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Maternal Predisposing Factors with The Incidence of Low Birth Weight in Central Java

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Abstract

In Central Java, the prevalence of LBW (Low Birth Weight) has increased from 4.3 (2018) to 4.7 (2019) and is the highest cause of neonatal mortality (46.4%) and infant mortality (40.5%). This research aims to analyze the relationship between the quality of ANC (Antenatal Care), iron supplementation, pregnancy complications, and maternal smoking status with LBW in Central Java. It was an analytical study that used secondary data from the 2017 IDHS (Indonesian Demographic and Health Survey). The sampling design used purposive sampling. The population study was 1205 babies born in Central Java. The sample comprised 952 babies. Independent variables were the quality of ANC, iron supplementation, pregnancy complications, and maternal smoking status, with the incidence of LBW as the dependent variable. Data analysis was performed by chi-square continuity correction and logistic regression. Pregnancy complications have been associated with incidences of LBW in Central Java (p-value = 0.0001). Iron supplementation (OR = 2.474) and pregnancy complications (OR = 4.869) affected the incidence of LBW in Central Java. Iron supplementation and pregnancy complications influenced the incidence of LBW in Central Java.

Introduction

In 2015, 14.6% of the incidences of LBW were found in the world, and the highest prevalence occurred in Asia (17.3%) (WHO and UNICEF, 2019). The incidence of LBW in developing countries in the Asia Pacific region experienced an increase of ≤2 babies per 100 live births in 2014 compared to 2000, while a 0.8% increase occurred in Indonesia (BKKBN et al., 2017). The 2018 Riskesdas (Basic Health Research) showed that 6.2% of babies born with LBW in Indonesia and 6.1% were found in Central Java (BKKBN et al., 2017). The Central Java Health Profile in 2019 showed an increase in the incidence of LBW from 4.3 (2018) to 4.7 (2019) (Central Java Provincial Health Office, 2019). A total of 5.9% of LBW events were found in single (Kujariningrum et al., 2021).

More than 37% of toddlers were stunted in 2013 (Bappenas and UNICEF, 2017). It was related to a history of LBW (p-value = 0.037; OR = 5.294) (Miranti et al., 2020). A study in South Asia showed that 17% of children with a history of LBW had a total IQ of less than 85 (Upadhyay et al., 2019). In Central Java, LBW is the biggest cause of neonatal mortality (46.4%) and infant mortality (40.5%) in 2019 (Central Java Provincial Health Office, 2019).

Visits and completeness of ANC services affect the incidence of LBW (Paul et al., 2019) The incidence of LBW was also related to maternal anemia status (OR = 1.23) (Figueiredo et al., 2018). As much as 50% of the 73.3% of pregnant women at Pejeruk Health Center had adherence to consuming low Fe tablets (Sarah and Irianto, 2018). The incidence of LBW was associated with pregnancy complications (Bener et al., 2012). The entry of nicotine into the body's mechanism of pregnant women has an impact on fetal growth and development

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(Nemoto et al., 2021). The incidence of LBW in Taiwan was associated with maternal smoking status (OR = 3.46) (Ko et al., 2014).

The incidence of LBW was related to many factors. There were differences in the causes of LBW in each region. A study to determine the risk factor of LBW in an area is urgently needed. There has been a lot of previously research about LBW, but for research with the scope of research in Central Java used the 2017 IDHS secondary data analysis with sample weighting has never been done. Based on the facts described above, this study aims to analyze the relationship between the quality of ANC, iron supplementation, pregnancy complications, and maternal smoking status with the incidence of LBW in Central Java.

Method

This study used a cross-sectional design and 2017 IDHS data. The study population consisted of 1205 babies born to WUS (Women of Childbearing Age) in 2012-2017 in Central Java. The research sample was taken using purposive sampling based on inclusion and exclusion criteria for the total population, so that a sample of 952 babies was obtained. The inclusion criteria included babies who were weighed at birth, babies who were last born by respondents in the range of 2012-2017, single births, and received ANC while in the womb. Infants with mothers who did not know the number of ANC visits, history of blood draws, history of consultations, and history of receiving Fe tablets were excluded from the study sample list as exclusion criteria.

The research variables consisted of the quality of ANC, iron supplementation, pregnancy complications, and maternal smoking status as independent variables, with the incidence of LBW as the dependent variable. This study used the weighting of the sample according to the ethics of using the 2017 IDHS raw data and referring to a tutorial published by the youtube account The DHS Program on August 25, 2015, entitled " Part IV: Demonstration of How to Weight DHS Data in SPSS & SAS ". The bivariate analysis used was a statistical analysis of chi-square continuity correction. The independent variables included in the multivariate logistic regression method enter are the independent variables with p-value ≤ 0.25. The analysis used a significance level of 0.05 and a confidence level of 95%. The likelihood of LBW occurrences can be seen from the calculation of the predicted value using the following formula:

$$f(Z)= \frac{1}{(1+ e^{(-(b0+b1x1+b2x2+...bixi))})}$$

Formula description:

f(Z)	= probability
b0	= constant
b1, b2, …bi	= partial regression coefficient
x1, x2, …xi	= independent variable
e	= exponent function with constant value 2.72

This study has passed the ethical clearance number: 12 / EA / KEPK-FKM / 2020 issued by the Health Research Ethics Committee, Faculty of Public Health, Diponegoro University on January 26, 2021.

