

Research Article

Maternal Factors Affecting the Incidence of Low Birth Weight (LBW) in Indonesia

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ABSTRACT

Low birth weight (LBW) is currently still a public health concern in developing countries. Infants with LBW have an increased risk of morbidity, stunted growth, and neonatal mortality. In this study, we aim to examine the maternal factors associated with LBW in Indonesia. This study uses a cross-sectional design, and data were obtained from the 2017 Indonesian Demographic and Health Survey (IDHS), which collected data from all the provinces in Indonesia. The data were analyzed with multiple logistic regression. Results showed that 7.1% of children under five years of age in Indonesia had LBW. LBW was associated with maternal factors, which include inadequate antenatal care (ANC) (aOR = 1.7; CI 95% = 1.4–2.0), multiparity (aOR = 1.3; CI 95% = 0.8–1.9), low household income (aOR = 1.3; CI 95% = 1.0–1.7), and low educational attainment (aOR = 1.8; CI 95% = 0.9–3.6). Efforts to decrease the prevalence of LBW in Indonesia include the improvement of (1) ANC programs, (2) family planning programs, (3) educational attainment programs, (4) women's education, and (5) household economy programs. These are all important strategies for reducing the incidence of LBW in Indonesia.

Keywords: Low Birth Weight, Antenatal Care, Maternal Factors, IDHS

INTRODUCTION

Low birth weight (LBW) is characterized by a weight of less than 2,500 grams measured during the first hour of a newborn's life. LBW is one of the public health problems and is still a global concern, especially in developing countries including Indonesia, with various short- and long-term impacts. Any increase the prevalence of LBW can be related to morbidity and mortality in children (Mahumud, Sultana, & Sarker, 2017; UNICEF, 2019; World Health Organization, 2014).

According to United Nations Children's Fund (UNICEF), it is estimated that of the 20.5 million births in the world in 2015, 14.6% of babies suffered from LBW (UNICEF, 2019). In Indonesia, as much as 56.6% of children under five years of age have their birth weight recorded, and from this percentage, 6.2% showed LBW, as revealed from the results of the 2018 Basic Health Research (*Riskesdas*). In 2019, the Ministry of Health's Directorate of Public Nutrition's data from 25 provinces found that 111,827 newborns (3.4%) suffered from LBW. These numbers revealed that LBW is the largest cause of neonatal mortality (infants aged 0–28 days) in Indonesia, which was 35.3%. Indirectly, LBW can also be a cause of death in infants or toddlers, even though the state has been consistent in its efforts to

promote children's health by ensuring children's quality of life (Kementerian Kesehatan RI, 2020).

The 65th World Health Assembly (WHA) approved a comprehensive implementation plan on maternal, infant, and child nutritional health. One of the targets to be achieved included a 30% reduction in the incidence of LBW in the world by 2025 (World Health Organization, 2014). This means that every year, there should be a 3.9% decrease in the incidence of LBW from 2012 to 2025, or a reduction from 20 million babies to 14 million babies with LBW (World Health Organization, 2014). The targets were designed to meet the objectives of the Sustainable Development Goals (SDGs), especially goal number 3, to ensure a healthy life and improve the welfare of the entire population, including infant and child health (World Health Organization, 2015).

In the first year of life, babies who suffer from LBW have a high risk of stunted growth and decrease intelligence level. In adulthood, the risk of experiencing non communicable diseases increases (UNICEF, 2019). This means that each increase in the percentage of LBW contributes to the burden on the state in the following years, considering that the morbidity rate will continue to increase.

