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Unveiling the risks of low birth weight prevalence: An ecological study in West Java

Mengungkap risiko prevalensi berat badan lahir rendah: Studi ekologi di Jawa Barat

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Abstract

Low birth weight (LBW) is a problem that encompasses the entire life cycle. Children born with low birth weight are highly vulnerable to developing diseases and death, and remain undernourished. This study aimed to analyze the factors related to the prevalence of LBW in West Java Province. This ecological study utilized secondary data from 2022 obtained from the Ministry of Health, Social Office Central Bureau of Statistics, and National Food Agency. The unit of analysis was all districts in West Java. The dependent variable was the prevalence of LBWs. The independent variables were pregnancy age at risk, preterm birth, MUAC <23,5 cm, parity, food security, early marriage, maternal education, and poverty. Pearson and Spearman correlation tests were conducted to examine the relationship between each independent variable and the prevalence of LBW. The overall prevalence of LBW infants was 20,9%, with a significant positive association found between the pregnancy age at risk percentage, percentage of preterm birth, percentage of MUAC <23,5 cm, percentage parity at risk, food security score, percentage of low education, and percentage of poverty (p=0,046, p=0,025, p=0,039, p=0,042, and 0,044; p=0,002). In conclusion, the percentage of preterm births is the primary cause of low birth weight in West Java.

Keywords: Ecological study, food security, low birth weight

Abstrak

Berat badan lahir rendah merupakan masalah yang menyangkut seluruh kepada seluruh siklus kehidupan. Anak-anak yang lahir dengan berat badan lahir rendah sangat rentan terhadap penyakit dan kematian, serta tetap mengalami kekurangan gizi dalam jangka waktu yang panjang. Penelitian ini bertujuan untuk menganalisis faktor-faktor yang berhubungan dengan prevalensi BBLR di Jawa Barat. Desain studi dilakukan secara ekologi dengan menggunakan data sekunder tahun 2022 yang berasal dari kementrian kesehatan, BPS, dan Badan Pangan Nasional. Unit analisis dilakukan terhadap semua kabupaten/kota di Jawa Barat. Variabel terikat dalam penelitian ini adalah prevalensi berat badan lahir rendah. Variabel bebas terdiri dari usia melahirkan beresiko, kelahiran prematur, lingkar lengan atas, paritas, ketahanan pangan, pernikahan dini, pendidikan ibu dan kemiskinan. Uji korelasi Pearson dan Spearman dilakukan untuk menguji hubungan antara masing-masing variabel independen dan prevalensi BBLR. Prevalensi keseluruhan bayi BBLR adalah 20,9%. Terdapat hubungan signifikan antara usia melahirkan beresiko, prematur, LiLA, paritas, ketahanan pangan, pendidikan ibu dan kemiskinan dengan prevalensi BBLR (p=0,046; p=0,025; p=0,039; p=0,042; p=0,044; p=0,002). Kesimpulan dari penelitian ini yaitu persentase kelahiran prematur merupakan faktor risiko paling berpengaruh terhadap kejadian berat badan lahir rendah di Jawa Barat.

Kata Kunci: Berat badan lahir rendah, ketahanan pangan, studi ekologi

Introduction

Nutritional challenges persist throughout life. Poor nutrition often starts in utero and extends to adolescent and adult life, particularly for girls and women. It also spans several generations. Undernutrition experienced during childhood, adolescence, and pregnancy has a cumulative negative effect on the birth weight infants (Marshall et al., 2022). Low Birth Weight is defined as a birth weight of less than 2,500 grams and is a global public health issue associated with both short-term and long-term complications (WHO, 2024).

Infants with LBW experience intrauterine growth retardation (IUGR), while women are born malnourished and face a significantly increased risk of mortality during the neonatal period or in later stages of infancy. If they survive, they are unlikely to significantly catch up on this lost growth and are more likely to experience a variety of developmental deficits. Therefore, infants with low birth weight are at a higher risk of being underweight or experiencing stunting during early development. The repercussions of undernourishment persist into adulthood. Epidemiological studies from both developing and industrialized nations increasingly indicate a correlation between fetal undernutrition and a heightened risk of various chronic diseases in adulthood (Bianchi & Restrepo, 2022).

In the Asian region, the prevalence of LBW is reported at 17,3%, whereas in Southeast Asia, it varies between 7% and 21% (WHO, 2014). According to the World Health Assembly Resolution, the World Health Organization (WH) has set a target to reduce the incidence of LBW by 30% by 2025, acknowledging that an estimated 15-20% of the 20 million births worldwide each year involve LBW. The risk of LBW is higher in developing countries, including Indonesia (Mediani, 2020).