Results and Discussion

Most (94.8%) babies born in Central Java in 2012-2017 had an NBW (Normal Birth Weight). As many as 68.9 % of babies were born to mothers who received poor-quality of ANC. Most (94.3%) babies were born to mothers who received iron supplementation during pregnancy. As many as 81.3% of babies were born to mothers who did not experience complications during pregnancy. Most (99.1%) babies were born to mothers who had never smoked. Based on chi-square continuity correction, pregnancy complications were related to the incidences of LBW in Central Java (p-value = 0.0001). There were no relationships between the quality of ANC, iron supplementation, and maternal smoking status with the incidence of LBW in Central Java (Table 1).

Table 1. Correlation of Quality of Antenatal Care, Iron Supplementation, Pregnancy Complications, and Mother's Smoking Status with LBW incidence (N=952)

Independent Variable	LBW				Total		p-value
	Not		Yes		f	%	
	n	%	n	%			
Quality of *Antenatal Care*							0.460
Good	278	94.2	17	5.8	295	100	
Poor	624	95.1	33	4.9	657	100	
Iron Supplementation							0.059
Yes	854	95.1	45	4.9	899	100	
Not	48	90.6	5	9.4	53	100	
Pregnancy Complications							0.0001
Not	749	96.8	26	3.2	775	100	
Yes	153	86.5	24	13.5	177	100	
Mother's Smoking Status							0.712
Not	893	94.8	50	5.2	943	100	
Yes	9	100	0	0	9	100	

Multivariate analysis using logistic regression with enter method resulting in iron supplementation and pregnancy complications affecting the incidence of LBW in Central Java. Mothers who did not receive iron supplementation during their pregnancy had a 2.474 times higher risk of giving birth to LBW babies than mothers who received iron supplementation (OR = 2.474). Mothers who experienced pregnancy complications had a 4.869 times higher risk of giving birth to LBW babies than mothers who did not experience complications (OR = 4.869) (Table 2). Based on the calculation above, f(Z) = 0.27 can be concluded that mothers who didn't receive iron supplementation and had pregnancy complications history have a chance of 27% given the incidence of LBW.

Table 2. Results of Multivariate Analysis The Effect of Iron Supplementation and Pregnancy Complications on the Incidence of LBW in Central Java 2012-2017 (N=952)

Variables		B	SE	Wald	Sig	Exp (B)
Model 1	Iron Supplementation	0.906	0.366	6.125	0.013	2.474
	Pregnancy Complications	1.583	0.218	52.670	0.0001	4.869
	Constant	-3.484	0.155	506.665	0.0001	0.031

The quality of ANC is a risk factor for LBW incidence (Owa et al., 2017). Most (93.27%) mothers access ANC services with low quality and this condition is related to the incidence of LBW in Indonesia (Darwis et al., 2020). In contrast to the conditions found in Central Java. The Chi-square result showed no relationship between the quality of ANC and the incidences of LBW in Central Java (p-value = 0.488). It is in line with Meiriza (2018), which concluded that there was no relationship between the quality of ANC at the level I health facilities and the incidence of LBW in Padang City (Meiriza et al., 2018). This study found as many as 68.9 % of infants born to mothers who received ANC with poor quality. The incidence of LBW was more found in the group of infants with mothers who received ANC with good quality (5.8%) compared to poor quality (4.9). It showed that pregnant women who receive good quality antenatal care can also deliver babies with LBW. This condition is possible because of the limited variables found in the secondary data of the 2017 IDHS and the information needed to assess the quality of ANC is not enough just by questionnaires result, but requires in-depth interviews. Owa (2019) conducted in-depth interviews and found that pregnant women who received less ANC quality had a 3.5 times higher risk of having a baby with LBW (OR = 3.5) (Owa, 2019).

Iron supplementation is an effort to respond to the high rates of iron deficiency anemia in pregnant women (Seu et al., 2019). The Chi-square test showed no relationship between iron supplementation and the incidences of LBW (p-value = 0.076). Different from the multivariate analysis result, which showed the effect of iron supplementation on the incidence of LBW (p-value = 0.013). Mothers who didn't receive iron supplementation during their pregnancy had a 2.474 times higher risk of having a baby with LBW than mothers who received iron supplementation (OR = 2.474). In line with Restu et al (2014), who found that iron supplementation affects the incidences of

LBW (OR = 3.82) (Restu et al., 2014). It shows that mothers who get iron supplementation can avoid anemia. Iron deficiency anemia causes an increase in serum norepinephrine concentration which results in maternal and fetal stress, stimulates the synthesis of CRH (Corticotrophin-Releasing Hormone) which will increase fetal cortisol production thus impacting IUGR (Intrauterine Growth Restriction) and resulted in LBW (Chhabra and Chopra, 2016). Iron supplementation can reduce the prevalence of iron deficiency anemia (Long et al., 2012). Each tablet contains FeSO4 mg (iron 30 mg), which is useful as a reserve of iron, red blood cell synthesis, and muscle blood synthesis during pregnancy (Seu et al., 2019).

