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Low Birth Weight Related Factors at Kertek 2 Public Health Centre Wonosobo Regency

Faktor-Faktor yang Berhubungan dengan Kejadian Berat Badan Lahir Rendah di Puskesmas Kertek 2 Kabupaten Wonosobo

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ABSTRACT

Background: Low Birth Weight (LBW) has a negative impact because it may cause infant mortality and other nutritional problems. This research differs from previous research because particular variables are characteristic of agricultural areas and tobacco producers.
Objectives: This study was to analyze the factors associated with low birth weight at the Kertek 2 Public Health Centre.
Methods: It was a quantitative research with a cross-sectional study design. The population was all babies born at the Kertek 2 Public Health Centre, Wonosobo Regency, in 2020. The sample in this study was found using the survey sample size formula with a known N value and was taken using a simple random sampling technique. The independent variables studied in this study included anemia, maternal age, mid-upper arm circumference, maternal weight gain during pregnancy, gestational age, parity, disease and infection, pregnancy interval, exposure to pesticides and smoke, alcohol, economic status, and education. The data were analyzed using Chi-Square and Fisher Exact tests with p-value <0.05. Multivariate data analysis was performed using a binary logistic regression test.
Results: Maternal factors related to LBW were maternal age (p= 0,003), gestational age (p=0,000), parity(p=0,022), and pregnancy interval (p= 0,018). Other factors, such as anemia, upper arm circumference, maternal weight gain, disease and infection, and environmental and socioeconomic factors, did not show a significant relationship.
Conclusions: The risk factors for low birth weight at Kertek 2 Public Health Centre were maternal age, gestational age, parity, and pregnancy interval.

INTRODUCTION

Low birth weight (LBW) is a public health problem worldwide. LBW incidence is prone to occur in Indonesia, categorized as a low and middle-income countries[1]. The latest data from the United Nations International Children's Emergency Fund (UNICEF) and the World Health Organization (WHO) 2015 stated that 1 out of 7 babies born was LBW[2]. In 2021, around 8% of babies in Asia were born LBW[3]. Based on Indonesian Basic Health Research (Riskesdas) 2017-2018, the prevalence of LBW in Indonesia has increased from 5.4% to 6.2%[4]. The Indonesian Directorate of Community Nutrition (2019) reported that out of 25 provinces in Indonesia, 3.4% of babies were LBW. In the same year (2019), LBW was Indonesia's number one cause of infant death (35.3%)[5]. The recommended target of Indonesia's RPJMN in 2025 is the prevalence of LBW, expected to be 3%[6].

LBW is an annual health problem in Wonosobo Regency, Indonesia. During the last four years, the prevalence of LBW has tended to increase. The prevalence of LBW was 5.14%, 5.36%, 5.16%, and 5.55% from 2017 to 2020, respectively. This prevalence has not been following the target of the Wonosobo District Strategic Plan, which ranges from 3-4%[7,8]. In 2018, Wonosobo Regency was included in the top ten highest prevalence of LBW and was ranked 8th with a prevalence of 5.36% in Central Java Province[9]. LBW in Wonosobo Regency is one of the top five causes of neonatal mortality after asphyxia. In 2018 and 2019, most neonatal deaths in Wonosobo Regency were caused by LBW, 31% and 25%, respectively[10,11]. Moreover, in 2020 LBW occupied the second position as the cause of infant death. The Kertek 2 Health Center is included in the top three highest LBW cases in 2020 in Wonosobo District (56 cases).

Various factors cause the incidence of LBW. In general, the incidence of LBW is caused by four factors: mother, infant, environment, and demographics[12]. To our knowledge, no research has been conducted on LBW factors at the Kertek 2 Health Center. Several studies have been conducted on LBW factors, but the differences

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from this study are the characteristics of agricultural and tobacco-producing areas. As an agricultural and tobacco-producing city, the local community and people in Wonosobo Regency work as farmers with a high rate of smoking habits. These agricultural activities cannot be separated from the use of pesticides. Based on previous studies, smoking and pesticide exposure were associated with low birth weight.

The nicotine and carbon monoxide content in cigarettes will inhibit the entry of oxygen and nutrients from mother to baby. Both passive and active smoking can affect the baby's weight. Research in Ethiopia shows that mothers whose husbands smoke have a 4.73 chance of giving birth to babies with LBW compared to mothers whose husbands are non-smokers[13]. Other than that, pregnant women exposed to pesticides, especially Organophosphate and Carbamate types, can interfere with the work of the Cholinesterase enzyme in breaking down acetylcholine. In contrast, acetylcholine plays a role in the activation of thyroid hormones. A pregnant woman with thyroid disorders can interfere with the growth and development of the fetus she contains[14]. Many previous studies have not conducted research related to this. Therefore, pesticide and cigarette smoke exposure research must be conducted to determine the relationship with LBW. This study aimed to analyze the factors associated with LBW, specifically at the Kertek 2 Health Center, Wonosobo Regency.