Birth weight is one of the most critical determinants of infant survival, growth, and future development. Risk factors associated with the incidence of LBW include the family's socioeconomic characteristics and the mother's health history. Socioeconomic factors are related to the mother's education, type of residence, family size, and economic status (Al Rahmad et al., 2024; Utami & Wulandari, 2020). LBW is a birth outcome indicator with a long-term impact and is a significant risk factor associated with maternal and infant mortality. LBW is more prevalent among infants born to young mothers under the age of 20 (Falcão et al., 2020; Trerotoli et al., 2020) Pregnancy in mothers under the age of 20 carries a higher risk of complications such as preeclampsia (high blood pressure during pregnancy), eclampsia (seizures during pregnancy), and infections. These conditions significantly increase the likelihood of preterm birth and delivering a LBW baby (WHO, 2023).

This situation is also linked to rising rates of early marriage. The impact of early marriage includes adolescent pregnancies, which are high-risk owing to the physical and emotional immaturity of young mothers. The risks for pregnant adolescents include miscarriage, pregnancy-related anemia, bleeding, inadequate nutrition, and maternal mortality. For the infants, risks include preterm birth, LBW, congenital abnormalities, infections, and infant mortality (Letari & Fitrianti, 2017).

Food security is a condition where sufficient food is available for every person at all times, and each individual has access to it, both physically and economically (BKP, 2021). Food insecurity, the major predictor of LBW associated with poor-quality dietary intake and decreased nutritional status among women, and poor nutritional status in pregnancy and pre-pregnancy, is linked to poor birth outcomes (Desalegn et al., 2021).

The prevalence of LBW in Indonesia increased from 11,37% in 2020 to 12,72% in 2021 (MoH, 2021). West Java is among the provinces with a rising trend in LBW cases, with rates increasing from 6,3% in 2018 to 11,96% in 2021 (Dinas Kesehatan Jawa Barat, 2018, 2021). West Java has a population exceeding 48 million, and its high birth rate significantly contributes to the incidence of LBW among infants. Various factors, including limited access to quality healthcare, insufficient awareness regarding prenatal nutrition, and socioeconomic challenges, further exacerbate this issue. The rising prevalence of LBW presents substantial risks for long-term health outcomes, including stunting and chronic diseases (Arsyi, 2021). Consequently, West Java has been prioritized in accelerated stunting reduction programs in Indonesia.

Disparities between regions in West Java at the district/city level require specific interventions, particularly in areas with a high prevalence of LBW. Ecological study is a type of

research design that focuses on population characteristics. This study incorporated spatial mapping to examine the prevalence of LBW and its related factors across different regions in West Java. This mapping technique helps identify geographic patterns and essential for health policy markers to increase attention to low birth weight causes (Rahman et al., 2023).

Although numerous studies have explored LBW at the individual level, research at the macro level in Indonesia remains limited. Most existing studies have predominantly focused on personal and household factors, creating a gap in understanding the broader systemic determinants of LBW (Tarigan et al., 2023). This research is important because it highlights the need for more comprehensive investigations that consider larger-scale influences on LBW. Expanding the research to include macro-level factors could provide a more holistic understanding of LBW in the Indonesian context. This study aimed to determine the prevalence of LBW in West Java and identify risk factors associated with LBW. These findings will inform the design of targeted interventions to prevent perinatal issues related to LBW, thereby improving maternal and child health outcomes in the region.

Methods

This study was conducted using a quantitative method and ecological analysis approach. Ecological studies focus on comparisons between groups rather than between individuals. The data analyzed is aggregate data at a certain group or level, which in this study is the district level (Laksono & Kusrini, 2020).

This research utilized secondary data collected from published studies or reports, including the Indonesian Nutrition Status Survey 2022 by the Ministry of Health of the Republic of Indonesia, Central Bureau of Statistics Indonesia, and National Food Agency 2022. The sample used in this research consisted of 27 samples, representing the total number of districts/cities in West Java, which included nine cities and 18 regencies.

Low birth weight in this study was categorized as an average provincial prevalence of 20,9%. Regions are categorized as low if the percentage is ≤20,9% and high if the percentage is >20,9%. Independent variables were categorized according to the targets set by the Regional Medium-Term Development Plan and average provincial percentage. Cut-offs were employed in this study to identify areas requiring further attention owing to unmet targets in specific programs. For variables without national or regional targets, the average provincial percentage was used as the cutoff.

