childbirth, and lactation is known to be 20–35 years in a healthy reproductive period. As a result, those in the middle of their reproductive cycle are quite supportive of nursing. When it comes to pregnancy, childbirth, and breastfeeding, women under the age of 20 are regarded physically, emotionally, and psychologically immature.

Education is one of the factors that can affect knowledge. The mother's education level describes health knowledge and influences her decision-making attitude. This study found that mothers who gave birth with education status ≤12 years were at risk for the incidence of LBW in Bahteramas Hospital, Southeast Sulawesi Province. Mothers who give birth with education status ≤12 years are five times greater risk of giving birth to LBW babies than mothers who give birth with education status >12 years. The findings of this study confirm recent research by Zaveri *et al.* (2020), who discovered that low maternal education was linked to the frequency of LBW in children in India and that pregnant women with a higher education had a higher likelihood of health awareness. Low-education mothers have a hard time accepting change, and the majority are unaware of the need of prenatal care [23]. The more educated a mother is, the better equipped she is to make decisions about health care throughout pregnancy, which can help the mother and her fetus avoid problems as early as feasible. This

study contradicts the findings of Bekela *et al*. (2020)and Alemu *et al*. (2019), both of whom conducted research in Ethiopia and found that mother's educational status was not connected with the incidence of LBW [6], [2]. This research is also consistent with those of Baye Mulu *et al*. (2020) and Shrestha *et al*. (2020) [5], [20].

In the Bahteramas Hospital in Southeast Sulawesi Province, mothers who work during pregnancy are not substantially connected with the prevalence of LBW, and this study conforms with Bekela *et al*. (2020), who reported that maternal occupation was not associated with the incidence of LBW [11]. Pregnant women who work in high-density environments will expend a lot of energy and put their professions ahead of their health. Working mothers, on the other hand, may not always have a greater chance of having LBW infants than mothers who do not work throughout pregnancy. Shrestha *et al*. (2020) came to a different conclusion, claiming that working moms were a risk factor for the occurrence of LBW.

Mothers who experience parity one or >3 are at greater risk of giving LBW babies than mothers who experience parity 2 or 3 at the Bahteramas Hospital, Southeast Sulawesi Province. This research confirms Aturocmah *et al*. (2020) findings from Tidar Hospital in Magelang City, which showed that parity was linked to the occurrence of LBW. Mothers with parity 1 or 3 are at risk of giving birth to LBW, and related primiparas lack prior pregnancy and childbirth experience, resulting in poor nutritional status, which causes anemia and affects the birth weight of infants, as well as a lack of ANC visits and knowledge of care during pregnancy. There is a lack of adequate and mental preparedness to accept pregnancy. Meanwhile, mothers who have given birth to more than four children are more likely to have LBW due to scar tissue from previous pregnancies and births, which causes an insufficient blood supply to the placenta, causing the placental attachment to be imperfect, the placenta to become thinner, the uterus to become wider, and the distribution of nutrients from the placenta to be disrupted. Because the transfer of nutrients from the mother to the fetus is impeded or insufficient to satisfy the fetus's demands, the fetus's growth can be stunted, leading to the delivery of LBW newborns.

It is feasible for mothers with a parity of one or more to give birth to LBW infants. This can be impacted by factors such as socioeconomic level, since those with a higher socioeconomic position are more likely to pay attention to their health to achieve their nutritional demands. Furthermore, Agorinya *et al*. (2018) and Baye Mulu *et al*. (2020) revealed that maternal parity had no effect on the incidence of LBW, contradicting the findings of the study [1], [5].

This study also found that mothers who had a previous history of preterm birth did not significantly correlate with the incidence of LBW in Bahteramas Hospital, Southeast Sulawesi Province. The results of this study also do not support the research conducted by Sharma and Giri, which found that there was a relationship between a history of past preterm births and the incidence of LBW [17], [18], [19]. The younger the gestational age in the previous preterm delivery, the faster the prematurity will occur in the subsequent pregnancy. If this happens, it can give birth to an LBW baby in the following delivery [21].

Throughout the bivariate analysis, mothers with a birth spacing of less than 2 years were not significantly linked with LBW incidence in Bahteramas Hospital, Southeast Sulawesi Province. This is confirmed by a study conducted by Bekela *et al*. (2020), which revealed no link between birth spacing and the prevalence of LBW [6]. However, a logistic regression analysis revealed that birth spacing of less than 2 years was linked to the occurrence of LBW. According to the hypothesis that birth spacing is too close, there is a higher chance of having LBW newborns because the circulation of nutrients to the fetus is disrupted. When compared to mothers who had a birth interval of more than 24 months between their previous and current pregnancies, those who had a birth interval of less than 24 months were eleven times more likely to give birth to LBW [12]. Because the recommended time between births is more than 2 years, the body will have enough time to heal its joints and reproductive organs before attempting to conceive again.

Mothers who gave birth with gestational age <37 weeks were not associated with LBW incidence in Bahteramas Hospital, Southeast Sulawesi Province. This contradicts the popular belief that preterm delivery is the most prevalent cause of LBW (fewer months). Because the baby's growth is not yet ideal, the gestational age is less likely to result in LBW newborns. The greater the short- and long-term hazards, the younger the gestational age. For the fetus, 37 weeks of gestation is a healthy gestational age. Babies who live in the mother's womb before 37 weeks of gestation have not been able to grow optimally, so the risk of the baby having a birth weight of fewer than 2500 g: the shorter the gestational age, the less perfect the growth of the organs in the body. The growth of the organs in the body improves for newborns that have been in the mother's womb for 37 weeks or longer, resulting in a baby who is born with an average weight. Baye Mulu *et al*. (2020), Bekela *et al*. (2020), Mingude *et al*. reported that gestational age was not connected with the incidence of LBW [5], [6], [16], and our study backs up their findings.

