

Maternal factors associated with the occurrence of Low Birth Weight (LBW) Infants at the Haji Hospital, East Java Province

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Abstract

Introduction: Low birth weight infants are an indicator of public health problems. They are also included in the 100 core health conditions the World Health Organization (WHO) compiled. LBW Infants are still the cause of infant mortality in Indonesia. The infant mortality rate in Indonesia is still not reaching the SDGs target.

Objective: This study aims to examine maternal factors associated with the occurrence of LBW Infants at the Haji Hospital, East Java Province

Method: This study used a retrospective method with a case-control study design. This study took a sample of 258 infants with inclusion and exclusion criteria. Data collection uses secondary data in the form of collection carried out in the delivery and medical records room.

Result: Bivariate analysis obtained the results of gestational age ($p < 0.001$), history of LBW infants ($p = 0.03$), anemia ($p = 0.641$), hypertension in pregnancy ($p < 0.001$), maternal illness ($p < 0.001$) with the occurrence of LBW infants. Based on multivariate analysis, mothers with gestational age < 37 weeks had OR 8.667 (95%CI 4.509-16.659), a history of LBW infant had OR 10.736 (95%CI 1.895-60.809), hypertension in pregnancy OR 2.468 (95%CI 1.250-4.869), and maternal illness OR 3.212 (95%CI 1.301-7.932) times to experience LBW infants.

Conclusion: This study highlights the burden of caring for LBW infants in the Haji Hospital in East Java province. Maternal factors need to be given special attention during pregnancy. Health promotion measures, early detection screening, and intervention of related factors need to be done so that the occurrence of LBW infants can be prevented.

Keywords: LBW infants; SDGs; Maternal Factors; Public Health; Mortality rate

1. Introduction

Neonatal conditions are currently in the Top 10 causes of death worldwide, accounting for 55% of 55.4 million deaths (1). Neonatal mortality is important because it contributes to infant mortality. Based on the 2020 Population Census, Infant mortality in Indonesia was 17 per 1000 live births, and this figure has not yet reached the Sustainable Development Goals (SDGs) target of 12 per 1000 live births. Based on Maternal Perinatal Death Notice (MPDN) data, the highest cause of infant death is low birth weight (LBW) infants, with the highest location of death in hospitals. A Low birth weight infant is defined as being lower than 2.5 kg as defined by the WHO. The global prevalence of LBW infants

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is 15.5%, or around 20 million are born every year, with 96.5% of them in developing countries and the highest prevalence in Asia. Implementing six global nutrition targets by 2025 will reduce the incidence of LBW infants by 30%, or 3% each year. Based on the Indonesia Demographic and Health Survey (IDHS) 2023, the prevalence of LBW infants in East Java (6.7%) has still not reached the national target (6.1%). The health profile of East Java Province over the last three years shows that the percentage of LBW infants tends to increase every year, namely 3.7% (2020), 3.8% (2021), and 3.9% (2020). Based on data obtained at the Haji Hospital, East Java Province, the incidence of LBW infants from 2021 to 2022 increased by 4.16%. The increase is quite significant in mid-2022, from June to August, from 19.23% to 48.64% (2)(3)(4).

The study shows that LBW infants have a 4.6 times higher risk of death compared to normal weight. LBW infants in their care are also at risk of complications such as hyperbilirubin, infection, impaired growth and nerve development, which can increase the dangers in childhood, such as stunting and low IQ, and as adults, are at risk of heart disease, obesity and diabetes(5–8). Multifactors cause infants with LBW. Maternal factors such as gestational age, anemia, hypertension, diabetes, infection, history of LBW infants, fetal factors such as multiple pregnancies, chromosomal abnormalities in the fetus, and other factors such as smoking, alcohol, environment, as well as economic conditions. (9)(10)(11). Maternal factors are more likely to carry out intervention and prevention. Three studies in different hospitals in Indonesia state that there is a diversity of results and maternal factors are dominantly associated with LBW infants (12)(13)(14)

Based on the problems and variations in data available in previous research regarding maternal factors associated with LBW infant occurrence, therefore researchers are interested in analyzing maternal factors associated with the occurrence of LBW infants in 2023 at the Haji Hospital, East Java Province, Surabaya, to find out the associated on maternal factors regarding of LBW infants, and can be used as a basis for preventing factors that health workers can prevent.

