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Original Research

The Relationship Between Dietary Patterns and Other Factors on the Incidence of Low Birth Weight in Infants Aged 0-6 Months in Selected Areas in Indonesia in 2025

Hubungan antara Pola Makan dan Faktor lain terhadap Insiden Berat Bayi Lahir Rendah pada Bayi usia 0-6 Bulan pada Lokasi Terpilih di Indonesia Tahun 2025

Erlia[1], Nurul Dina Rahmawati[1*], Diah Mulyawati Utari[1], Susianto[2]
[1]Nutrition Science Department, Faculty of Public Health, University of Indonesia, Jakarta, Indonesia
[2]World Vegan Organisation, Singapore

*Email corresponding author: nuruldina@ui.ac.id

Abstract: *Low birth weight (LBW), defined as a birth weight of less than 2,500 grams, remains a significant public health concern due to its considerable impact on infant mortality and long-term growth dan development outcomes. This study aims to examine the relationship between maternal dietary patterns (non-vegetarian and vegetarian) and other maternal factors—including pre-pregnancy nutritional status, gestational weight gain, parity, interpregnancy interval, education, antenatal care utilization, supplement intake, and dietary frequency – with the risk of LBW in selected areas in Indonesia.This research uses a cross-sectional design involving 122 respondents, data were collected through structured questionnaires and a Food Frequency Questionnaire (FFQ). The study was conducted from March to May 2025 using purposive sampling. A LBW prevalence of 5.7% in Indonesia, with prevalence rates of 8.3% among vegetarian mothers and 5.1% among non-vegetarian mothers. Bivariate analysis revealed no statistically significant associations between LBW incidence and dietary type (p = 0.623), frequency of staple food consumption (p = 0.272), frequency of animal protein consumption (p = 0.751), frequency of plant protein consumption (p = 0.113), pre-pregnancy nutritional status (p = 0.941), gestational weight gain (p = 0.707), interpregnancy interval (p = 1), parity (p = 0.709), ANC visit frequency (p = 1), maternal education level (p = 0.650), and supplement consumption (p = 0.555). There is no significant relationship between all independent variables with the incidence of low birth weight.*

Key words: Infants, Low birth weight (LBW), Risk factors, Dietary Habit

1. INTRODUCTION

Low birth weight (LBW) occurs when a baby is born weighing less than 2500 grams. LBW is a significant public health issue that affects the nutritional status of toddlers. It is estimated that 15%-20% of births worldwide result in LBW, making it one of the leading causes of high infant mortality rates (IMR). The prevalence of LBW varies across regions, with the highest being 28% in South Asia and the lowest at 6% in East Asia and the Pacific. According to the 2022 Indonesian Nutritional Status Survey (SSGI), the overall prevalence of LBW in Indonesia is 6%. Nutritional issues in Indonesia are an indirect cause of maternal and child mortality. Considering that pregnant women and toddlers are vulnerable groups to malnutrition and will affect the nutritional status in subsequent life stages, it is theoretically not recommended for pregnant women to follow a vegetarian diet due to concerns that they may suffer from malnutrition and give birth to undernourished babies (1,2).

During the pregnancy period, the nutritional status of the mother, which depends on the mother's eating patterns and habits, in this case following a vegetarian diet. A vegetarian diet consists of all fruits, vegetables, whole grains, legumes, herbs, and minimally processed spices, and excludes red meat, poultry, and fish. A vegetarian diet does indeed have lower levels of essential micronutrients such as iron, zinc, vitamin B12, vitamin D, omega-3 fatty acids, calcium, and iodine. However, on the other hand, another study showed that vegetarians have a higher intake of vitamin A in their diet compared to non-vegetarians or omnivores (3). A plant-based diet is also generally rich in fiber, magnesium, potassium, and antioxidants, and tends to have lower intake of saturated fatty acids. In addition, according to the statement from the Academy of Nutrition and Dietetics, a well-planned vegetarian diet is suitable for individuals at all stages of the life cycle, including during pregnancy and breastfeeding (4). From various existing literature and data, studies that include the relationship between vegetarian and non-vegetarian diets on the incidence of Low Birth Weight (LBW) are still needed. Although the prevalence of LBW in Indonesia is low, this research remains urgent to conduct due to the impact of LBW on increasing infant and maternal mortality rates. Additionally, there is still a perception that vegetarian mothers are at risk of giving birth to LBW babies. Therefore, this study aims to compare pregnancy outcomes regarding LBW incidence with various risk factors, one of which is diet type and maternal intake during pregnancy.