Food security was measured using the food security index score, which more accurately reflects the level of food security in a given region. Food security was categorized based on the cutoff point of the composite score. The categorization for regency with low food security is < 75,68, and for cities with a score < 70,64. The aim of this prioritization is to identify districts/cities that are more vulnerable to food and nutrition insecurity, and to measure changes in their status compared to the previous year.

Early marriage is defined as marriage that occurs at an age below 19 years old. The percentage of early marriages is categorized based on the Medium-Term Development Plan target of Indonesia for 2024, which is 8,74%. Areas that have reached the target of ≤8,74% are categorized as low and those that are still more than 8,74% are categorized as high.

The poverty percentage was categorized based on the Regional Medium-Term Development Plan target of West Java for 2023, which is 7,67%. Areas that have reached the target of ≤7,67% are categorized as low and those that are still more than 7,67% are categorized as high.

Spatial analysis through mapping utilizes locational data to pinpoint regions with a high incidence of LBW and determine specific intervention priorities for these areas. This mapping facilitates the visualization of programs that have successfully met their targets in various regions. Mapping was executed using QGIS 3.34.7 software.

Data processing and analyses were performed using Microsoft Excel and SPSS software version 26. Univariate analyses were conducted for each variable to provide an overview of their distribution and proportions within the dataset. Bivariate analyses were subsequently performed to assess the relationship between each independent variable and the prevalence of LBW in West Java.

Correlation tests were also employed: Pearson's correlation for normally distributed data, which measures the strength and direction of a linear relationship; and Spearman's

correlation for non-normally distributed data, which assesses the strength and direction of a monotonic relationship, ensuring the appropriateness of the analysis for different data distributions. An independent variable was considered to have a statistically significant association with LBW prevalence if the p-value was less than 0,05. A positive correlation indicated that an increase in the independent variable was associated with a higher prevalence of LBW, whereas a negative correlation suggested that an increase in the independent variable corresponded to a decrease in LBW prevalence.

Multivariate analysis was conducted using logistic regression to predict the risk factors that most significantly contributed to the occurrence of low-birth-weight infants. Bivariate tests with a p-value <0,25 were followed by multivariate analysis, specifically multiple logistic regression, to analyze the risk factors associated with low birth weight. This approach allowed for a comprehensive examination of multiple variables simultaneously, helping to identify the specific factors that are most strongly associated with the likelihood of low birth weight outcomes.

This study used secondary data obtained from the Indonesian Ministry of Health. The implementation of the 2022 Indonesian Nutritional Status Survey was based on a letter from the Vice President's Secretariat to the Minister of Health (Letter No. B.470/KSNB/SWP/PKM.00/07/2021 dated July 5, 2021, regarding 2022 survey implementation. Additionally, a letter from the Bappenas (Ministry of National Development Planning), No. 030007/PP.03.02/D.5/T/3/2022, dated March 11, 2022, highlighted the urgency of conducting the survey by the Ministry of Health as the primary source of data on stunting and wasting achievements.

Result and Discussion

The results of the descriptive analysis of the low birth weight (LBW) prevalence and risk factors for LBW are presented in Table 1. According to the 2022 Indonesian Nutrition Status Survey, the prevalence of low birth weight (LBW) in Indonesia is 6% (MoH, 2021). The average prevalence of LBW in West Java was 20,9% (Table 1). In Figure 1, 44,4% of the regions are categorized as having a high prevalence of LBW. This indicates that the incidence of LBW in West Java is significantly higher than the national average, and warrants attention from the West Java government, particularly from each district and city leader.

Table 1. The results of descriptive analysis of the low birth weight prevalence, maternal health history and socioeconomic factors, food security and early marriage in West Java Province

Variables	n	Mean ± SD	Median	Min	Max
Low birth weight prevalence (%)	27	20,9 ± 9,92	18,9	2,2	42
Maternal health history					
Percentage of maternal age at risk (%)	27	11,5 ± 3,49	11,5	3,3	19,6
Percentage of preterm birth (%)	27	27,6 ± 6,02	27,2	18,6	39,7
Percentage of MUAC <23,5 cm (%)	27	7,9 ± 2,09	7,6	3,5	12,9
Percentage of parity 1 and ≥4 (%)	27	8,6 ± 1,43	8,9	6,1	10,6
Food security score	27	82,2 ± 5,49	82,4	70,6	93,6
Early marriage (%)	27	19,5 ± 6,08	17,6	9,1	29,9
Socioeconomic					
Percentage of low education (%)	27	49,2 ± 16,49	51,2	20,2	72,9
Percentage of poverty (%)	27	8,7 ± 2,82	8,7	2,5	12,8

