ORIGINAL ARTICLE

Determinants of Low Birth Weight Babies (LBW) in the Bolo Health Center, Bima Regency, Indonesia

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Abstract

Low birth weight babies (LBW) are still the main cause of perinatal death. At worldwide, the prevalence of LBW is estimated at 15%, and Indonesia has a low birth weight prevalence of 10.2%. LBW is the main cause of infant mortality in Bima Regency, at 43.75%. This study aims to determine the relationship and describe the determinants of infants’ LBW. This research was conducted at Bolo Health Center, Bolo Subdistrict, Bima Regency in March and April 2018. The research method is quantitative research combined with qualitative research, and case control was used as the research design. The total population was 909 people, and the sample comprised 180 people. The sampling technique was simple random sampling. Data analysis techniques consisted of univariate analysis, chi-square test, and a simple logistic regression test. The qualitative data analysis techniques were in-depth interviews and FGD (focus group discussion). The results of the study were that there was a significant relationship between the size of maternal LILA, BMI, maternal weight gain during pregnancy, ANC frequency, anemia and Fe consumption and LBW, where p<0.05. In the multivariate analysis of the simple logistic regression test, it was obtained that the mother’s LILA size with an Exp (B) value was 19.017 (4.946–73.121), which means that the size of the mother’s LILA had an effect 19.017 times on low birth weight babies. Increased counseling on nutrition and prevention of anemia in pregnant women; socialization of reproductive health; family planning; consumption of iron; improving the quality of health services, especially inspection of ANC according to standards; improving facilities and infrastructure for health facilities; and conducting training on basic LBW management at the health office and health center can all help address LBW.

Keywords: Determinants, low birth weight, public health, Indonesia

Introduction

The maternal mortality rate (MMR) and infant mortality rate (IMR) are indicators of the success of community health development1,2. Low birth weight (LBW) babies are still the main cause of perinatal death. There are around 20 million low birth weight babies in the world, and 19 million of them are in developing countries, with incidence rates ranging from 11% to 31%. The prevalence of LBW in Indonesia was 10.2%, while in West Nusa Tenggara Province, it was 12.5% of live births3.
The cause of severe birth babies is influenced by two types of factors: internal and external\textsuperscript{4,5}. Internal factors consist of maternal, fetal, and uterine placental factors. External factors consist of social and environmental factors. Maternal factors consist of maternal characteristics (age, parity, distance of pregnancy, upper arm circumference (LILA), height, and nutritional status) and other supporting factors (gestational age, weight gain, antenatal care (ANC), hemoglobin (HB), Fe supplementation, and blood pressure)\textsuperscript{6}.

The Nawacita Program Presented by the President of the Republic of Indonesia has nine priority agencies and health sectors that contribute to the achievement of all Nawacita, especially in improving the quality of Indonesian human life, and those are included in the Ministry of Health’s 2015–2019 report. In this effort to improve public health status, one of the indicators that will be achieved is the declining percentage of LBW from 10.2% to 8% in 2019\textsuperscript{3}.

The Regency of Bima occupies the third position of infant mortality rate in NTB Province of Indonesia. The largest group of them were caused by LBW (43.75%). Based on data from the Bima health office, Bolo Health Center is the health center with the highest number of LBW cases. In 2014, there were 54 cases; in 2015, there were 58 cases; in 2016, there were 63 cases; and in 2017, there were 60 cases of LBW\textsuperscript{3}. The purpose of this study was to determine maternal factors, including maternal age, size of maternal LILA, BMI, maternal weight gain during pregnancy, anemia, and consumption of Fe tablets.