2. METHODS

This research was conducted using quantitative methods to determine the description of the incidence of Low Birth Weight (LBW) as the dependent variable with the types of maternal diet, including frequency of consumption during pregnancy (staple foods, animal protein, plant protein), as well as other supporting factors, including pre-pregnancy nutritional status, gestational weight gain, maternal education, parity, pregnancy spacing, frequency of Antenatal Care (ANC), and maternal supplement consumption during pregnancy as independent variables. The research design used is Cross-Sectional with independent and dependent variables measured simultaneously in selected areas in Indonesia.

This study uses 2 sample groups, namely vegetarian and non-vegetarian groups. Sampling of both groups was conducted through purposive sampling, focusing on respondents with a vegetarian diet pattern. Samples of babies with vegetarian mothers are specifically sought in various Maitreya temples scattered across Indonesia, while non-vegetarian samples are obtained from the results of questionnaires and offline interviews. The inclusion criteria are mothers living in Indonesia who have maintained the same diet (vegetarian or non-vegetarian) during pregnancy, have babies aged 0-6 months, and possess a Maternal and Child Health (*KIA*) book. The exclusion criteria include mothers with a history of giving birth to low-birth-weight babies, premature babies, and multiple pregnancies. These criteria were applied to minimize potential bias, as infants born preterm, from multiple pregnancies, or to mothers with a prior history of LBW are inherently at higher risk of LBW due to established biological and clinical factors (5). Including these cases could confound the relationship between maternal dietary patterns and other maternal factors with LBW outcomes. Therefore, this exclusion was intended to ensure a more homogeneous study population and to better isolate the associations of interest. Additionally, mothers who smoke and consume alcohol during pregnancy are also excluded. Based on the sample calculation, a minimum total sample size of 50 people for each group should obtained for this study. This number is then doubled to achieve a minimum sample size of 100 people for two

population samples and was added by 10% to anticipate the case incomplete data. Thus, a minimum of 110 respondents need to be achieved for this study. Bivariate analysis was conducted to examine the association between independent variables—including maternal dietary patterns, frequency of food consumption (staple foods, animal protein, plant-based protein, vegetables, and fruits), pre-pregnancy nutritional status, gestational weight gain, education, parity, interpregnancy interval, antenatal care (ANC) visits, and supplement intake—and the dependent variable, low birth weight (LBW). The Chi-square test was used to assess differences in LBW proportions across categorical variables, while the independent t-test was applied to evaluate differences in mean dietary intake frequency between LBW and non-LBW groups.

3. RESULTS

This study involved 122 mothers with infants aged 0–6 months, with a low prevalence of low birth weight (LBW) at 5.7%. Most respondents were non-vegetarian (80.3%), had normal pre-pregnancy nutritional status (63.1%), adequate gestational weight gain (52.5%), sufficient antenatal care (ANC) visits (90.2%), and high educational attainment (77.9%). The mean birth weight was 3101.3 grams (±415.6), indicating that most infants were born within the normal range. Bivariate analysis showed that none of the examined variables—including maternal dietary type, dietary intake frequency, pre-pregnancy nutritional status, gestational weight gain, interpregnancy interval, parity, ANC visits, maternal education, and supplement consumption—were significantly associated with LBW ($p>0.05$). Similarly, no significant differences were observed in the mean frequency of staple food, animal protein, or plant protein consumption between LBW and non-LBW groups.

Table 1. Respondents Characteristics based on the Majority of Independent Variables

Variable		Frequency (n)	Percentage (%)
Low Birth Weight (LBW)	Not LBW	115	94,3
Maternal Diet Type	Non Vegetarian	98	80,3
Pre-Pregnancy Nutritional Status	Normal	77	63,1
Gestasional Weight Gain	Sufficient	64	52,5
Interpregnancy Interval	Sufficient	65	85,5
Parity	Multipara	76	62,3
ANC Visit Frequency	Sufficient	110	90,2
Maternal Education Level	High Education	95	77,9
Supplement Consumption	Yes	109	89,3

Table 2. Numeric Variable Distribution

Variable	N	Minimum	Maximum	Mean	Median	Standard Deviation
Birth Weight	122	2100	4370	3101,3	3065	415.557
Frequency of Staple Food Consumption	122	2,2	9,605	4,74	4,4	1,45
Frequency of Animal Protein Consumption	122	0	10,6	3,7	3,4	2,16
Frequency of Plant Protein Consumption	122	0,067	11,29	2,56	2,05	2,03
Pre-Pregnancy Nutritional Status	122	14,7	40,4	22,49	21,83	4,2647
Gestasional Weight Gain	122	-5	24	11,12	10,5	5,683
Interpregnancy Interval	76	3	192	60,82	59	37,365
ANC Visit Frequency	122	0	18	9,17	9	3,456