Based on the mapping of LBW prevalence, the highest prevalence of LBW was observed in Kuningan Regency (40%), whereas the lowest prevalence was observed in Bekasi City (2,2%). The central to southern regions of West Java tend to have higher LBW cases than the northern and northwestern areas of the province. This suggests disparities in access to healthcare services, maternal nutritional status, and other factors affecting the incidence of LBW in these regions. Kuningan Regency exhibits a high incidence of LBW likely due to its location in the southern region of the province, which, according to the map, has inadequate access to healthcare factors.

According to the mapping of LBW prevalence, the occurrence of LBW was not randomly distributed, but concentrated in specific geographic areas. Regions with a high prevalence of low birth weight were mostly located in the southern and eastern regions. Poverty in these regions tends to be high, which significantly contributes to the incidence of LBW. For instance, the Indramayu and Kuningan regency and Tasikmalaya city are known to have poverty rates that are considerably higher than the provincial average. Factors such as limited access to healthcare services, poor nutritional quality, and low educational attainment further exacerbate poverty in these areas.

High poverty rates make it difficult for families to meet the nutritional needs of pregnant women, a situation compounded by inadequate access to information and healthcare services. Economic constraints also limit access to quality healthcare, thereby increasing health risks for pregnant women. Additionally, ecological aspects such as environmental degradation and a lack of sustainable agricultural practices further exacerbate food insecurity, making it even more challenging for families to provide adequate nutrition for expectant mothers.

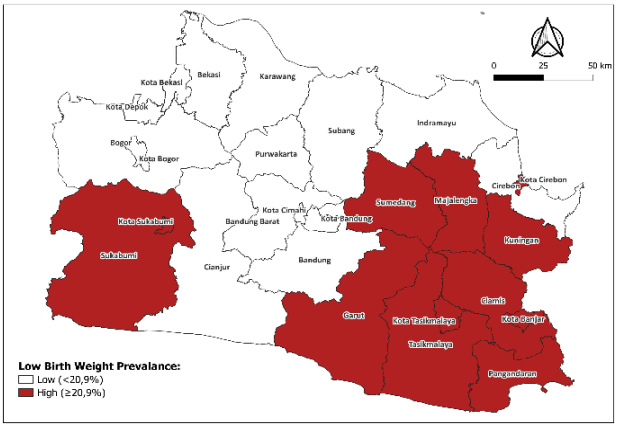

Figure 1. Distribution of LBW in West Java 2022

One of the challenges in addressing nutritional issues is the diversity of regional conditions. These variations lead to differences in nutritional adequacy across regions, resulting in disparities in nutritional status between urban and rural areas, and varying access to quality healthcare services for impoverished populations in remote areas. Economic factors, along with insufficient public awareness regarding proper nutrition, contribute significantly to the worsening prevalence of nutritional issues within the population (Siddiqui et al., 2020).

The persistently high incidence of LBW in certain areas of West Java may be associated with developmental disparities, particularly in the healthcare infrastructure, which hinders access to maternal and child health services. Prior research has demonstrated that regions with underdeveloped healthcare infrastructure are frequently linked to health challenges, including LBW, due to insufficient prenatal care, poor maternal nutrition, inadequate health education, and poverty (Faruqi et al., 2015).

The maternal age at risk for delivering LBW babies includes mothers under the age of 20 and over the age of 35 (Rizkika et al., 2023). The average percentage of high-risk pregnant women in West Java was 11,5%. The region with the highest percentage is Sukabumi Regency (19,6%), whereas the region with the lowest percentage is Depok City (3,29%).

Preterm is defined as babies born alive before 37 weeks of pregnancy are completed (WHO, 2023). The average preterm birth rate in West Java is 27,6%. The region with the highest percentage was Cirebon City (39,7%), while the region with the lowest percentage was Bogor City (18,6%).

Maternal Upper arm circumference (MUAC) is an anthropometric measure that reflects the nutritional status of pregnant women, and is used to assess the risk of Chronic Energy Deficiency (CED) during pregnancy. A measurement of less than 23,5 cm indicates a risk. The average percentage of pregnant women with a MUAC of less than 23,5 cm in West Java was 7,9%. The region with the highest percentage is Banjar (12,9%), while the region with the lowest percentage is Bekasi (3,45%).