Pregnancy complications are a collection of symptoms of health problems during pregnancy that can affect the health conditions of the baby and mother (BKKBN et al., 2017; Neiger, 2017). Some symptoms of pregnancy complications, such as prolonged nausea and vomiting, hypotension, and hypertension, are associated with a lack of nutritional intake for the fetus and LBW (Marshall et al., 2022). The results of this study found that the incidences of LBW were more in the group of infants with mothers who had complications during their pregnancy (13.5%) than in the group of infants with mothers who had no complications during their pregnancy (3.2%).The Chi-square result showed a significant relationship between pregnancy complications and the incidence of LBW (p-value = 0.0001). Mothers who experienced pregnancy complications had a 4,869 times higher risk of having a baby with LBW than mothers who did not experience pregnancy complications (OR = 4.869). Siramaneerat (2018) mentions the same finding that pregnancy complications are associated with the incidences of LBW (p-value = 0.0001; OR = 1.731) (Siramaneerat et al., 2018). The most common complication found in this study was bleeding (5.5%). Antepartum hemorrhage is associated with incidences of LBW (Bener et al., 2012). Antepartum hemorrhage can increase the likelihood of preterm birth which is a risk of LBW (Sharami et al., 2013). Pregnant women who experience antepartum hemorrhage have a 1.6 times higher risk of giving birth to LBW babies than mothers who don't experience antepartum hemorrhage (Bener et al., 2012). There was a difference in birth weight in the group of mothers with and without antepartum hemorrhage. The antepartum hemorrhage causes blood flow that distributes oxygen and nutrients to the placenta from the mother to the fetus to be disturbed. Impaired delivery of oxygen and nutrients will cause fetal anemia, a shock to fetal death. Fetuses that survive until birth will experience various disorders, including LBW (Kuribayashi et al., 2021). Pregnancy complications accompanied by anemia can worsen the condition of the fetus. Pregnant women with anemia had 3.59 times higher premature rupture of membranes than non-anemic mothers (OR = 3.59). This condition requires immediate delivery so that premature birth occurs if the gestational age is less than 37 weeks and increases LBW risk (Pratiwi et al., 2018).

Receptors in the placental blood vessels that mix with nicotine cause a decrease in blood flow in the placenta and fetal vasoconstriction which results in impaired delivery of oxygen and nutrients to the fetus so that the fetus experiences malnutrition which results in impaired fetal growth (Nemoto et al., 2021). The entry of nicotine into the body's mechanism is proven to have an impact on the low production of the hormone Insulin-Like Growth Factor-1 in pregnant women who smoke, affect fetal growth and development (Fang et al., 2015). Pregnant women who smoke will give birth to babies with birth weights 320-435 grams lower than pregnant women who do not smoke (Kataoka et al., 2018). The outcome of this study shows that the incidences of LBW are more common in the group of infants whose mothers didn't smoke (5.2%), while NBW is more common in the group of infants with mothers who smoked (100%). The Chi-square result showed no relationship between the mother's smoking status and the incidences of LBW (p-value = 0.706). In line with Phowira et al (2020) stating that the mother's smoking status was not related to the incidence of LBW in DKI Jakarta (p-value = 0.448) (Phowira et al., 2020). There was no relationship between the frequency of smoking per day and the incidences of LBW in Lampung Province (Sulistiyani et al., 2019). It can be said that pregnant women who do not smoke can

give birth to babies with LBW. This mechanism shows that the impact of nicotine entering the body cannot be described only by the status of a pregnant woman as an active smoker or not, as information is available in the 2017 IDHS data. LBW was found in mothers with high levels of nicotine > 143 μg/g keratinize. This condition is not only found in pregnant women who smoke actively. Pregnant women who don't smoke have an average nicotine level of 153.2 ± 96.0 μg/g keratinize (>143 μg/g keratinize) as a result of exposure to cigarette smoke from the environment (passive smoking) (Huang et al., 2017). There was a relationship between passive smoking mothers and the incidences of LBW (OR = 3.04) (Ardelia et al., 2019).

Conclusion

Most babies are born at a standard weight. There was a relationship between pregnancy complications and the incidences of LBW in Central Java. The quality of antenatal care, iron supplementation, and maternal smoking status were not related to the incidences of LBW. A pregnant woman who doesn't get iron supplementation (OR = 2.474) and complications of pregnancy (OR = 4.869) had a chance of 0.84 for having a baby with LBW. The pregnant women who experience signs of complications immediately take action and visit health facilities for further assistance. Pregnant women are also advised to take Fe tablets regularly at least 90 tablets during their pregnancy.

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