METHODS

A quantitative study with a cross-sectional study design was done. Three hundred ninety-six (396) infants born at Kertek 2 Health Center in Wonosobo Regency in 2020 were selected as the study population. The sample in this study was calculated using a survey research formula with a known number of N. As many as 65 samples were obtained with a 10% estimated dropout. The sampling flow was preceded by making a frame containing a list of names of all potential subjects (infants born at the Kertek 2 Health Center in 2020). The sampling was done using a simple random sampling technique through a lottery to obtain the number of samples according to the calculation. The randomly selected sample has the following inclusion criteria: (1) the babies born were live births, (2) the babies were recorded in data at the Kertek 2 Health Center, (3) single-born babies, (4) the mothers had a complete MCH book, (5) the mothers gave birth in January-December 2020, and (6) the mothers were examined for Hb levels in the third trimester. The exclusion criteria were: (1) stillbirths, (2) incomplete respondent data, (3) the location of the mother giving birth other than the Kertek 2 Health Center, and (4) the method of checking Hb levels other than cyanmethemoglobin.

LBW was the dependent variable in this study, with category <2,500 grams. The independent variables in this study consisted of LBW factors, including maternal, environmental, and socioeconomic factors. Maternal factor variables included anemia, maternal age during pregnancy, upper arm circumference, maternal weight gain, gestational age, parity, disease and infection during pregnancy, and gestation interval. Environmental factors included exposure to pesticides, cigarette smoke, and alcohol. Socioeconomic factors consisted of economic status and education.

This study used primary data from a validated questionnaire, including pesticide exposure, cigarette smoke, alcohol, and the mother's education level. Moreover, this study used secondary data obtained from the mother and child care (MCH) handbook and cohort reports from the health center, which included data on anemia, maternal age during pregnancy, upper arm circumference, maternal weight gain, gestational age, parity, disease and infection during pregnancy, gestation interval, and economic status.

In the third trimester, the anemia variable (hemoglobin (Hb) level) was measured from the mother's MCH book at the Kertek 2 Health Center. Measurement of Hb levels used the cyanmethemoglobin method. Anemia is considered if the Hb level is <11 gr/dl. Maternal age was categorized into two: (1) at risk if aged <20, (2) non-at risk if aged 20-35. Chronic Energy Deficiency (CED) data were obtained from the mother's MCH book in the first trimester. If the mother's upper arm circumference was <23.5 cm, she was categorized as having CED. Data on maternal weight gain was obtained from the mother's MCH book by calculating the difference between the mother's weight during the early pregnancy and the mother's final weight from the last weighing before the mother gave birth. Maternal weight gain is categorized based on standards from the Institute of Medicine and the National Research Council which are adjusted for the mother's Body Mass Index (BMI) during the first trimester of pregnancy. If the mother's BMI <18.5, the total weight gain is generally between 12.5-18 kg, BMI 18.5-24.9 of 11.5-16 kg, BMI of 25-29.9 of 7-11.5 kg, and BMI ≥30, the minimum increase is between 5-9 kg. If the mother's weight gain follows the recommendations, it is categorized as normal[15]. Gestational age was categorized as <38 weeks and ≥38 weeks[16]. The parity was categorized into parity <1 and parity ≥1[17]. Disease and infection during pregnancy were categorized into sick and not sick. According to research data, the interval between pregnancies was categorized as <8 years and ≥ eight years to obtain a significant relationship[18].

The pesticide exposure was measured using a questionnaire on whether or not the mother was involved in agricultural activities during pregnancy, with a total score of 12. Categorizing pesticide exposure scores were based on the median/middle value of the total score, with a total score of 6. Pesticide exposure was categorized as low if the score was 0-6 and categorized as high if the score was 7-12. Exposure to cigarette smoke was also measured using a questionnaire with a total score of 20. The categorization of smoking exposure scores was based on the median/middle value of the total score, with a total score of 20 (a score of 0-10 was categorized as low exposure, and a score of 11-20 was categorized as high exposure)[19]. Economic status was categorized as poor (low-income family) based on the ownership of a healthy Indonesian card from the government for underprivileged families. The education level of the respondents was categorized into primary education (elementary school and junior high school) and further education (high school and university).