2. Material and methods

This study uses an analytical observation with a case-control study. The population was all infants born in 2023 at the Haji Hospital, East Java Province, totaling 677 infants, with a case population of 109 infants and a control population of 568 infants. Inclusion criteria were LBW infants born in 2023, with exclusion criteria being twins, infants born with congenital abnormalities, and incomplete medical records. The sampling technique was total sampling in the case group and the control group using a simple random sampling method with a ratio of 1:2. The sampling technique in the control group was selected based on a shuffle system making a list of patients with normal birth weight, from the list then the sample is taken randomly by drawing the numbers of prospective respondents on the existing list.

3. Results and discussion

Data obtained from 1 year of labor were 109 Infants born with low birth weight, and after exclusion, the final resulted in a total of 258 samples (86 cases and 172 controls).

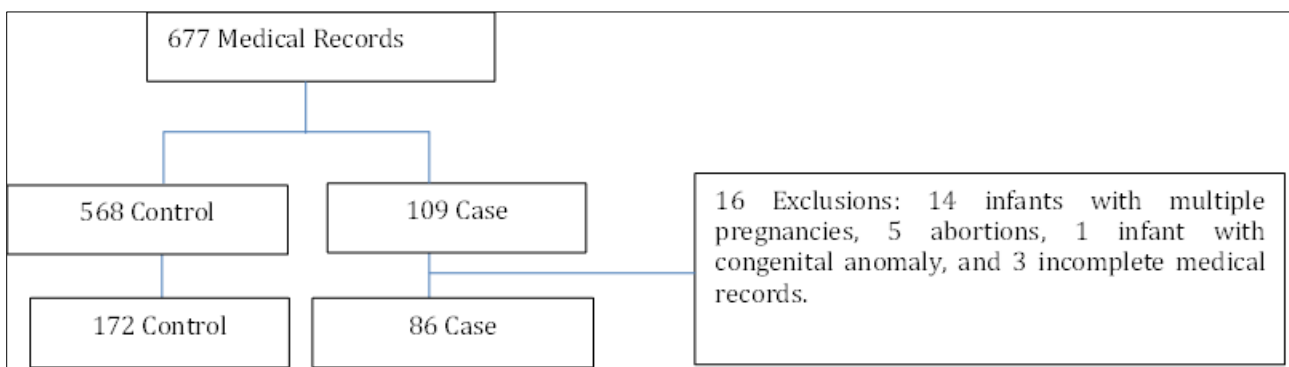


Figure 1 The Medical Searching Results

86 samples were in the low birth weight infant case group, 78 infants in the low birth weight category and 8 very low birth weight infants.

3.1. Distribution of maternal factors

Table 1 Frequency Distribution of maternal factors at Haji Hospital, East Java Province, Indonesia

Maternal Factors	Criteria	Total	
		F	%
Gestational age (Weeks)	<37	73	28.2
	≥37	185	71.8
History of LBW infants	Yes	10	3.9
	No	248	96.1
Anemia (gr%)	<11	86	33.3
	≥ 11	172	66.7
Hypertension in pregnancy	Yes	67	26.0
	No	191	74.0
Maternal illness	Yes	32	12.4
	No	226	87.6

Table 1 shows that the highest number of mothers born at gestational age ≥37 weeks, no history of LBW infants, Hb levels ≥ 11 gr%, no hypertension in pregnancy, and no mother illness. There were differences in the distribution of gestational age factors; in the case group, there were a more mothers at gestational age <37 compared to gestational age ≥37.