Table 3. Independent Variable Analysis with the Incidence of LBW

Variable	Low Birth Weight Incident				Total		*p value*	OR (95% CI)
	LBW		Not LBW					
	n	%	n	%	n	%		
Maternal Diet Type								
Vegetarian	2	8,3	22	91,7	24	100	0,623	1,691 [0,308-9,297]
Non Vegetarian	5	5,1	93	94,9	98	100		
Pre-Pregnancy Nutritional Status Underweight	1	6,3	15	93,8	16	100	0,941	0,822 [0,86-7,882]
Normal	4	5,2	73	94,8	77	100		1
Overweight Obesity	2	6,9	27	93,1	29	100		0,74 [0,128-4,273]
Gestasional Weight Gain								
Insufficient	4	6,9	54	93,1	58	100	0,707	1,506 [0,323-7,033]
Sufficient	3	4,7	61	95,3	64	100		
Interpregnancy Interval								
Insufficient	1	7,1	13	92,9	14	100	1	1,115 [0,115-10,822]
Sufficient	4	6,5	58	93,5	62	100		
Parity								
Nulipara	2	4,3	44	95,7	46	100	0,709	0,645 [0,120-3,472]
Multipara	5	6,6	71	93,4	76	100		
ANC Visit Frequency								
Insufficient	0	0,0	12	100	12	100	1	-
Sufficient	7	6,4	71	93,6	110	100		
Maternal Education Level								
Low Education	2	7,4	25	92,6	27	100	0,650	1,440 [0,263-7,872]
High Education	5	5,3	90	94,7	95	100		
Supplement Consumption								
No								
Yes	1	7,7	12	92,3	13	1	0,555	1,431 [0,159-12,908]
	6	5,5	103	94,5	109	6		

Tablel 4. The Relationship Between the Frequency of Consumption of Staple Foods, Animal Protein, and Plant Protein with the Incidence of LBW

LBW Incident	N	Mean	Standard Deviation	p-value
Frequency of Consumption of Staple Foods with LBW Incident				
LBW	7	4,91	1,71	0,739
Not LBW	115	4,73	1,44	
Frequency of Consumption of Animal Protein with LBW Incident				
LBW	7	3,89	1,460	0,826
Not LBW	115	3,70	2,196	
Frequency of Consumption of Plant Protein with LBW Incident				
LBW	7	2,01	1,305	0,462
Not LBW	115	2,60	2,069	

4. DISCUSSION

Low Birth Weight (LBW)

In this study, the distribution of birth weight for babies ranged between 2100 to 4370 grams, with an average of 3101.27 grams. This study found a prevalence of LBW at 5.7%, similar to the prevalence of LBW in Indonesia according to the Indonesian Nutrition Status Survey (SSGI) 2022, which is 6%.

Maternal Diet Type with Low Birth Weight

Statistical tests obtained a p-value = 0.623, indicating that there is no significant relationship between the mother's diet type and the occurrence of low birth weight (LBW). This result is consistent with a cross-sectional study by Przybysz et al., 2023, which also showed no difference in the birth weight of babies born to vegetarian and non-vegetarian mothers (p-value 0.16). The insignificant results of this analysis may occur due to the imbalance in the number of vegetarian and non-vegetarian respondents, with a predominance of non-vegetarian respondents. Additionally, the development of knowledge among mothers regarding balanced nutritional intake during pregnancy and supplement consumption also contributes to the absence of a significant difference in birth weight between babies born to vegetarian and non-vegetarian mothers. This is supported by research by Fikawati et al., 2012 which shows that weight gain during pregnancy in vegetarian mothers is actually higher and their intake of energy and protein sufficiently meets the nutritional adequacy figures (6). In addition, vegetarian mothers usually consume supplements during pregnancy to address the potential deficiency of important nutrients such as vitamin B12, iron, and protein. Therefore, this research shows that if a mother follows a well-planned and balanced vegetarian diet, she can have pregnancy outcomes, including adequate birth weight for the baby.

Frequency of Staple Food Consumption with Low Birth Weight

Different from previous studies, the analysis results of this study show no difference in the average frequency of staple food consumption between the Low Birth Weight (LBW) group and the non-LBW group, p-value = 0.272. This may occur due to the different categories between staple foods and carbohydrates. Carbohydrates can also be obtained from fruits, plant proteins, and vegetables, although in smaller amounts. Moreover, staple foods, known as the body's energy sources, are not one of the factors that need to be given more attention during pregnancy because they are usually already adequate. Research by Chong et al., 2015 also indicates that maternal macronutrient intake does not affect the birth weight of the baby.