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The data in this study were analyzed using Chi-Square 2x2 and the alternative test, Fisher's Exact, to determine the relationship between variables with a significance of <0.05. In addition, multivariate data analysis was performed through binary logistic regression. This research received ethical approval from the Faculty of Public Health Ethics Committee, Diponegoro University (No: 358/EA/KEPK-FKM/2021).

RESULTS AND DISCUSSION

The distribution of the characteristics of the respondents and the research variables shows in Table 1. Based on Table 1, the category of infants who experienced LBW was 33.8%. Almost all mothers were housewives (87.7%), while others worked as entrepreneurs, farmers, and teachers. Most mothers in the Kertek 2 Health Center working area have an elementary school education, with a percentage of 58.5%. The level of tertiary education (high school) (1.5%) was the lowest level of a mother's education.

Table 1. Characteristics of respondents

Variable	Category	Total	
		n	%
Infant's weight	LBW	22	33.8
	Normal	43	66.2
Mother's job	Housewife	38	58.5
	Self-employed	16	24.6
	Farmer	10	15.4
	Teacher	1	1.5
Mother's education	Elementary school	57	87.7
	Junior high school	4	6.2
	High school	3	4.6
	College	1	1.5
Anemia	Anemia	6	9.2
	Not Anemia	59	90.8
Mother's age at pregnancy	<20 and >35 years	5	7.7
	20-35 years	60	92.3
Upper arm circumference	CED (Chronic Energy Deficiency)	17	26.2
	No CED	48	73.8
Weight gain	Not enough	38	58.5
	Normal	27	41.5
Gestational age	< 38 weeks	18	27.7
	≥ 38 weeks	47	72.3
Parity	< 1 time	18	27.7
	≥ 1 time	47	72.3
Diseases and Infections	Yes (sick)	9	13.8
	No (not sick)	56	86.2
Pregnancy Distance	< 8 years	31	47.7
	≥ 8 years	34	52.3
Pesticide Exposure	High exposure	6	9.2
	Low Exposure	59	90.8
Alcohol consumption	Consumption	0	0.0
	No consumption	65	100
Cigarette Exposure	High exposure	17	26.2
	Low exposure	48	73.8
Economic Status	Not sure	41	63.1
	Non-middle low-income families	24	36.9

The results of the bivariate analysis that examines the relationship between maternal, environmental, and socioeconomic factors are shown in Table 2. Based on Table 2, factors related to LBW at the Kertek 2 health center were maternal age at pregnancy, gestational age, parity, and distance pregnancy. In addition, Table 2 also displays the Prevalence Risk (PR) value to see the magnitude of the risk from the LBW factor.

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Table 2. Low birth weight (LBW) factor relationship analysis

Variable	Category	Birth Weight		p-value	PR 95% CI
		LBW	Normal		
Anemia	Anemia	1 (4.5%)	5 (11.6%)	0.655	0.468 (0.076-2.895)
	Not Anemia	21 (95.5%)	38 (88.4%)		
Mother's age at pregnancy b	<20 and >35 years	5 (22.7%)	0 (0%)	0.003*	3.529 (2.360-5.278)
	20-35 years	17 (77.3%)	43 (100%)		
Upper arm circumference	CED	6 (27.3%)	11 (25.6%)	0.883	1.059 (0.496-2.259)
	No CED	16 (72.7%)	32 (74.4%)		
Weight gain	Not enough	14 (63.6%)	24 (55.8%)	0.545	0.804 (0.393-1.644)
	Normal	8(36.4%)	19 (44.2%)		
gestational age	< 38 weeks	13 (59.1%)	5 (11.6%)	0.000*	3.772 (1.962-7.251)
	≥ 38 weeks	9 (40.9%)	38 (88.4%)		
Paritas	< 1 time	10 (45.5%)	8 (18.6%)	0.022*	2.176 (1.148-4.125)
	≥ 1 time	12 (54.5%)	35 (81.4%)		
Diseases and Infections	Yes (sick)	2 (22.2%)	7 (77.8%)	0.706	0.622 (0.174-2.220)
	No (Not sick)	20 (35.7%)	36 (64.3%)		
Pregnancy Distance	< 8 years	6 (27.3%)	25 (58.1%)	0.018*	1.523 (1.062-2.185)
	≥ 8 years	16 (72.7%)	18 (41.9%)		
Pesticide Exposure	High exposure Low	3 (13.6%)	3 (7.0%)	0.398	0.644 (0.267-1.555)
	Exposure	19 (86.4%)	40 (93.0%)		
Alcohol consumption	Consumption	0 (0%)	0 (0%)		
	No consumption	22 (100%)	43 (100%)	**	**
Cigarette Exposure	High exposure	8 (36.4%)	9 (20.9%)	0.180	0.620 (0.371-1.211)
	Low exposure	14 (63.6%)	34 (79.1%)		
Economic Status	Not sure	14 (63.6%)	27 (62.8%)	0.947	1.024 (0.505-2.079)
	Non-middle low income families	8 (36.4%)	16 (37.2%)		
Education	Base	17 (31.5%)	37 (68.5%)	0.487	0.693 (0.325-1.477)
	Carry on	5 (45.5%)	6 (54.5%)		