Table 2 Bivariate analysis of maternal factors and Low birth weight infant at Haji Hospital, East Java Province, Indonesia

Maternal Factors	Case (n=86)		Control (n=172)		P Value
	N	(%)	N	%	
Gestational age					
<37 weeks	51	59.3	22	12.8	<0.001
≥37 weeks	35	40.7	150	87.2	
History of low birth weight infants					
Yes	8	9.3	2	1.2	0.03
No	78	90.7	170	98.8	
Anemia					
Hb<11 gr%	27	31.4	59	34.3	0.641
Hb ≥ 11 gr%	59	68.6	113	65.7	
Hypertension in pregnancy					
Yes	35	40.7	32	18.6	<0.001
No	51	59.3	140	81.4	
Maternal illness					
Yes	20	23.3	12	7.0	<0.001
No	66	76.7	160	93.0	

Table 2 shows the association between maternal factors and the incidence of LBW infants with p-value <0.05. Gestational age, history of LBW infants, hypertension in pregnancy, and maternal illness are maternal factors associated with LBW infants occurrence. Anemia is a maternal factor that is not associated with the occurrence of LBW infants.

Table 3 Multivariate analysis of maternal factors and Low birth weight infant at Haji Hospital, East Java Province, Indonesia

Maternal Factors	COR (95% CI)	AOR (95% CI)	P-Value
Gestational age	9.935	8.667	<0.001
History of LBW infants	8.718	10.736	0.007
hypertension in pregnancy	3.002	2.468	0.009
maternal illness	4.040	3.212	0.011

Table 3 shows the calculation of p<0.25 in bivariate analysis. The results illustrate the strength of the influence of variables in maternal factors on the incidence of LBW Infants. The strength of the influence of the variable gestational age with the LBW Infants occurrence is OR 8.667 (95% CI 4.509-16.659), variable history of LBW OR 10.736 (95% CI 1.895-60.809), variable hypertension in pregnancy OR 2.468 (1.250-4.869), variable maternal disease OR 3.212 (1.301-7.932). Based on the OR value, the most influential variable with the occurrence of LBW was the history of LBW.

The analysis from 258 samples at Haji Hospital, East Java Province, Indonesia, gestational age was found to be a factor for low birth weight infants. The mechanism of preterm labor is activation of the maternal HPA axis (maternal stress, premature onset of physiologic initiators), inflammation (chorion-decidual infection, systemic infection), decidual hemorrhage and pathologic uterine distention which will affect CRH, E1-E3, IL-1, IL-6, IL-8, TNF, CSF, FasL making cervical change rupture membrane or uterine contractions occur (15). Previous studies also support this finding, which states that one of the factors for LBW infants is gestational age <37 weeks. This study showed that mothers with gestational age <37 weeks 8.667 times born to low birth weight infants. Another study mentioned the chance of giving birth to an LBW baby is 4.7 times higher for newborns occurring at <37 weeks of gestation (16). The association of preterm labor with the incidence of LBW infants can also be triggered by other factors such as maternal infection, hypertension in pregnancy, or a poor obstetric history such as a history of recurrent LBW infants.

The history of previous births is important to determine the success of future pregnancies. Mothers with a previous history of delivered LBW infants will be more likely to have a recurrence in the next pregnancy. It can be caused by anatomical abnormalities such as uterine septum. This condition is the most commonly encountered abnormality and is also associated with reproductive failure, such as recurrent pregnancy loss. This vascularization failure leads to obstruction of decidual development, placenta and reduction of endometrial capacity that could retard fetal growth, leading to preterm labor and delivery of low birth weight infants. In addition, maternal psychology can also affect perinatal outcomes. Stress in pregnancy can increase the hormone cortisol, which can cause preterm labor and low birth weight infants (17)(18)(19). This study is the same as the case-control study conducted by Xi et al. (2020). it was found that low birth weight infants were significantly associated with a history of low birth weight infants with a p-value <0.001. Another study was conducted by Jamie and Ahmed (2020), who studied the factors associated with low birth weight infants. The results obtained showed that the mother's history of low birth weight infants was associated with the occurrence of low birth weight infants, and mothers who gave birth to low birth weight infants previously were 5.21 times likely to give birth to recurrent low birth weight infants (9) (20).