To reduce the incidence of LBW, strategies related to improving maternal nutritional status,

preventing conditions that can worsen pregnancy, and providing adequate maternal services are needed (World Health Organization, 2014). This suggests that the incidence of LBW is caused by the mother's condition during pregnancy, for example, teenage pregnancy, malnutrition, and pregnancy complications (Kementerian Kesehatan RI, 2020). In addition, there are many other maternal factors that affect the incidence of LBW, such as maternal education, number of antenatal care (ANC) visits, parity, maternal occupation, family socio-economic status and area of residence (Khan, Islam, Awan, & Muurlink, 2018; Nyamasege et al., 2019; Siramaneerat, Agushyana, & Meebunmak, 2018). In this study, we aim to determine maternal risk factors associated with the incidence of LBW in children under five years of age in Indonesia using data from the 2017 Indonesian Demographic and Health Survey (IDHS).

MATERIALS AND METHODS

This study used secondary data from the 2017 IDHS. The data were taken from 34 provinces in Indonesia, which can be accessed from the website

<http://dhsprogram.com/data/availabledatasets.cfm>. The IDHS aims to present estimates at the national and provincial levels of population and maternal and child health. The sample includes the census block originating from the 2010 population census block (SP2010). The sample selection was carried out in two stages. First, in regencies/cities, a systematic probability proportional to the size (PPS) of the census block was selected with the number of households listed in SP2010, as well as stratification according to urban, rural, and welfare indices. The second stage, was systematically selecting households for each census block. Data collection from the IDHS focused on indicators of fertility, reproductive health, maternal and child health, mortality, nutrition, knowledge, attitudes, and behavior on certain issues. This is an analytical study with a cross-sectional design. The population was all women aged 15–49, who had children born alive in the last five years in Indonesia at the time of the 2017 IDHS, while the sample size was 16,343 women aged 15–49 years who had children

aged 0–59 months with the criterion that respondents had complete data on all the analyzed variables. The dependent variable in this study was LBW, whereas the independent variable was maternal factors (number of ANC visits, parity, maternal education, maternal occupation, wealth quintile, and area of residence).

The data were analyzed using a sample complex with attention to stratification, clustering, and sample weight of children under five years of age (USAID, 2018). Percentage and Chi-square test were used for univariate and bivariate analyses, followed by a multivariable test using multiple logistic regression. The selection of candidate variables that were included in the multivariable analysis was based on the results of the bivariate analysis those with p value ≤ 0.25 . Multivariable analysis began by entering all the candidate variables into the model; then, variables with p value > 0.05 were excluded one by one from the model. If there was a change in OR $> 10\%$ in the variables in the model, they were reentered as confounding variables. The final model was obtained when there were no more variables that have p value > 0.05 and confounding variables.

ETHICS

This study was based on a secondary data analysis of IDHS 2017. The authors permission to use and download the data was given by ICF Internasional. Before the survey starts, The DHS project obtained ethical approvals from the research ethics committee in each country. ICF International approved to use the survey datasets for this study.

RESULT AND DISCUSSION

During 2012–2017, 7.1% of children under five years of age in Indonesia were born with LBW. There were slightly more males (50.9%) than females (49.1%) among these children. In terms of age group, 26.4% of these children were in the 30–34 month age group, followed by the 25–29 month age group (25.7%), 35–39 month age group (19.8%), less than 24 months age group (18.6%), and 40–59 month age group (9.5%).

Table 1: Maternal Factors Risk of Low Birth Weight Infants (n = 16,343), IDHS 2017

Independent Variable	%	LBW Status		cOR	CI 95% OR	P
		BBLR (%)	No LBW (%)			
ANC						
≥ 4 times	82.9	6.4	93.6	1.0		
< 4 times	17.1	10.9	89.1	1.8	1.5-2.1	<0.0001
Parity						