*: Significant test relationship
**: Cannot be analyzed statistically because the data does not vary
a: Data analysis with Chi-Square
b: Data analysis with Fisher Exact

Table 3. Multivariate analysis of factors associated with LBW

Variable	Sig	Exp(B)	R square
Mother's age	0.999		
Gestational age	0.001*	0.084	0.483
Parity	0.728		
Pregnancy spacing	0.245		

Based on the multivariate analysis of binary logistic regression in Table 3, it was found that of the four factors associated with LBW, only gestational age significantly affected LBW p<0.05 (p=0.001). After further analysis, it was obtained that the substantial value of the effect of Exp(B) from gestational age was 0.084, meaning that the more mothers with gestational age <38 weeks, the higher the incidence of LBW by 8.4%. The joint strength of the influence of the variables of maternal age, gestational age, parity, and the distance between at-risk pregnancies was 0.483 or 48.3%. That was, the power of influence as a whole was weak. The insignificant effect of maternal age, parity, and gestation interval variables was probably due to the less varied study sample. Besides that, the number of babies with LBW was less compared to the group that did not have LBW (normal). These conditions could make the analysis results insignificant.

This study's results indicate no relationship between anemia and LBW, with a p-value of 0.655. The absence of a relationship between anemia and LBW in this study occurred because anemic women at the study site were immediately given instructions or directions from health workers to treat anemia, such as giving blood-boosting tablets and nutritional counseling. This condition indicates that anemia in pregnant women is immediately intervened, which can reduce the risk of LBW. Mothers with anemia in this study also did not have other aggravating factors that caused LBW. In addition, in this study, the incidence of LBW was not entirely a manifestation of anemia during pregnancy. There may be other factors that were dominant and significantly contributed to LBW but were not examined, including intake of macronutrients during pregnancy[20]. If the mother was anemic but the macronutrient intake was maintained, the risk of giving birth to a LBW baby can be reduced.

In line with research (Najdah, 2020), this study stated no relationship between anemia and LBW (p=0.891)[21]. The next possible cause that made the results of this study insignificant was the cases of anemia

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by the subjects were mild anemia (Hb 10-10.9 gr/dl). Similar to a study in India, the risk of LBW depends on the mother's anemia level. The more severe the level of anemia, the greater the risk of LBW. The risk of LBW was found in severe anemia (OR, 2.5), moderate anemia (OR, 1.11), and mild anemia (OR, 0.57) [22]. This finding showed that mild anemia had likely to have a low risk of giving birth to LBW babies.

This study showed a relationship between maternal age during pregnancy and LBW. Based on this study, most mothers who gave birth to LBW babies were adolescents <20 years. This finding indicates that pregnant adolescents have a 3.529 risk of giving birth to LBW babies. This study found that many mothers married at a young age (<20) while the mothers were still in the growth phase. As a result, mothers and babies compete for nutrition, leading to the sub-optimal growth of babies in the womb. Adolescent reproductive organs are not fully ready because of the maturation process. Blood circulating to the uterus is also not optimum, disrupting the distribution of nutrients to the infants[23]. This term aligns with a study by Rismanieta (2016) that maternal age was related to LBW (p=0.039, OR=2.346).

Several young women in Wonosobo District married at 16 and 17 years. Moreover, in rural areas, based on the low level of economy and education, parents were encouraged to get their children married soon so that their economic burden would be reduced by marrying off their children. In addition, there is a stigma that girls who are not immediately married will become "old maids"[24]. This phenomenon can encourage a young marriage which is a possibility for teenagers to get pregnant at the age of <20 years. Furthermore, mothers aged > 35 years are also at risk of giving birth to LBW babies. At that age, the mother's reproductive functions are functionally decreased, especially in the endometrium. This condition interferes with the distribution of the mother's nutrition to the baby[25].