Anemia in this study is a factor that is not associated with the incidence of LBW infants. The study found that low Hb concentrations were associated with an increased likelihood of poor birth outcomes (LBW, IUFD, perinatal and neonatal mortality), and mothers who were anemic during pregnancy were 3.51 times more likely to deliver low birth weight infants (21)(22). there is no relationship between anemia and LBW infants, and it could be due to the frequency of mild anemia in pregnant women dominating overall cases of anemia. Col Madendag et al. (2019) explained in their study that the fetal weight is significantly higher in the severe anemia group compared to mild anemia (23). In this study, the results of Hb concentration taken in third-trimester pregnant women, which is based on the study of Adam et al. (2019) that first-trimester HB concentration can also be a risk factor for low birth weight infants and other factors that more strongly influence the occurrence of LBW infants are the cause of no relationship on this factor (24).

Hypertension in pregnancy in this study includes chronic hypertension, chronic hypertension superimposed with preeclampsia, gestational hypertension, and preeclampsia/eclampsia. There was a relationship between hypertension

in pregnancy and the occurrence of LBW infants; hypertension in pregnancy was 2.468 times experiencing LBW infants. A meta-analysis study conducted by Arabzadeh et al. (2024) showed that almost 1/3 of pregnancies with hypertension resulted in the birth of low birth-weight infants (25). In hypertensive conditions in pregnancy, the spiral artery is relatively vasoconstriction, which decreases uteroplacental blood flow and causes hypoxia and placental ischemia, resulting in IUGR and LBW (15)(26). This study supports a previous study, that shows the results of hypertension in pregnancy associated with low birth weight infants and shows an OR value of 2.6 times having LBW infants (27)

Maternal illness needs to be considered, and it can affect pregnancy and the resulting neonatal outcomes. In this study, maternal illness is associated with LBW infants and mothers who have a disease 3.212 times births to infants with low birth weight compared to mothers who do not have a disease in themselves. Maternal diseases in this study were infectious diseases (HIV+ and Hbsag +), non-communicable diseases (pregestational DM), infectious diseases (UTI), and autoimmune diseases. Mothers infected with sexually transmitted diseases are at risk of ectopic pregnancy, abortion, endometritis, and prematurity, and the fetus can experience LBW and even death in utero. Mothers with UTIs in pregnancy are more likely to experience problems such as preterm labor and are at risk of giving birth to infants with low birth weight. This is also in line with a meta-analysis study conducted by Wulandari, Budihastuti, and Murti (2021) showing that mothers with urinary tract infections (UTI) during pregnancy can increase the risk of LBW Infants by 1.54 times compared to pregnant women without UTIs (28)(29)(30)(31). The chronic disease in this study is diabetes mellitus. In diabetes mellitus mothers, the disruption of insulin action can cause plasma osmolality and dehydrated renal tubular fluid to enter the placenta, so that the baby will be overnourished or the baby can shrink. This study supports a previous study which shows that there is an association between pregestational diabetes and gestational DM with pregnancy complications, including premature birth so that infants are born with low birth weight, congenital anomalies to stillbirth in the fetus (32)(33)(15).

4. Conclusion

Based on the results of research conducted related to the analysis of maternal factors associated with LBW infants at the Haji Hospital of East Java Province 2023, it can be concluded that gestational age, history of LBW infants, hypertension in pregnancy and maternal illness are associated with LBW infants, while anemia is not associated with LBW infants. These factors need to be given special attention during pregnancy. Health promotion measures, early detection screening, and intervention of related factors need to be done so that the occurrence of LBW infants can be prevented. And it is hoped that future research will investigate additional factors that contribute to LBW infants.

Compliance with ethical standards

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Disclosure of Conflict of interest

the authors state that no conflict of interest exists in this study

Statement of ethical approval

Ethical clearance was accepted by the Ethics Committee of the Hajj Hospital of East Java Province, Indonesia, Number 445/021/KOM.ETIK/2024, on January 31, 2024, and the ethics committee of the faculty of medicine, Airlangga University Surabaya, Indonesia Number 48/EC/KEPK/FKUA/2024, on February 6, 2024. Number 48/EC/KEPK/FKUA/2024 on February 6, 2024.

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