Independent Variable	%	LBW Status		cOR	CI 95% OR	P
		BBLR (%)	No LBW (%)			
≤ 2 children	96.3	7.0	93.0	1.0		
> 2 children	3.7	10.5	89.5	1.6	1.1-2.3	0.027
Mother's education level						
Bachelor's degree	16.2	5.7	94.3	1.0		
High school graduate	30.6	6.8	93.2	1.2	1.0-1.5	0.104
Middle school graduate	28.5	6.9	93.1	1.2	1.0-1.6	0.088
Elementary school graduate	18.8	8.8	91.2	1.6	1.2-2.1	<0.0001
Elementary school undergraduate	5.3	8.4	91.6	1.5	1.1-2.2	0.018
No educational level	0.6	11.8	88.2	2.2	1.2-4.2	0.014
Mother's occupation status						
Not working	49.5	7.5	92.5	1.0		
Working	50.5	6.8	93.2	0.9	0.8-1.1	0.195
Wealth quintile						
Uppermost	20.2	5.8	94.2	1.0		
Upper middle	20.6	6.6	93.4	1.1	0.9-1.5	0.328
Moderate	21.3	7.6	92.4	1.3	1.0-1.7	0.035
Lower middle	19.7	7.1	92.9	1.3	1.0-1.6	0.097
Lowermost	18.3	8.8	91.2	1.6	1.2-2.0	<0.0001
Residence area						
Rural	50.6	7.2	92.8	1.0		
Urban	49.4	7.1	92.9	0.9	0.8-1.1	0.837

*cOR = crude Odds Ratio

Table 1 shows that during the last five years, most of the pregnant women had ANC visits of more than four times (82.9%), but there were still pregnant women with ANC visits of less than four times (17.1%). The risk of mothers with ANC visits of less than four times to deliver LBW babies was 1.8 times higher (OR = 1.8; 95% CI = 1.5–2.1) (Table 1) than that of mothers with more than four ANC visits.

In addition, 96.3% of children under five years of age have a mother with parity of less than or equal to two children, and the rest of the children (3.7%) have a mother with parity of greater than two children. The risk of mothers with parity of greater than two children to deliver LBW babies was 1.6 times higher (OR = 1.6; 95% CI = 1.1–2.3) than that of mothers with parity of less than or equal to two children.

Occupation status was almost the same between working and nonworking mothers (50.5% versus 49.5%). The risk of working mothers to give birth to LBW babies was almost the same as that of nonworking mothers (OR = 0.9; 95% CI = 0.8–1.1; $p = 0.195$).

Furthermore, the percentages of mothers who graduated from middle school (28.5%) or high school (30.6%) were higher than those with other educational levels, whereas 0.6% had no education at all. The risk of mothers with no education to deliver LBW babies was 2.2 times higher (OR = 2.2; 95% CI = 1.2–4.2), that of mothers who did not graduate from elementary

school was 1.5 times higher (OR = 1.5; 95% CI = 1.1–2.2), that of mothers who graduated from elementary school was 1.6 times higher (OR = 1.6; 95% CI = 1.2–2.1), and that of mothers who graduated from middle and high school was 1.2 times higher than that of college graduates.

In term of wealth quintile, the percentage of families with moderate wealth (21.3%) was higher than those belonging to other wealth quintiles, whereas 18.3% belonged to the lowest wealth quintile. Family wealth quintile showed that risk of families belonging to the lowest wealth quintile of having LBW babies was 1.6 times higher (OR = 1.6; 95% CI = 1.2–2.0), and that of families belonging to the lower middle wealth quintile was 1.3 times higher than that of uppermost wealth quintile.

The area of residence was almost the same between rural (50.6%) and urban (49.4%) areas. The risk of mothers living in urban areas to give birth to LBW babies was almost the same as that of mothers living in rural areas (OR = 0.9; 95% CI = 0.8–1.1 p value = 0.837). The final model of multivariable analysis consisted of ANC visits, parity, maternal education, and wealth quintile (Table 2). The results of the final model analysis showed that the more the ANC visits, the lower the risk of LBW. The risk of mothers with ANC visits of less than four times to give birth to LBW 1.7 (adjusted OR = 1.7; 95% CI = 1.4–2.0), that of mothers with parity of greater than two children was 1.3 (adjusted OR = 1.3; 95% CI = 0.8–1.9),

and that of mothers belonging to the lowest wealth quintile was 1.3 (adjusted OR = 1.3; 95% CI = 1.0–1.7). The lower the mother's educational level, the higher the risk of giving

birth to LBW babies: the uneducated mothers have an odds ratio of 1.8 (adjusted OR = 1.8; 95% CI = 0.9–3.6).