Parity refers to the number of pregnancies experienced by a woman. Parity is considered high-risk if the woman experiences her first birth or has a high parity (more than four pregnancies). The average percentage of high-risk parities in West Java is 8,6%. The region with the highest percentage is Sukabumi City (10,6%), whereas the region with the lowest percentage is Pangandaran Regency (6,09%).

Food security across districts and cities in West Java was measured using the Food Security Index (FSI). The FSI is a composite score derived from various indicators that reflect the food security status of a region and can indicate achievements in food security and nutrition

within that area. The region with the highest score was Bekasi City (93,55), while the region with the lowest score was Bogor Regency (70,57).

The average number of early marriages in West Java was 19,5%. All regions experienced a high percentage (100%) of early marriages compared to the target set in the 2020-2024 National Medium-Term Development Plan (RPJMN), which is 6,92%. The region with the highest percentage is Garut Regency (29,9%), whereas the region with the lowest percentage is Cimahi City (9,16%).

Maternal education is categorized as low if the mother has less than 9 years of schooling (Angkasa & Nadiyah, 2019). The average percentage of mothers with low educational levels in West Java was 49,2%. The region with the highest percentage is Cianjur Regency (72,9%), whereas the region with the lowest percentage is Bekasi City (20,2%).

The poverty percentage in West Java was 8,7%. The Indramayu Regency (12,8 %) is the region with the highest poverty percentage. The region with the lowest percentage was Depok (2,53%). Poverty is a significant determinant of ill health and a barrier to accessing necessary healthcare services. The impact of poverty extends beyond financial constraints, encompassing other factors such as limited access to information about health-promoting behaviors and a lack of representation or advocacy needed to ensure effective delivery of social services (World Bank Group, 2014).

Table 2. The result analysis of the association between independent variables and low birth weight prevalence

Variables	Low Birth Weight Prevalence				p-value	r
	High		Low			
	n	%	n	%		
Percentage of maternal age at risk						
Low	7	58,3	6	40	0,046*	0,387
High	5	41,7	9	60		
Percentage of preterm birth						
Low	6	50	9	60	0,025*	0,430
High	6	50	6	40		
Percentage of MUAC <23,5						
Low	8	66,7	9	60	0,039*	0,400
High	4	33,3	6	40		
Percentage of parity 1 and ≥4						
Low	7	58,3	5	33,3	0,042*	0,395
High	5	41,7	10	66,7		
Food security						
Low	5	41,7	2	13,3	0,042*	-0,379
High	7	58,3	13	86,7		
Early marriage						
Low	0	0	0	0	0,843	0,040
High	12	100	15	100		
Percentage of low maternal education						
Low	2	16,7	10	66,7	0,044*	0,390
High	10	83,3	5	33,3		
Percentage of poverty						
Low	2	16,7	7	46,7	0,002*	0,572
High	10	83,6	8	53,5		

Table 2 shows the results of the analysis of the association between the independent variables and LBW prevalence. Pregnant women under the age of 20 and over 35 years have a high risk of delivering LBW babies (Fajriana & Buanasita, 2018). Pregnant women aged ≥ 35 years have a higher likelihood of experiencing preterm birth, hypertension, superimposed preeclampsia, and severe preeclampsia, while their risk of developing chorioamnionitis is

reduced. Women aged 40 years and above are at an increased risk for mild preeclampsia, fetal distress, and impaired fetal growth (Cavazos-Rehg et al., 2015).

Table 2 shows that the age of the pregnant women at high risk was significantly positively associated with LBW incidence (p<0,05). This positive correlation indicates that as the number of high-risk pregnant women increases, the prevalence of LBW also increases. This is evident from Figure 2, which shows that 58,3% of the areas with a high prevalence of LBW had a low percentage of high-risk pregnant women. Additionally, 9 of 14 areas with a high percentage of high-risk pregnant women had a low prevalence of LBW. All regions with a high percentage of high-risk pregnant women also had a high prevalence of LBW. The study also found that the percentage of high-risk maternal age was highest in district areas. This finding aligns with previous research showing a significant positive relationship between maternal age at childbirth and LBW incidence (Tarigan et al., 2023).

Regions with a high prevalence of at-risk pregnancies are typically influenced by factors such as early marriage, limited education, restricted access to reproductive healthcare, insufficient awareness of age-related pregnancy risks, and elevated poverty levels, which collectively contribute to the high incidence of maternal risk.