**Method**

This research uses a quantitative and qualitative approach, with case control as the research design. Data collection was carried out from March to April 2018. The population was all mothers who gave birth from January to December 2017. The samples in this study amounted to 180. The sampling technique was simple random sampling. Data collection used medical records, which was supplemented with qualitative research, namely conducting in-depth interviews and FGDs. Data analysis included univariate, bivariate (chi-square), and multivariate analysis using logistic regression.
Results

Table 1. Univariate analysis Case: Frequency Distribution and Control Based on Factors Size of LILA, BMI, Addition of Weight During Pregnancy, and Hb, Frequency of ANC, and Fe Tablet Consumption at the Bolo Health Center

| Variables | Results of the study | | | | |
|-----------|----------------------|------|-----------------|----------------|
|           | Case (LBW) freq. %   | Control (Not LBW) freq. % |
| LILA      |                      |                              |
| Chronic Energy Deficiency (KEK) (< 23.5 cm) | 47 78.3 | 22 46.0 |
| Not KEK (≥ 23.5 cm) | 13 21.7 | 98 81.7 |
| BMI       | < 18.5 kg/m2 or >25 kg/m2 | 33 55.0 | 23 19.2 |
|           | 18.5-25 kg/m2 | 27 45.0 | 97 80.8 |
| Weight addition status during pregnancy | <11.5 kg or >16 kg | 43 71.7 | 29 40.3 |
|           | 11.5-16 kg | 17 28.3 | 78 75.8 |
| Anemia    | < 11 g/dl | 42 70.0 | 32 26.7 |
|           | ≥ 11 g/dl | 18 30.0 | 88 73.3 |
| Frequency ANC | < 4 Times | 40 66.7 | 36 30.0 |
|           | ≥ 4 Times | 20 33.3 | 84 70.0 |
| Consumption Fe | < 90 tablets | 48 80.0 | 40 33.3 |
|           | ≥ 90 tablets | 12 20.0 | 80 66.7 |

Based on the results of the univariate analysis, table 1 shows that the causes of LBW were as follows: risky maternal age factors (<20 years and >35 years) was 53.3%, LILA size (<23.5 cm) was 78.3%, maternal BMI was 55.0%, the addition of maternal BB during pregnancy was 71.7%, anemia was 70.0%, and Fe tablet consumption was 80.0%.

Table 2. Bivariate analysis: Relationship Between Size of LILA, BMI, Addition of Maternal BB During Pregnancy, Anemia, Frequency of ANC, and Consumption of Fe

<table>
<thead>
<tr>
<th>Variables</th>
<th>Case (LBW) freq. %</th>
<th>Control (Not LBW) freq. %</th>
<th>Total freq. %</th>
<th>p value</th>
<th>OR (95%) CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>LILA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 23.5 cm</td>
<td>47 78.3</td>
<td>22 18.3</td>
<td>69 38.3</td>
<td>8.632</td>
<td>(4.117-18.097)</td>
</tr>
<tr>
<td>≥ 23.5 cm</td>
<td>13 21.7</td>
<td>98 81.7</td>
<td>111 61.7</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>
Table 2 shows that the factors associated with LBW include maternal LILA size (p-value: 0.000), BMI (p-value: 0.000), maternal weight addition during pregnancy (p-value: 0.000), ANC frequency (p-value: 0.000), anemia (p-value: 0.000), and Fe consumption (p-value: 0.000).

Based on the results of in-depth interviews, most of the informants said that the size of LILA ranged from 20 cm to 23 cm, and most mothers with LBW experienced KEK due to the size of the mother’s LILA being less than 23.5 cm.

Based on the results of in-depth interviews, most of the informants knew the causes of LBW at Bolo Health Center. The mother’s BMI/nutritional status was included in the less category because many pregnant mothers failed to consume nutritious food and lacked knowledge about nutritious food.

Based on the results of in-depth interviews, most of the informants already knew about their weight before and after pregnancy. But some of them also did not know that weight gain before and after pregnancy was not in accordance with the standard addition of maternal BB during pregnancy.

Most of the informants said they had anemia, with an average HB of 7 to 9 g/dL, which means that most informants
experienced anemia with an HB below normal, which is <11g/dL.