The frequency of ANC is one factor that contributes to LBW. This is because the ANC visit is an important indication in raising awareness and monitoring the mother's and fetus's nutritional status throughout pregnancy. During ANC, mothers will get normal prenatal care, such as an explanation of indicators of difficulties, blood pressure checks, maternal nutrition, the administration of at least 90 iron

pills during pregnancy, and early diagnosis of issues that impact the baby's birth weight.

One of the routine prenatal care procedures for treating hypertension during pregnancy is a blood pressure check. According to this study, mothers who have had a history of hypertension during pregnancy are more likely to develop LBW. The findings of this study support those of Hailu and Kebede (2018) and Toru and Anmut (2020), who discovered that women with a history of hypertension during pregnancy had an impact on the prevalence of LBW [10], [21]. Hypertension in pregnancy (blood pressure 140/90 mmHg) induces vasoconstriction of the spiral arteries and failure of "spiral artery remodelling," leading in reduced uteroplacental blood flow, hypoxia, and ischemia in the placenta. Reduced uteroplacental blood flow can prevent nutrients from being transferred from the mother to the fetus, resulting in LBW.

Furthermore, this study discovered that moms with a history of anemia during pregnancy are more likely to develop LBW. The findings of this study support the hypothesis that the condition of a pregnant woman's Hb levels might impact the baby's growth and development. Assume that there is not enough iron available at this time to balance Hb levels in the mother's body and deal with fluid retention, which occurs between 32 and 36 weeks of pregnancy. In that instance, metabolism in fetal body tissues would be disrupted, potentially interfering with fetal growth in the womb. Fetal development begins in the third trimester, and fat, iron, and calcium are stored for postnatal requirements.

Pregnant women and their growing infants benefited from ANC checks during pregnancy because pregnancy abnormalities can be diagnosed and treated early. The majority of LBW were delivered to moms who had had ANC screening four times throughout their pregnancy, according to the findings. This suggests that pregnant women's knowledge of the need to monitor their pregnancy is still low. This might be due to the fact that the majority of them have just completed secondary school and hence are unaware of how to obtain health treatments.

Education status, parity, birth spacing, history of hypertension, and history of anemia were revealed to be significant factors in the multivariate logistic regression model on the incidence of LBW in this study. Birth distance is the factor most likely to influence the occurrence of LBW. As a result, moms who have a birth spacing of less than 2 years are more likely to generate LBW children than mothers who have a birth spacing of more than two years.

LBW is an important public health issue and reducing it needs a comprehensive strategy because of the numerous factors involved. It is necessary to promote socialization regarding the optimal age for pregnancy and delivery. Socialization can take many forms, such as health workers providing intense counseling to couples of reproductive age so that the pregnancy and birthing processes can be carefully planned [22]. Attitudes and actions in dealing with challenges, such as dietary management for pregnant women and maternal parity, are primarily determined by education and job. As a result, it is vital to increase women's education in order for pregnant women to identify the hazards to themselves and the fetus to be born.

Encourage moms to live a healthy lifestyle, eat nutritious meals, and give Fe supplementation for pregnant women are all things that may be performed to prevent or reduce the prevalence of hypertension and anemia. In addition, maintaining a short birth interval is crucial to ensure the health of the fetus. Pregnant women, according to studies, must maintain a healthy dietary intake to ensure optimal fetal growth and development. In order to lower the incidence of LBW, early diagnosis of risk factors during pregnancy and delivery is crucial. The necessity of frequent ANC check-ups must be carried out to avoid any unfavorable outcomes.

Thus, if efforts to prevent and control LBW can be carried out properly, success in increasing the baby's weight will be realized and the level of knowledge of mothers both in regulating pregnancy spacing to knowing unsafe ages to undergo pregnancy and childbirth as well as providing nutrition, starting from the time in the womb to giving birth. Thus, the decline in the number of LBW in Indonesia will occur if the community can implement preventive measures and control LBW in infants.

Conclusions

Maternal education status, parity, birth spacing, history of hypertension, and history of anemia were all linked to the frequency of LBW in Bahteramas Hospital in Southeast Sulawesi Province, according to the study's findings. Mothers with a birth spacing of less than 2 years are the characteristics that determine the frequency of LBW at the Bahteramas Regional General Hospital in Southeast Sulawesi Province.

Acknowledgments

Author Contribution

All authors contributed equally to this article, and YA conducted this study. Furthermore, WW and AA contributed significantly to the arrangement of this article. At the same time, NB, SR, and SS participated in the review and gave recommendations before data were obtained in the field, while EW contributed to writing this article. All authors listed above contributed to preparing, drafting, and revising the manuscript, gave final approval of the published version, and agreed to be accountable for all aspects of the work.

Availability of Data and Materials

The data underlying this article will be shared on reasonable request to the corresponding author.

Ethics Approval and Consent to Participate

Ethical approvals were obtained from Research Ethical Committee Faculty of Public Health, Hasanuddin University (Protocol Registration Number 7521092064 signed on Letter Number 11311/UN4.14.1/TP.01.02/2021).

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