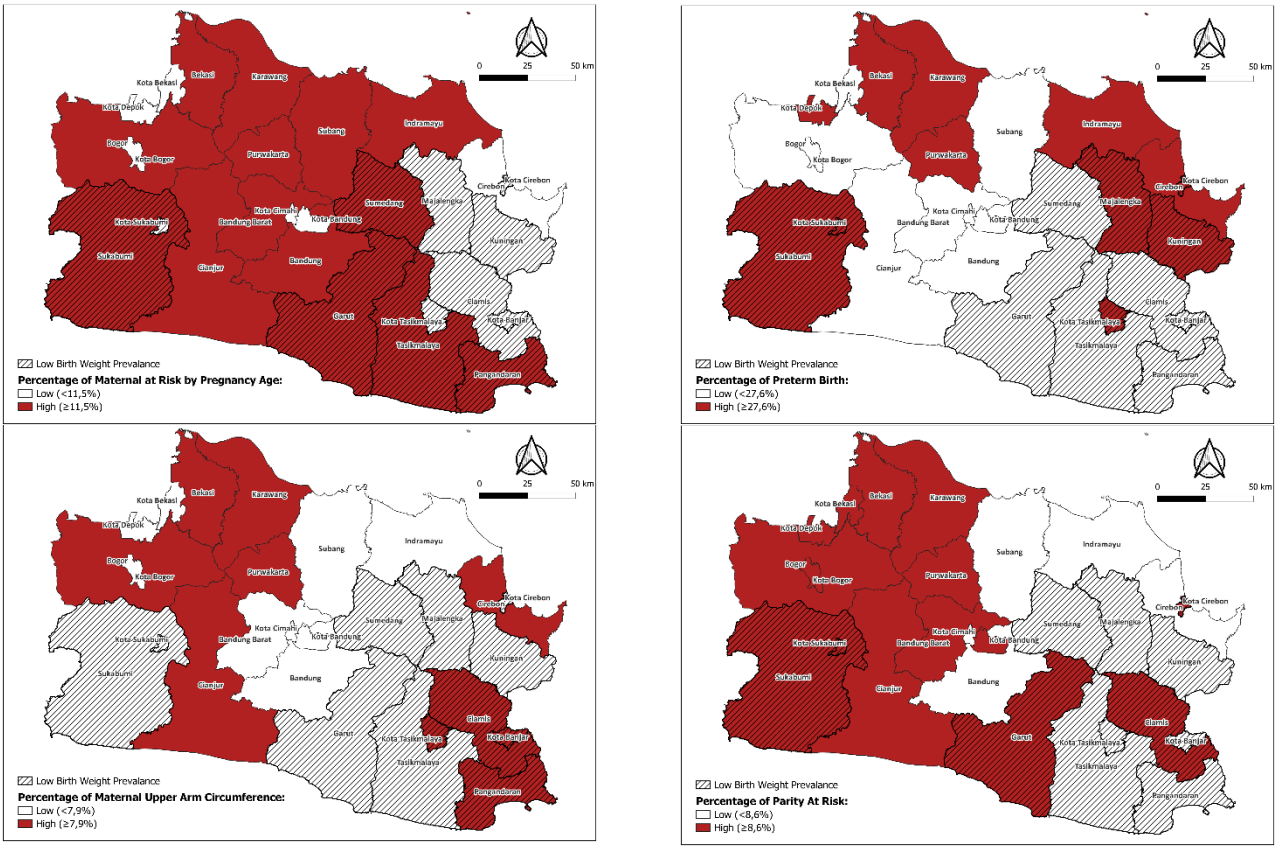

Figure 2. Distribution of maternal health history with LBW prevalence in West Java 2022

LBW is commonly caused by premature birth, defined as birth before 37 weeks of gestation. Premature infants have less time in their mother's womb to develop and gain weight, as significant weight gain occurs during the final weeks of pregnancy. The results of this study showed a significant positive relationship between premature birth and LBW incidence (P <0,05). The positive correlation indicated that as the percentage of premature births increased, the prevalence of LBW also increased.

This can be observed in Figure 2, where 60% of the areas with a low percentage of premature births also had a low prevalence of LBW. This finding is consistent with a study conducted in India, where approximately 12-18% of premature babies had low birth weight (Jana, 2023). Poor mother nutrition during

gestation increases the risk of preterm birth, resulting in an undernutrition infant (Aryastami et al., 2017).