This study's upper arm circumference variable was unrelated to LBW (p=0.883). There was no relationship between CED and LBW, possibly because pregnant women who had CED were given supplementary food interventions (PMT). Supplementary food given to pregnant CED women improves the mother's nutritional status. Based on the Sleman Health Center study, giving PMT for recovery was significantly associated with increased maternal arm circumference for three months (p=0.000) [26]. This research aligned with Sangi (2021), with a p-value = 0.117[27]. The mother's upper arm circumference data were obtained in the first trimester. The second and third-trimester data were not studied. As expected, mothers who had CED in the first trimester may no longer be CED in the next trimester, which caused no significant relationship between variables.

This study differs from existing theories and a study results in Ethiopia (with a p-value of 0.005)[28]. Chronic energy deficiency (CED) during pregnancy was associated with decreased blood volume, resulting in hampered blood flow of nutrients from mother to baby. Upper arm circumference <23.5 cm is one way to detect a mother's malnutrition. The development of the fetus in the womb is very dependent on the nutritional condition of the mother. If the mother has a nutrient deficiency, fetal growth is stunted, eventually leading to low birth weight[13].

Maternal weight gain during pregnancy was not related to LBW p=0.545. In this study, 56.9% of mothers had good nutritional status, and some mothers were overweight (9.2%) and obese (16.9%). There was no relationship between maternal weight gain during pregnancy and LBW because the mother's nutritional status could indicate the presence of nutritional reserves in the body. Intake of nutritious food does not necessarily increase the mother's weight but can be absorbed by the baby. In addition to obtaining nutrition from the food consumed by the mother, the baby in the womb can also take from the mother's nutritional reserves. Therefore, with a good nutritional status, even if the mother does not gain maternal weight, the baby will still receive nutrition from the reserves in the mother[29]. A similar study (Haryanti, 2019) showed no relationship between maternal weight gain and LBW p value = 0.736.[30,31].

This study's results showed a significant relationship between gestational age and LBW (p=0.000). This study showed that full-term babies aged <38 weeks had a risk of LBW. This finding possibly happened because even though the babies were born at full term, the mothers had to aggravate factors at risk of LBW, such as low economic status and education, mothers with CED, and mothers being exposed to pesticides during activities on agricultural land. This study also found premature/not full term, <37 weeks born with LBW. The high risk of gestational age for LBW births was caused by babies who were not yet full-term. Their organs have not yet fully grown, which contributes to birth weight. The baby's weight will increase as the gestational age increases. Therefore, babies with gestational age <37 weeks will weigh less than full-term babies. Babies born prematurely are usually born earlier of the placenta so that the flow of the mother's nutrients to the baby is less than a full-term baby. As a result, the baby's weight is low, and LBW births occur[32]. The results of calculating the Prevalence Ratio in this study showed that mothers whose gestational age was <38 weeks had a 3.772 risk of giving birth to LBW babies (95% CI 2.583-6.417). This study was in line with a study by Apriani (2021) with more significant risk results. The preterm gestational age had a risk of 20.213 times giving birth to LBW babies (p=0.000)[33].

The parity was related to LBW (p-value = 0.022). Parity with a risk category was <1 or new mothers who had never given birth to a baby. There was a relationship between parity at risk and LBW because mothers with parity <1 did not have pregnancy experience, pregnancy care, or nutritional intake for their babies, so they were likely not ready to get pregnant[25]. Meanwhile, mothers with parity > 1 already had skills and knowledge for the subsequent pregnancy. Mothers with parity <1 have high anxiety because it is their first pregnancy. A mother's anxiety will interfere with the mother's mental health, which is one factor affecting the baby's health. Mothers who have never given birth are physically and mentally unprepared. Thus, during the pregnancy, the mother is inexperienced, which increases the risk of LBW[33]. This study's results align with research at the Medan City

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Hospital that the parity of mothers who were pregnant for the first time was associated with the incidence of LBW p-value = 0.034[25].

The relationship between disease and infection in LBW mothers in this study was not proven significant, with a p=1.000. Maternal medical history that could contribute to LBW is hypertension, anemia, diabetes mellitus, pre-eclampsia, eclampsia, asthma, and other chronic diseases[34]. Meanwhile, based on the results of this study, only 2 out of 9 mothers suffered from chronic diseases. Most of the mothers suffered from not severe and recovered quickly, such as flu in just two days and toothache in five days. Therefore, disease in mothers in this study area was not significantly related to LBW births. The results of this study were similar to the research (Suryati, 2014) p= 0.754.