Table 2: Results of the Logistic Regression Model for Maternal Factor Risk of Low Birth Weight in Indonesia, IDHS 2017

Independent Variables	Category	aOR	CI 95% aOR
ANC	≥ 4 times	1.0	
	< 4 times	1.7	1.4-2.0
Parity	≤ 2 children	1.0	
	> 2 children	1.3	0.8-1.9
Mother's Education	Bachelor's degree	1.0	
	High school graduate	1.2	0.9-1.5
	Middle school graduate	1.2	1.0-1.5
	Elementary school graduate	1.5	1.1-2.0
	Elementary school undergraduate	1.3	1.0-2.0
	No educational level	1.8	0.9-3.6
Wealth quintile	Uppermost	1.0	
	Upper middle	1.1	0.8-1.4
	Moderate	1.2	0.9-1.6
	Lower middle	1.1	0.8-1.5
	Lowermost	1.3	1.0-1.7

*aOR = adjusted Odds Ratio

In this study, we aim to determine the maternal risk factors for the incidence of LBW in Indonesia using the 2017 IDHS data. The results of the multivariable analysis showed that maternal education, ANC visits, wealth quintiles, and parity have significant relationships with the incidence of LBW. The results of the multivariable analysis showed that ANC visits and maternal education greatly affected the incidence of LBW. The risk of mothers with no education to deliver LBW babies is 1.8 times higher than those that of college graduates after controlling for other maternal variables. The risk of mothers with ANC visits of less than four times to deliver LBW babies was 1.7 times higher than those with ANC visits of greater than four times after controlling for other maternal variables.

This finding is in line with the results of previous research that showed that mothers who completed only elementary school education were 2.2 times more likely to have LBW babies than college graduates. Every one-year increase in the mother's educational level can reduce the probability of having LBW by 20% (Grytten, Skau, & Sørensen, 2014; Siramaneerat et al., 2018). Another study found that very low education were 1.3 times higher risk of delivery LBW infant than high education mother attainment (Sembiring, Besral, & Herdayati, 2021). Education is closely related to the mindset and behavior of mothers,

which can lead to behaviors that benefit the health of mothers and their families. The higher the educational level of the mother, the easier it is for her to understand the information that she has received, such as information on managing nutrition during pregnancy to ensure that the baby will be born healthy (Prickett & Augustine, 2016; Titaley, Ariawan, Hapsari, Muasyaroh, & Dibley, 2019).

In other contexts, education can lead to changes in health patterns, including the following (Grépin & Bharadwaj, 2015): (1) Education affects a person's health because educated persons are more obedient in maintaining their health. (2) Education makes a person more aware and directs behavior toward better prevention or treatment. (3) Increased education can be correlated with a higher income, which indirectly affects health by increasing an individual's purchasing power.

Improved education is intended to increase mothers' understanding and to encourage them to become healthy. The results of previous studies, which were carried out on the basis of group intervention, aims to increase the optimal weight of infants by providing nutrition counseling to pregnant women. The recommended information is to improve nutrition among pregnant women and encourage ANC visits. The results of the intervention showed an increase in the frequency

of ANC visits for pregnant women. In addition, the prevalences of under-and over-nutrition in the intervention group decreased (Nyamasege et al., 2019).

Investments in education for women provide benefits for the health of their children, such as facilitating early development through choice behavior during childbirth, utilization of health services, access to information, employment income and reduction of all risk factors that will impact children's health, one of which is LBW. Access to education for women has the potential to improve children's health in the short term, as well as generate economic benefits in the long term, because healthy children have the opportunity to become educated and productive individuals (Le & Nguyen, 2020).

