

Hemoglobin concentration is correlated with Low Birth Weight Babies (LBWB)

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ABSTRACT

Out of 9% prevalence of Low Birth Weight Babies (LBWB), 5.32% takes place in Special Region of Yogyakarta. Out of 5 municipalities in Yogyakarta, the highest rate of LBWB case takes place in the Municipality of Kulon Progo. According to perinatal birth rate in Kulon Progo in 2018, out of 2,392 babies, 359 babies were born with LBWB. Babies born with LBWB condition may experience breathing pattern problem, hypothermia and other potential infections.

The population of this study were 2,392 babies delivered in a Public Hospital within the Municipality of Kulon Progo, Yogyakarta City in the period of January-December 2018. Mothers giving birth to 171 babies with LBWB condition (50%) and 171 babies of normal birth weight (50%). Respondents' characteristic determined in the study is those with the risk factor of Hemoglobin (Hb) concentration of 44.7%. According to the analysis result, hemoglobin concentration correlates with the case of LBWB with p-value of 0,000 and Odd Ratio of 7.638 times.

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1. Introduction

Low birth weight baby is defined as any baby whose birth weight is less than 2,500 grams, regardless of the gestation period or pregnancy week (Tshotetsi, Dzikiti, Hajison, & Feresu, 2019). The term newborn baby means a newly-delivered baby out of a mother's womb, either through normal childbirth or with the assistance of certain methods, from day one of birth until one month of age (Kong, Road, & Hospital, 1994). Children healthcare aims to prepare the future generation to be healthier, smarter and better in overall quality of life, as well as to reduce infant mortality rate (Mathews, Macdorman, & Thoma, 2015). Children healthcare within the context of Indonesian healthcare is provided starting from pregnancy, during delivery, post-delivery and until the age of 18 years old (Kemenkes, 2018).

Infant Mortality Rate (IMR) is one of the more serious problems in Indonesia, with cases increasing incrementally each year. Infant mortality rate in Indonesia happens at the rate of 22 cases in every 1,000 birthrate with approximately 10,924 cases of death (Kemenkes, 2018). High baby mortality rate in Indonesia indicates that the country sees a higher baby mortality rate than that of other Developing Countries (Organization, 2014).

LBWB is not the sole cause for prenatal death or other disease infections. The most recent study found that LBWB also increases the risk for congenital problems, such as diabetes and cardiovascular conditions in the future (Organization, 2014). This problem is considered so prevalent globally that

World Health Assembly in 2012 stipulated *Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition*, aiming to decrease LBWB up to 30% by 2025 (Organization, 2014).

According to the result of Yogyakarta Health Census (2017), *Infant Mortality Rate* is one important indicator in determining the society health level as it provides a general overview on the health level of a society. This number is sensitively influenced by the level of health and wellbeing. Infant mortality rate (IMR) is one of the health indicators included in one of the MDG targets. Nation-wide, Special Region of Yogyakarta is ranked fifth in infant mortality rate, surpassed only by East Kalimantan, Administrative Region of Jakarta, Riau and South Sulawesi. The common cause for infant death and neonatal case in DIY is LBWB.

Several factors influence low birth weight baby cases, the first being maternal factors, including age, parity, hemoglobin concentration (Hb), race, infertility, bad history of pregnancy, abnormal birth, close gap between pregnancies, LBWB history, acute or chronic diseases, bad habit during pregnancy, like smoking or drinking, preeclampsia, and other factors. Secondly, there is placenta-related factor, including tumor and double pregnancy. Thirdly, there is fetus-related factor, such as hereditary infection and chromosome abnormality (Halahleh, Gale, & Nagler, 2015). Potential effects experienced by low birth weight baby are breathing pattern problem, hypothermia, potential infections (Vlaardingerbroek et al., 2013).

Study results suggested that the statistical test result indicates that if p value = 0,001, where $p < 0,005$ indicates possible correlation between pregnant mothers' age and the risk of LBWB (Delnord, Blondel, & Zeitlin, 2015). Mothers' age during pregnancy influences the pregnancy condition as it relates with the maturity of reproductive organ and their psychological state (Kenny et al., 2013).

Reflecting from the perinatal birth rate in 2018, the hospital sees the perinatal birth rate of 2,392 babies. The number of perinatal birth experiencing LBWB between January and December was 359 babies. This is the highest rate of LBWB in all municipalities in Yogyakarta. With this data, the authors were interested in conducting a study in the Municipality of Kulon Progo due to the high number of perinatal birth experiencing LBWB.

2. Method

Ethical approval was obtained from Ethical Board of Universitas Aisyiyah Yogyakarta (Ref No: 529/KEP-UNISA/III/2019). The design of the study was quantitative study, using observational analytic method with case control design, which means the study design used compares variable case group and the control group in order to determine the proportion of occurrences based on the presence/absence of exposure (Bruce, Pope, & Stanistreet, 2008). Population was identified from secondary data (retrospective data). The population of this study was all babies born i.e. 2,392 babies born in 2018, in the period of January-December 2018. The study conducted in a hospital within Kulon Progo Municipality, Yogyakarta. In collecting the data for this study, especially on the correlation between Hb concentration and LBWB cases, the authors utilized data collection instruments in the form of data documentation data using checklist form technique, which involving factors influencing low birth weight baby cases (LBWB). The Chi-Square test was used to analyze the relationship of the variables. Statistical calculations were performed using Statistical Package for the Social Sciences version 16 for Window. All hypotheses testing were performed at the 5% significance level.