The results of this study showed that there was a relationship between pregnancy spacing and LBW p=0.018. This study showed a relationship between birth spacing (> 5 years) and LBW. This condition happens because the distance between pregnancies that are too far increases the risk of premature birth. In this study, the distance between most mothers' pregnancies was ≥ 8 years. According to WHO, good pregnancy spacing should not be <2 years. However, the <2 years category did not show a significant relationship in this study and could show a significant relationship at intervals of ≥ 8 years of pregnancy. The relationship between long birth spacing with LBW occurs because there is an increased risk of pregnancy complications such as pre-eclampsia, hypertension, obesity, and gestational diabetes. Pregnant women with long birth spacing were likely to have premature rupture of membranes compared to 12-23 month pregnancies. This condition triggers the birth of premature babies and usually occurs LBW[18].

This research was in line with research (Mahande, 2016) in Tanzania that pregnant women who are too far apart were at risk of giving birth to LBW babies. Several studies have suggested a distance of 27-50 months as the optimal pregnancy spacing. The relationship between long birth spacing and the increased risk of LBW can be explained by physiological and anatomical declines in the mother as an adaptation of the reproductive system that decreases gradually after a long time if a woman is not pregnant[35]. However, research on the relationship between long birth spacing and LBW needs to be studied further because of the inconsistent results, and there are still few studies. Several studies have not clearly explained the relationship between the two variables. In addition, mothers with long birth spacing and giving birth to LBW babies are rare cases.

This study explained that pesticide exposure was unrelated to LBW p-value= 0.398. There was no relationship between exposure to pesticides and LBW because the intensity of exposure to pesticides by mothers was mainly low. Mothers' participation in agricultural activities was not too long, and more dominant husbands worked in the fields. Mother works on farms, and using complete personal protective equipment (long-sleeved shirt, long pants, mask, gloves, head cover/hat, and shoes) can minimize pesticide exposure. Moreover, the possibility of the type of pesticide used is also not necessarily dangerous, such as organophosphates and carbamates[36]. All mothers who work on agricultural land also do not participate in pest spraying activities, and male farmers carry out these activities. Similar research was also carried out by (Fatmawati, 2016) with p-value = 0.077[14].

The results of this study indicate that there are no subjects who consume alcohol (0%). Consumption of alcohol is not following the religion of the local community, so no one consumes it. This study's results indicated no relationship between exposure to cigarette smoke and LBW (p=0.180). The nicotine and carbon monoxide content in active and passive smokers will inhibit the entry of oxygen and nutrients from mother to baby[13]. There was no relationship between smoking exposure and LBW in this study because the two groups had the same possibility of being exposed to cigarette smoke, which made the analysis results insignificant. In addition, based on the results of interviews with respondents, when the mother's husband smokes, the mother stays away/not around people who smoke. Sometimes husband also smokes in a different place, not with the mother. Most mothers also did not work, so exposure to passive smoking was only from family members. This study aligned with research (Simamora, 2020) with a p-value = 0.554)[37].

This study's relationship between economic status and LBW was not proven to be related p=0.947. The results of this study were not the same as existing theories because they can be caused by economic status indicators that were examined only based on the categories of low-income families and non-poor families from the government. In comparison, other indicators can measure economic status, such as family income level, number of family members, living conditions, and monthly expenses not examined by researchers[38]. This finding aligned with research (Nuryani, 2017) that economic status was unrelated to LBW p value = 0.709.

The mother's education level was unrelated to LBW (p=0.487). This result possibly happened because the mother's nutritional knowledge did not always depend on her level of education. Nowadays, all mothers can access the internet to increase their knowledge. Several health services have social media accounts sharing health information, including the Kertek 2 Health Center. Pregnant women in the area also have a WhatsApp group with health workers. Based on research by Sarasati (2020), WhatsApp groups for pregnant women can be a means of disseminating information because mothers can ask midwives/health workers about pregnancy[39]. This study follows a 2012 research by Widianingsih with a p-value= 0.996. In other words, even though mothers have a low level of education, it does not rule out the possibility for mothers to increase their knowledge through various sources.

CONCLUSIONS

Factors associated with LBW at the Kertek 2 Health Center in Wonosobo Regency were the mother's age, gestational age, parity, and gestation interval. Anemia, upper arm circumference, weight gain, and maternal disease did not correlate with LBW. Likewise, alcohol consumption, pesticide exposure, and cigarette

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exposure during pregnancy were not associated with LBW. The same thing also happened in the analysis of demographic factors, which consisted of the mother's economic status and education level. It turned out that there was no relationship with the incidence of LBW at the Kertek 2 Health Center, Wonosobo Regency. Every mother needs to prepare for pregnancy physically, mentally, and nutritionally. Following the results of this study, the risk of LBW can be reduced by preparing for pregnancy according to the mother's age, parity, and spacing of pregnancies that are not at risk. Fulfilling maternal nutrition during pregnancy is essential for preventing premature births and LBW. Research on LBW factors will assist in formulating appropriate policies by regional conditions to reduce the prevalence of LBW. If the prevalence of LBW decreases, it will reduce the Infant Mortality Rate (IMR) and encourage the achievement of other nutritional targets, such as reducing the prevalence of stunting, wasting, and other malnutrition problems.