In this study, the number of ANC visits was also associated with LBW occurrence. The risk of mothers with ANC visits of less than four times to give birth to LBW babies was 1.7 times higher than that of mothers with ANC visits of greater than four times after controlling for other maternal variables. Similar to the results of Fonseca et al, risk of LBW among mothers with fewer ANC visits was 1.78 times higher than mother that among mothers with more ANC visits. Inadequate number of ANC visits was associated with LBW, with the probability of LBW occurrence being higher (Fonseca, Strufaldi, Carvalho, & Puccini, 2014).

ANC is essential to detect infant abnormalities during neonatal development. Early detection ensures the health of the mother in order to give birth to a healthy baby and to anticipate complications associated with pregnancy problems, which contributes to the prevention of LBW (Kementerian Kesehatan Republik Indonesia, 2014; Zhou et al., 2019). ANC consists of several components that are basic requirements for pregnant women to be able to monitor their pregnancy (Fonseca et al., 2014). According to Regulation Number 97 of the Ministry of Health of the Republic of Indonesia published in 2014, it is advisable during pregnancy to make ANC visits at least four times, that is, once in the first trimester, once in the second trimester, and twice in the third trimester, these health services should be provided by competent health workers (Kementerian Kesehatan Republik Indonesia, 2014).

Furthermore, from the parity analysis results, risk of mothers with more than two children to give birth to LBW babies was 1.3 times higher than that of mothers with two or fewer children after controlling for other maternal variables. Parity was a major contributor to the increase in the incidence of LBW in South Korea from 2005 to

2015 (Oh & Bae, 2019). Hinkle et al. found that the weight of the newborn decreased with increasing maternal parity, the decrease occurred with a short pregnancy interval, whereas the long gestation interval was assumed to be biased (Hinkle et al., 2015). Many children have difficulties in fulfilling their primary and secondary needs, which are not in accordance with household needs, resulting in less than optimal nutritional and health status. A large number of households members leads to a reduction in food availability, and there is competition for available resources (Titaley, Ariawan, Hapsari, Muasyaroh, & Dibley, 2019).

In This study, we also found that mothers belonging to the lowermost wealth quintile were 1.3 times more likely to have LBW babies than mothers in belong to the uppermost wealth quintile. Several studies also link nutrition problems in developing countries, one of which is the high incidence of LBW babies among those living underpoor socio-economic conditions (Ekholuenetale, Tudeme, Onikan, & Ekholuenetale, 2020; Van De Poel, Hosseinpoor, Speybroeck, Van Ourti, & Vega, 2008).

The results of the demographic survey in Indonesia showed the characteristic patterns of the background of women with the wealth quintile of society, as follows (BKKBN, BPS, Kementerian Kesehatan RI, & USAID, 2017): (1) The percentage of women (aged 15–19 years) finishing high school and above increases with increasing wealth quintile. The median educational level of household members in the uppermost quintile is the highest compared with that of household members in the lower quintile. (2) The percentage of women (aged 15–19 years) who read and access information media, such as newspapers/magazines and listen to the radio increases with increasing wealth quintile. (3) The higher the educational level and wealth quintile, the lower the total fertility rate (TFR) with the median birth spacing of women in the lowermost wealth quintile being 56 months, whereas that in the uppermost quintile is 61 months. The survey results confirm the relationship between wealth quintiles and several maternal characteristics in Indonesia. The maternal characteristics that mentioned in the IDHS are also at risk for the of LBW occurrence, as the results of this study have shown.

CONCLUSIONS AND RECOMMENDATIONS

The maternal factors in Indonesia, which contribute to the risk of LBW occurrence, were ANC < 4 visits, parity > 2 children, low maternal education, and belonging to the lowermost wealth quintile. The maternal factors that were

most strongly associated with the incidence of LBW were education (no formal education history) and ANC visits of less than four times. It is suggested that more serious efforts are needed to improve the ANC program, family planning program, education program, and the socio-economic status of Indonesian women. Efforts to increase the knowledge of Indonesian women to improve maternal health are essential to give birth to a healthy future generation. Improving women's education is an important goal in the strategy to reduce the incidence of LBW in Indonesia.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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