Maternal Upper arm circumference (MUAC) less than 23,5 cm was significantly positively associated with the incidence of LBW (p<0,05). The positive direction indicates that

As the percentage of mothers with UAC less than 23,5 cm increases, the prevalence of LBW also increased. This finding is consistent with a study conducted in Ethiopia, which also showed a significant relationship between chronic energy deficiency (CED) (<23,5 cm) and LBW incidence (Addila et al., 2021).

The study found that most areas with a lower percentage of MUAC less than 23,5 cm, compared than the provincial average had a low prevalence of LBW. This is evident from Figure 2, which shows that 9 of 17 areas with a lower percentage of UAC had a low prevalence of LBW. In this study, the proportion of pregnant women at risk of CED in West Java was 7,9%, whereas of that the 2022 target was 10%. This achievement indicates that the target for pregnant women at risk for CED has exceeded the 2022 Ministry of Health's Strategic Plan target.

Parity was significantly associated with the prevalence of LBW (p<0,05). A parity of less than 1 is considered a risk factor because the mother lacks experience in pregnancy, including in baby care and nutritional intake (Sembiring et al., 2019). On the other hand, high parity (≥4 children) is linked to an increased risk of hypertension, placenta previa, and uterine rupture (Rahfiludin & Dharmawan, 2020). All regions with high parity also had high rates of LBW. Additionally, 58,3% of the regions with low parity experienced high rates of LBW.

Food security score had a significant negative relationship with the prevalence of LBW (p<0,05). This finding aligns with Chowdhury et al., (2018), which states that mothers from food-insecure households have a 38% higher chance of having a small-sized baby compared to mothers from food-secure households. Food-insecure households place additional stress on pregnant women and are three times more likely to experience symptoms of depression than women from food-secure households.