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REFERENCES

1. The World Bank. World Bank Country and Lending Groups – World Bank Data Help Desk. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups (2022).
2. United Nations Children's Fund, (UNICEF) & World Health Organization, (WHO). *UNICEF-WHO Low birthweight estimates: Levels and trends 2000–2015*. (2019). doi:10.1016/S2214-109X(18)30565-5.
3. Low birthweight. https://www.marchofdimes.org/complications/low-birthweight.aspx#.
4. Health Research and Development Agency. *Main Results of 2018 Riskesdas*. https://kesmas.kemkes.go.id/assets/upload/dir_519d41d8cd98f00/files/Hasil-riskesdas-2018_1274.pdf (2018).
5. The Ministry of Health of the Republic of Indonesia. *Indonesia Health Profile 2019*. (Ministry of Health of the Republic of Indonesia, 2020).
6. Ministry of VAT, B.*et al.*Development of Nutrition in Indonesia. (2019).
7. Wonosobo District Health Office.*Recap of LBW Data at the Wonosobo District Level for January-December*. (2020).
8. Wonosobo District Health Office. *Wonosobo District Health Service Strategic Plan for 2016-2021*.
9. Central Java Provincial Health Office. Number of Babies Born, Babies with Low Birth Weight (LBW), LBW Referred, and Malnourished According to Districts/Cities in Central Java Province (Soul), 2017-2018 'Central Java Province BPS'. https://jateng.bps.go.id/indicator/30/378/1/nomor-bayi-hir-bayi-berat-badan-hir-dinding-bblr-bblr-dirjuk-dan-bergizi-bad-menurut- regency-city-in-province-jateng-tenggara.html.
10. Wonosobo District Health Office.*Wonosobo District Health Profile 2018*. (2018).
11. Wonosobo District Health Office.*Wonosobo District Health Profile 2019*. (2019).
12. Labir, IK, Widarsa, IKT & Suwiyoga, K. Anemia of First and Second Trimester Pregnant Women Increases the Risk of Low Birth Weight Babies at Wangaya Hospital Denpasar.*Public Health and Preventive Medicine Archive* **1**, 19 (2013).
13. Mingude, AB, Gebretsadik, W., Misker, D. & Woldeamanuel, GG. Determinants of Low Birth Weight among Live Birth Newborns Delivered at Public Hospitals in Gamo Gofa Zone, South Ethiopia: Unmatched case control study.*SAGE Open Medicine* **8**, 1–8 (2020).
14. Fatmawati, M. & Windraswara, R. Risk Factors of Pesticide Exposure During Pregnancy on Low Birth Weight in Vegetable Farmers. *Unnes Journal of Public Health* **5**, 306–315 (2016).
15. National Research Council. *Weight Gain During Pregnancy: Re-examining the Guidelines*. The National Academies Press (The National Academies Press, 2009). doi:10.17226/12584.
16. Murray, Sr*et al.* Long Term Cognitive Outcomes of Early Term (37-38 Weeks) and Late Preterm (34-36 Weeks) Births: A Systematic Review. *Wellcome Open Research* **2**, (2017).
17. Garces, A. *et al.* Association of Parity With Birthweight and Neonatal Death in Five Sites: The Global Network's Maternal Newborn Health Registry study. *Reproductive Health* **17**, 1–7 (2020).
18. Zhang, Q. *et al.* Association between Maternal Interpregnancy Interval After Live Birth or Pregnancy Termination and Birth Weight: A Quantile Regression Analysis. *Scientific Reports* 2018 8:1 **8**, 1–8 (2018).
19. Ratnasari, D., Suhartono, S. & Rahfiludin, MZ. Risk Factors for Low Birth Weight in Agricultural Areas (Study in Brebes Regency). *Journal of Nutrition and Food* **12**, 41–48 (2017).
20. Health, J., Syari, M., Serudji, J. & Mariati, U. The Role of Macronutrient Intake of Pregnant Women on Birth Weight of Babies in Padang City. *Andalas Health Journal* **4**, (2015).
21. Najdah Najdah & Yudianti Yudianti. Nutritional Status and Anemia in Pregnant Women with Birth Weight. *Permas Scientific Journal: STIKES Kendal Scientific Journal* **10**, 57–62 (2020).
22. Kumari, S. *et al.* Maternal and Severe Anemia in Delivering Women is Associated With Risk of Preterm and Low Birth Weight: A Cross-Sectional Study from Jharkhand, India. OneHealth **8**, 100098 (2019).
23. Rismanieta, YES, Fatmaningrum, W. & Perbowo,