Frequency of Animal Protein Consumption with Low Birth Weight

The analysis of the relationship between the frequency of animal protein consumption and the occurrence of low birth weight (LBW) showed that the average frequency of animal protein consumption in the LBW group was slightly higher compared to the non-LBW group. The statistical test results showed a p-value of 0.826 indicating that there is no difference in the average frequency of animal protein consumption between the LBW and non-LBW groups. However, upon further analysis, it was found in the non-LBW group that there was a difference in the average daily animal protein consumption between the vegetarian and non-vegetarian groups with a p-value < 0.001. This is consistent with the study by Chong et al., 2015, which also indicates that maternal macronutrient intake does not affect the birth weight of babies; in fact, this study found that lower maternal protein intake was significantly related to longer birth length in boys, but not in girls (7). Although adequate protein intake is very important during pregnancy, the frequency of protein consumption does not appear to be the sole determinant of infant birth weight, but the overall dietary balance and nutritional adequacy play a more important role in influencing pregnancy outcomes (8).

The Frequency of Plant Protein Consumption and Low Birth Weight

The analysis of the relationship between the frequency of plant protein consumption and the incidence of Low Birth Weight (LBW) shows that the average frequency of plant protein consumption in the LBW group is 2.01; which is 0.59 lower than in the non-LBW group. The statistical test yielded a p-value of 0.462, indicating that there is no difference in the average frequency of plant protein consumption between the LBW and non-LBW groups. However, after further analysis, it was found that in the non-LBW group, there is a difference in the average daily consumption of plant protein between the vegetarian and non-vegetarian groups with a p-value <0.001. This may be due to protein being fulfilled from animal sources such as meat, fish, eggs, etc. in the non-vegetarian respondents, as well as from eggs, milk, and its products in the vegetarian diet. In addition, according to the theory, a well-structured and balanced diet that combines and complements different amino acids through a variety of food sources will prevent protein deficiencies. This can be observed in all respondents following a vegan diet who consume plant-based protein supplements such as chia seeds, flax seeds, chickpeas, and imitation meat made from soybean protein. Balanced energy and protein supplementation can reduce the risk of fetal mortality and stunted growth (9).

Nutritional Status of Pregnant Women with Low Birth Weight

In this study, the statistical test results showed a p-value = 0.941, indicating that there is no significant relationship between BMI before pregnancy and the incidence of low birth weight. The analysis of underweight BMI and overweight and obesity BMI showed a greater tendency for low-birth-weight incidence compared to normal BMI. Mothers with underweight BMI have an increased risk of antepartum and postpartum hemorrhage and are more likely to require potentially life-saving interventions. Meanwhile, mothers with overweight and obesity BMI have a significantly higher risk of pregnancy complications, such as gestational diabetes, preeclampsia, amniotic fluid embolism, etc (10). In addition, the occurrence of low birth weight is influenced by various other factors related to nutritional status, such as gestational weight gain and intake during pregnancy.

Gestational Weight Gain and Low Birth Weight

In this study, the results of the analysis of the relationship between gestational weight gain and the incidence of low birth weight (LBW) showed a p-value = 0.707, indicating

that there is no significant relationship between gestational weight gain and the occurrence of LBW. However, there is a tendency that respondents with less gestational weight gain are less likely to give birth to LBW babies compared to respondents with adequate gestational weight gain. This is supported by research by Ciptaningtyas et al., 2022, which states that mothers with less weight gain during pregnancy are 5.3 times less likely to give birth to LBW babies compared to mothers with normal weight gain during pregnancy (11). This variable is not significant in this study because although gestational weight gain can lead to low birth weight, there are other factors such as metabolism, infections, and abnormalities or complications in pregnancy, such as inadequate placental or uterine function, that can be more closely related to the occurrence of low birth weight. Additionally, gestational weight gain also needs to be viewed in terms of its composition, muscle, or fat. A study shows that lean body mass (muscle and water) gained during pregnancy is positively related to birth weight (12). Conversely, an increase in fat mass, especially in the third trimester, does not have a significant impact on birth weight. Furthermore, when the weight gain occurs also affects its relationship with the baby's birth weight. Research by Young et al., 2017 also found that weight gain during the first 20 weeks of pregnancy has the most significant impact on fetal growth and development and pregnancy outcomes.