Most of the informants said that they had carried out a pregnancy checkup fewer than four times. This was due to lazy informants, no one took and work reasons and wanted to have a pregnancy if there was a health center was close to home and no one had to deliver.

Most of the informants said they were lazy and forgot to consume Fe because consuming Fe caused the mother to feel dizzy and nauseous and to vomit. Meanwhile, some informants said that medicine added to blood felt bitter and unpleasant.

Discussion

Relationship between mothers’ LILA size and LBW

LBW that occurred in Bolo Subdistrict was caused by mothers’ lack of adequate nutritional intake during pregnancy. Mothers who experienced KEK tended to have worse health, physical, and nutritional conditions and to be characterized by a small body (stunting) and thinness (wasting), as measured by the size of the upper arm (LILA). In their daily lives, mothers in Bolo Subdistrict mainly consume food that is sold in the market, such as meatballs, chicken noodles, cassava sticks, and instant noodles. None of these are guaranteed to be clean and contain enough nutrients, protein, and energy to meet nutritional needs during pregnancy. During pregnancy, mothers often feel nauseous and vomit, so they fail to eat, which reduces their nutrient intake, even though a pregnant mother needs more nutrition than a non-pregnant woman.

Previous study shows that there is a significant relationship between maternal LILA and LBW, with a p-value of 0.0057. The results of this study indicate that there is an effect of maternal LILA on the incidence of LBW, with an OR value of 15.625, which means that pregnant mothers with KEK during pregnancy are at risk of 15.6 times for having LBW births than the non-KEK pregnant mothers. Another study shows that there was a significant relationship between LILA mothers and LBW, with a p-value of 0.0458.

The LILA measurement is intended to find out if a person is suffering from KEK. Chronic lack of energy in a pregnant mother is caused by a failure to consume nutrient sources. This is because the amount of instant food consumed by the pregnant mother causes an imbalance between energy intake and energy expenditure. LILA can describe the reserve of sufficient energy and fat during pregnancy; if the energy and fat reserves are reduced, then the mother will be at risk of experiencing KEK, which will affect the baby to be born later8.
The relationship between mothers’ BMI and LBW

The increase in maternal weight before pregnancy affects the nutritional status of the mother during pregnancy. Low maternal BMI before pregnancy increases the risk of low BMI during pregnancy. Mothers who have ideal body weight before pregnancy tend to experience ideal weight gain during pregnancy compared to mothers who have a body weight that is not ideal before pregnancy. Mothers with abnormal BMI before pregnancy are at risk of giving birth to babies with low birth weight because the parameters of the baby’s birth weight are seen from the mother’s BMI before pregnancy. The more normal the mother’s body mass index during pregnancy, the more normal the baby’s birth weight. Conversely, if the mother’s body mass index is in the thin category, there is a greater risk of giving birth to a baby with low birth weight.

The relationship between the addition of maternal weight during pregnancy and low birth weight

Maternal weight gain during pregnancy is one of the assessments of maternal nutritional status during pregnancy, as a mother’s food intake during pregnancy must be sufficient for the mother and the fetus. This is because the fetus consumes nutrients via the placenta, so mothers with normal weight gain during pregnancy will have babies with normal weight. On the other hand, mothers with lower weight during pregnancy are at risk of giving birth to babies with LBW. Midwives providing IEC about the importance of increasing maternal weight during pregnancy is expected to increase maternal knowledge about maintaining maternal health during pregnancy.

Another study showed that there was a significant relationship between weight gain during pregnancy and the incidence of LBW (p-value: 0.000), while the OR was 9.82. The results found an influence of the proportion of maternal weight gain during pregnancy on LBW, with an OR value of 9.821, meaning that respondents with risky weight gain during pregnancy had a risk of 9.821 times to give birth to LBW babies compared to respondents who had no risky weight during pregnancy. Maternal weight gain during pregnancy is 10 kg, and maternal weight during pregnancy must increase according to gestational age. When the mother’s weight increases within the normal range, it produces a normal-weight baby. If the mother’s weight is less than normal, she will be at risk of miscarriage, premature birth, LBW, and bleeding during and after delivery.
The relationship between anemia and LBW