P. The Relationship between The Age of Pregnant Women and The Incidence of Low Birth Weight Babies (LBW) at RSUD dr. Soetomo Surabaya Period June – August 2013. JUXTA: *Scientific Journal of Airlangga University Medical Students* **8**, 35–40 (2016).

24. Mahfuz, MJQuality of Marriage Age, Motives, Factors and Their Impacts in Wonosobo Regency. ADHKI: *Journal of Islamic Family Law* **1**, 59–72 (2019).
25. Sembiring, JB, Pratiwi, D. & Sarumaha, A. Relationship of Age, Parity and Age of Pregnancy with Low Birth Weight Babies at Mitra Medika General Hospital Medan. *Journal of Community Midwives* **2**, 38–46 (2019).
26. Utami, R., Gunawan, IMA & Aritonang, I. Effect of Supplementary Feeding (PMT) Recovery on Nutritional Status in Pregnant Women in Sleman Regency. *Journal of Nutrition* **20**, 19–26 (2018).
27. Sangi, R. *et al.* Evaluating Association of Maternal Nutritional Status With Neonatal Birth Weight in Term Pregnancies: A Cross-Sectional Study With Unexpected Outcomes. *Cureus* **13**, (2021).
28. Addila, AE, Azale, T., Gete, YK & Yitayal, M. The Effects of Maternal Alcohol Consumption during Pregnancy on Adverse Fetal Outcomes Among Pregnant Women Attending Antenatal Care at Public Health Facilities in Gondar Town, Northwest Ethiopia: A Prospective Cohort Study. *Substance abuse treatment, prevention, and policy* **16**, (2021).
29. Widianingsih, D. Factors Influencing the Incidence of Low Birth Weight Babies in Giving Mothers in the Perinatology Room of the 45 Kuningan Regional General Hospital. *Journal of Health Sciences Bhakti Husada* **1**, 18–21 (2012).
30. Haryanti, SY & Pangestuti, Dina Rahayuning Kartini, A. Anemia and Kek in Pregnant Women as Risk Factors for Low Birth Weight Babies (Bblr) (Study in the Work Area of the Juwana Health Center, Pati Regency). *Public Health Journal (e-Journal)* **7**, 322–329 (2019).
31. Manuputty, M. *et al.* Relationship Between Maternal Weight Gain During Pregnancy With Baby's Birth Weight in Manado City. KESMAS **6**, (2017).
32. Purwanto, AD Risk Factors Correlated with Incidence of Low Birth Weight Cases.*Journal of Epidemiology Periodical* **4**, 349 (2017).
33. Apriani, E., Subandi, A., Khusni, A. Relationship Between the Age of Pregnant Women, Parity and Gestational Age with LBW Events in Cilacap Hospital. *Tens : Trends of Nursing Science* **2**, 45–52 (2021).
34. Suryati. Factors Influencing the incidence of LBW in the Working Area of the Air Cold Health Center. *Andalas Public Health Journal* **8**, 72–78 (2014).
35. Mahande, MJ & Obure, J. Effect of Interpregnancy Interval on Adverse Pregnancy Outcomes in Northern Tanzania: A Registry-Based Retrospective Cohort Study. (2016) doi:10.1186/s12884-016-0929-5.
36. Lubis, FH Risk Factor Analysis of Pesticide Exposure in Pregnancy with Low Birth Weight (LBW) in Padangsidimpuan City in 2019. *Journal of Public Health and Nutrition (Jkg)* **3**, 39–47 (2020).
37. Simamora, SED & Ronoatmodjo, S. Correlation between Exposure to Cigarette Smoke from Husbands in Women Aged 15-57 Years with the Incidence of Low Birth Weight Babies in Indonesia (Fols-5 2014 Advanced Data Analysis). *Journal of Reproductive Health* **11**, 89–100 (2020).
38. Nuryani, N. & Rahmawati, R. Incidence of Low Birth Weight in Tinelo Village, Gorontalo District and Factors Affecting It. *Journal of Nutrition and Food* **12**, 49–54 (2017).
39. Sarasati, F. Utilization of Social Media as Promotional Media. *Communication Research Journal* **2**, 257–264 (2020).

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