Pregnancy Interval and Low Birth Weight

In this study, a p-value of 1 was obtained, indicating that there is no significant relationship between pregnancy interval and the occurrence of Low Birth Weight (LBW). This may be due to the majority of respondents having a sufficient pregnancy interval, resulting in a higher probability of LBW occurrences among respondents with sufficient pregnancy intervals compared to those with close pregnancy intervals. Although not significant, there is a tendency for mothers with close pregnancy intervals to give birth to LBW infants, consistent with previous research findings. Between pregnancy interval and the occurrence of LBW, there are connecting factors such as maternal nutrition, maternal recovery conditions, or health issues that were not investigated in this study, which is why no significance was found between pregnancy interval and the occurrence of LBW.

Parity and Low Birth Weight

The results of the statistical test showed a p-value = 0.709, indicating that there is no significant relationship between parity and the incidence of low birth weight (LBW). This result may be caused by the fact that the multipara category is not separated from grand multipara (more than 5 live births). The analysis results do not align with the research theories of Kaur et al., 2014 and Prudhivi et al., 2015, but are similar to the findings of Sumana et al., 2016. The differences in these results may be due to the variation in confounding variables that were not studied, such as age, maternal health, and socioeconomic status(13–15).

ANC (Antenatal Care) Frequency with Low Birth Weight

The statistical test resulted in a p-value = 1, indicating that there is no significant relationship between ANC frequency and the occurrence of Low Birth Weight (LBW). The analysis did not find an OR value because the number of respondents in the ANC frequency category was low and the number of births with LBW was 0. This can occur according to the theory that quality > quantity of visits. A high frequency of visits does not guarantee the quality of visits and the education obtained during examinations. Furthermore, there are many other factors that play a greater role in the occurrence of LBW. Moreover, the number of respondents in the low ANC frequency category is only

9.8% of the total respondents, making it difficult to observe a significant relationship between ANC frequency and the occurrence of LBW.

Maternal Education and Low Birth Weight

Statistical test results showed a p-value = 0.65, indicating that there is no significant relationship between the mother's last education and the incidence of low birth weight (LBW). Although not statistically significant, mothers with low education are still more likely to give birth to LBW infants compared to mothers with higher education. This is consistent with previous research theories by Grytten et al., 2014; Siramaneerat et al., 2018; Arsyi, M., and Besral, 2021. The lack of significance in the education variable is due to the fact that the variable studied is only the mother's last education, not nutritional knowledge (16–18). High last education does not guarantee that the mother possesses good nutritional knowledge to implement proper nutritional guidelines during pregnancy. In addition, it was also found that counseling received by mothers during pregnancy has a protective effect against the incidence of LBW. Mothers who do not receive nutritional counseling during pregnancy have a 2.4 times higher risk of giving birth to low-birth-weight infants compared to mothers who receive counseling (19). Therefore, it is important to provide education and nutritional information that is easily accessible and understandable for all mothers, regardless of their educational background.

Supplement Consumption and Low Birth Weight

The statistical test results showed a p-value of 0.555, indicating that there is no significant relationship between supplement consumption and the occurrence of low birth weight (LBW). In this study, mothers were considered to have consumed supplements if they consumed at least one of the following micronutrients: folic acid, vitamin B12, and iron. Although not statistically significant, there was a tendency for mothers who did not consume supplements to give birth to babies with low birth weight, consistent with previous studies and WHO recommendations that micronutrient supplementation is very important during pregnancy to avoid anemia, premature delivery, and low birth weight. The lack of significance of the supplement consumption variable on the occurrence of low birth weight may be due to the very small number of respondents who did not consume supplements, only 10.7% of the total respondents. In addition, perhaps for mothers who do not take supplements, they consume herbal medicines or traditional spices that contain essential micronutrients for pregnancy or fulfill their micronutrient needs through the food they consume.

5. CONCLUSION

This study demonstrates that no single maternal factor—including dietary type, nutritional intake frequency, or maternal characteristics—was significantly associated with the incidence of low birth weight in the study population. These findings indicate that low birth weight is influenced by a complex and multifactorial set of determinants rather than isolated risk factors. From a practical perspective, these results suggest that public health interventions should move beyond simplistic categorizations such as dietary type (e.g., vegetarian vs. non-vegetarian) and instead emphasize ensuring overall nutritional adequacy, improving the quality of antenatal care, and strengthening maternal health monitoring systems.

In addition, future research should consider: (1) using larger and more representative samples to improve statistical power, (2) incorporating measures of dietary quality and nutrient adequacy rather than frequency alone, and (3) and examining contextual and

biological factors, such as maternal health conditions and placental function. These actions are essential to generate more robust evidence and to inform more effective strategies for reducing the risk of low birth weight.

CONFLICT OF INTEREST

The authors declare that there were no conflicts of interest in this study.

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