The cause of mothers having anemia is that they fail to consume blood tablets during pregnancy. Additionally, mothers in Bolo Subdistrict also failed to consume foods that can increase hemoglobin levels, such as vegetables, fruits, and side dishes. Low hemoglobin levels in the blood can cause anemia. Another factor is a lack of information and IEC given by midwives to pregnant women about the risk of anemia during pregnancy and socialization about the importance of consuming blood-boosting foods and Fe during pregnancy\(^\text{12}\). Low HB levels make blood unable to transfer oxygen to all tissues\(^\text{13}\). This consequently affects metabolism and disrupts the exchange of important nutrients in the tissues. Low HB will result in a lack of absorption and transportation, which causes a lack of nutrient supply via the placenta. As a result, the placenta becomes small, and the transfer of nutrients to the fetus, which is needed for fetal development and growth, decreases. In pregnant mothers, anemia is often found, which is also associated with iron deficiency\(^\text{14}\).

The relationship between the frequency of ANC and LBW

LBW that occurred in Bolo Subdistrict was caused by the geographical conditions of the Bolo Subdistrict area. This area mainly consists of plantations and rice fields, so the health center was quite far from where the mothers lived. This means that mothers did not pay attention to the importance of the ANC test. Mothers were more concerned with helping their husbands to get money, and there was no support from their husbands and families to carry out prenatal checks. Besides, the mothers only went to the health center if they had their medical checkups scheduled. But their medical checkup schedule was once a month, and Bolo Subdistrict has 14 villages with 57 health centers, and each village has five health centers, depending on the population. Thus, each village was limited in its ability to carry out mothers’ routine medical checkups, so the target of routine ANC examination in pregnant mothers was disturbed, and mothers did not reach the standard of at least four ANC examinations during pregnancy.

Another reason for the lack of high-quality ANC examinations conducted by midwives at Bolo Health Center was the midwives’ lackluster efforts in early detection of pregnant women and their lack of effective IEC for pregnant mothers. Midwives are expected to provide effective IEC knowledge to foster changes in mothers’ behavior and attitudes to improve their ability to maintain and care for themselves during pregnancy and prepare...
for childbirth\textsuperscript{15}. Because of the lack of high-quality ANC examinations, pregnant mothers did not know their condition during pregnancy. Another study shows that the quality of antenatal care affects the incidence of LBW at $\alpha = 0.05$. Mothers who have poor-quality antenatal care risk 16,333 LBW births compared to mothers with good-quality antenatal care\textsuperscript{16}.

**Relationship between Fe consumption and LBW**

Fe is needed for fetal development and growth. Mothers with consumption of Fe <90 tablets during pregnancy are at risk of giving birth to babies with LBW. Another reason that mothers give birth to babies with low birth weight is the lack of information about the importance of Fe consumption during pregnancy to prevent anemia, which can cause mothers to give birth to LBW babies.

A previous study showed a significant relationship between adherence to consuming Fe tablets during pregnancy and the incidence of LBW ($p=0.036$)\textsuperscript{17}. Another study showed that there was a significant relationship between the administration of Fe supplementation and LBW ($p=0.001$)\textsuperscript{13}.

**Conclusion**

The causes of LBW in the Bolo Health Center are the LILA size factor of KEK mothers (<23.5 cm), maternal BMI, maternal weight gain during pregnancy, maternal anemia (<11 g/dL), the frequency of antenatal care being incomplete (<4 times), and Fe consumption <90 tablets. Further study is needed to enhance any efforts to improve counseling education and information on reproductive health among adolescents regarding nutrition counseling, prevention of anemia, and reproductive health, including a comprehensive socialization approach to maternal and child care, effective media utilization, facilities and infrastructure, as well as high quality and standards of MCH services.

**Conflict of Interest**

The authors declared that there is no competing interests exist.

**References**