3. Results

In the table 1, it is confirmed that one of the characteristics of mothers in the category of No-LBWB risk is having the age of 20-35 years old. There are 264 mothers in the category of No-LBWB risk (77.2%). According to the study results, the majority of mothers giving birth are 20-35 years old of age. This is considered as reproductive age as this influences the existing parity. 189 mothers giving birth in the hospital did not experience anemia, constituting as 55.3% of the study participant population.

Table 1. Demographic variables of participants

Mothers' characteristics	F	%
Mothers' age		
At risk	78	22.8%
Parity		
At risk	132	38.6 %
Hb Concentration		
At risk	153	44.7 %

In the table 2, it is indicated that there are more cases of LBWB if the mothers are anemic (116 mothers or 67.8% of the population), than if the mothers are not anemic (55 mothers or 32.2% of the population). There are more cases of mothers giving birth to NBWB (Normal Birth Weight Baby) if the mothers are not anemic (134 mothers or 78.4% of the population) than if the mothers are anemic (37 mothers or 21.6% of the population). The result of chi-square test yields Asymp.Sig value or p value = 0,000 ($p < 0,05$). Therefore, H_a is accepted and H_o is rejected. Therefore, it is concluded that there is a significant correlation between hemoglobin concentration and LBWB cases in this study.

Table 2. The correlation between hemoglobin concentration and LBWB cases

HB Concentration	Birth Weight				Quantity		P value
	LBWB		Not LBWB		F	%	
	F	%	F	%			
Anemia	116	67.8%	37	21.6%	153	44.7%	0,000
Not Anemic	55	32.2%	134	78.4%	189	55.3%	
Total					342	1	

Based on the OR value, it can be established that pregnant anemic mothers have the possibility of giving birth to LBWB 7,638 times higher than pregnant mothers who are not anemic.

4. Discussion

The analysis on the correlation between hemoglobin concentration and LBWB cases establishes that anemic mothers (<11gr%) has a higher possibility of giving birth to LBWB, as shown by 116 respondents (67.8%) in the study. Meanwhile, non-anemic mothers ($\geq 11\text{gr}^0\%$) has a lower possibility of giving birth to LBWB, as shown by 55 respondents (32.2%). The result of this study indicates the correlation between hemoglobin concentration and LBWB cases.

In this study, according to the result of *chi-square* test, the correlation between hemoglobin concentration and LBWB cases acquires the value of Asymp.Sig = 0,000 ($p < 0,05$), indicating that there is a significant correlation between the concentration of hemoglobin and LBWB. Anemia is a condition where the concentration of hemoglobin or Hb is considered deficient or under the normal limit (Haider et al., 2013).

Anemia occurs when pregnant mothers fail to sufficiently acquire Vitamin A, which holds an integral role in mobilizing iron reserve in the body in synthesizing hemoglobin (Imdad & Bhutta, 2012). Insufficient Vitamin A intake correlates with the changes of iron metabolism in the case of iron deficiency (Coad & Conlon, 2011). Anemia in pregnancy occurs when pregnant mother Hb concentration is <11% during the first or third trimester and <10.5% during the second trimester. Anemia symptom pregnant mothers may experience is fatigue, paleness, and fainting, even if blood pressure is within limit. Clinically speaking, malnourished body and paleness on the pregnant mothers are two indications of anemia (Kalaivani, 2009).

Anemia occurs when the blood capacity in carrying oxygen is reduced. Iron deficiency anemia is defined as low serum ferritin concentration of <30 g/dl and hemoglobine of <11,0 g/dl in the first trimester, <10,5 g/dl in the second trimester and 11,0 g/dl in the third trimester (Robson & Waugh, 2012).

The result of this study is consistent with the theory as proposed in the classification by the health department, which establishes that Hb is considered normal when ≥ 11 gr%, low when <11 gr%, average when <8 gr% and high when <5 g%. The effects of anemia are, among others, abortus, premature birth, low birth weight, prolonged labour period due to weak ovarian muscles, postpartum hemorrhage, high susceptibility index, prone to cordis decompensation for mothers with Hb lower than 4g, shock during labor, stillbirth, miscarriage and congenital problems.

The result of this study is consistent with another study that anemic mothers constitute as 43.1% cases of LBWB and non-anemic mothers constitute 6.8% of LBWB cases (Elhassan, Abbaker, Haggaz, Abubaker, & Adam, 2010). This condition occurs because anemic pregnant mothers have lower metabolism and the baby receive less blood supply from the mother, hindering the growth and development of the fetus (Ahankari, Myles, Dixit, Tata, & Fogarty, 2017). Meanwhile, in some cases, non-anemic mothers also experience the case of LBWB as there are other risk factors contributing to LBWB, for instance, pregnancy occurring <37 weeks may also cause the case of LBWB (Haider et al., 2013).

The result of this study is inconsistent with another study as the result of the *Chi-square* results p value of 0,107, indicating that anemia and the case of LBWB is not significantly correlated (Kalaivani, 2009). The result is inconsistent with the theory establishing that anemia is influenced by low intake of foods containing iron (Fe), which results low Hb concentration on pregnant mothers (Ahankari et al., 2017). Anemia is not a risk factor in the case of LBWB delivery as it does not impact hormonal and physiological capacity of a mother. However, the risk is 4.2 times higher on anemic mothers than non-anemic mothers.

5. Conclusion

There is a correlation between Hemoglobin concentration and LBWB cases in this study, with p-value of 0,000 and Odd Ratio of 7,638. Pregnant mothers with low Hemoglobin concentration are 7.6 times more likely to give birth to LBWB.

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