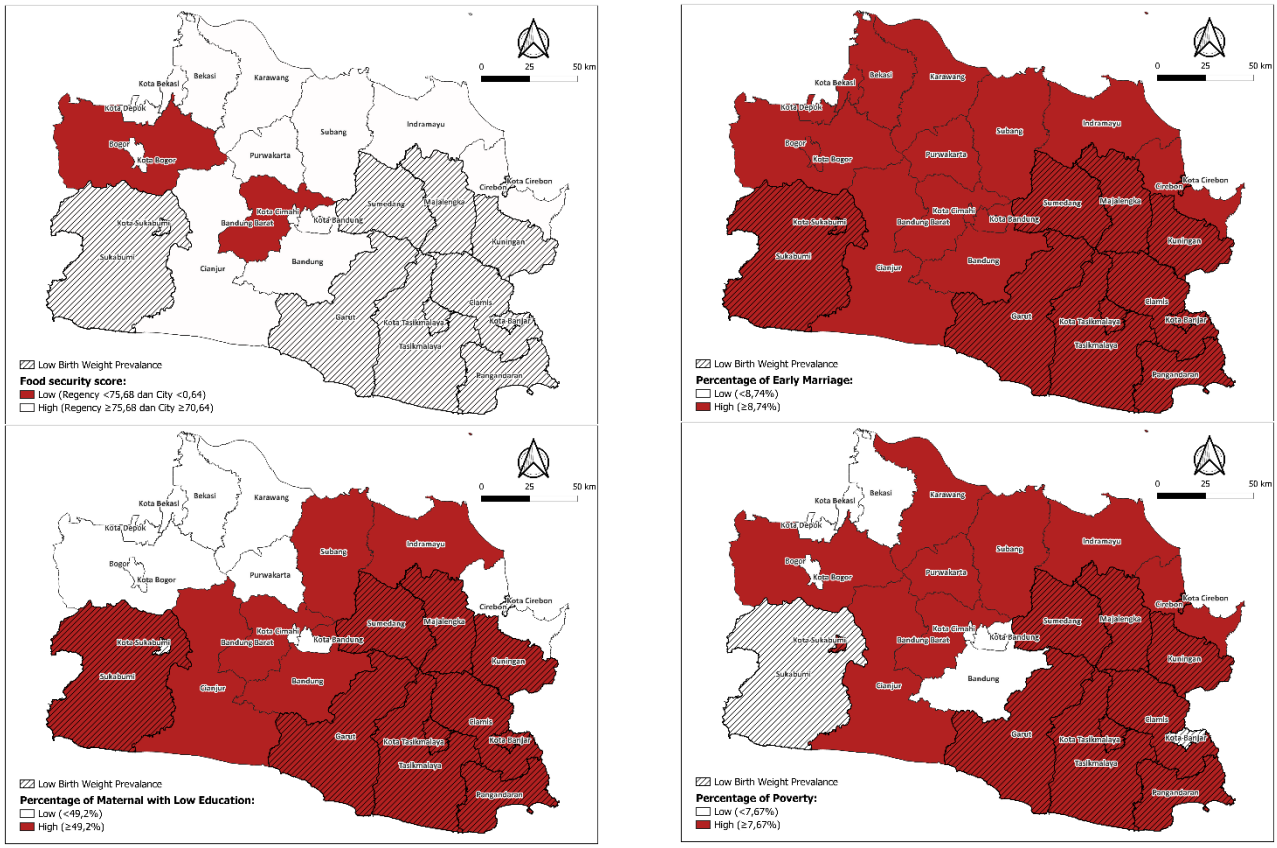

Figure 3. Distribution of food security score, early marriage and socioeconomic factors with LBW prevalence in West Java 2022

Figure 3 shows that most regions in West Java are food secure, and there are still five regions with low food security scores that have a high prevalence of LBW. Furthermore, 86,7% of regions with high food security scores had a low prevalence of LBW. This means that there is a negative relationship between food security scores and the prevalence of LBW. This indicates that higher food security scores in a region are associated with a lower LBW prevalence.

Food security issues in West Java have become a focus of both central and local governments, particularly given the province's agrarian potential. Local governments have been working to address food security by implementing various policies, including the issuance of Governor Regulation No. 112 of 2020 on the Food Plan for West Java Province for 2020-2024.

Statistical analysis showed that early marriage did not have a significant relationship with LBW prevalence ($p>0,05$). Figure 2 indicates that all the regions had a high percentage of early marriages (100%). Furthermore, 44,4% of these regions had a high prevalence of LBW. This finding contrasts with studies by Lestari & Fitrianti, (2017) and Maulinda et al., (2021), which suggest that early marriage is a contributing factor to LBW.

In this study, early marriage was not identified as the primary factor contributing to LBW in West Java. Human development is closely linked to improvement in educational quality. Average Length of Schooling (RLS) and Expected Length of Schooling (HLS) are indicators of educational knowledge. According to data from West Java, these indicators have been consistently increasing each year, with RLS reaching 102,09% and HLS reaching 100,63% in 2022 (Dinas Pendidikan Jawa Barat, 2022). Early marriage among adolescents does not directly lead to LBW because the prospective mothers typically have acquired knowledge to prepare for their pregnancies.

Statistical analysis showed that low maternal education level was significantly positively associated with the prevalence of LBW ($p<0,05$). This finding aligns with the study by Tessema et al., (2021), which states that higher levels of education in women are associated with a reduction in LBW, compared to women with low or no education. Literacy is often linked to better nutritional knowledge and practices as well as behaviors related to seeking information about nutrition during pregnancy, which can influence birth outcomes.

Figure 3 shows that 83,3% of the areas with low maternal education had a high prevalence of LBW, and 10 out of 12 areas with low maternal education also had low LBW prevalence, indicating a positive relationship between the percentage of low maternal education and LBW prevalence. The uneven quality of education in West Java is attributed to significant disparities between rural and urban areas, as seen in the differing educational infrastructure.

In 2020, the average length of schooling in West Java was 8,55 years, equivalent to completing the eighth grade. However, this achievement falls short of the government's target for a 12-year compulsory education program. The Regional Medium-Term Development Plan (RPJMD) also prioritizes the completion of the 12-year compulsory education program during the 2018-2023 period. Generally, education levels correlate with nutritional knowledge, and higher education levels are positively associated with more diverse food consumption (Makate & Nyamuranga, 2023). Poverty was defined as the average per capita monthly expenditure below the poverty line. Statistical analysis showed that the percentage of poverty was significantly positively associated with the prevalence of LBW ($p<0,05$). The relationship between these two variables has a strong and positive correlation ($r = -0,572$), meaning that as the percentage of poverty increases, the prevalence of low birth weight (LBW) also increases. This finding is consistent with the research by Manyeh et al., (2016), which identifies poverty as a significant factor contributing to LBW.

Poverty reflects socioeconomic status, which indirectly leads to risk factors that affect the survival of mothers and newborns. Communities with a low economic status often have limited access to information and health services. LBW can result from poor maternal nutrition among women with lower socioeconomic status (Fosu et al., 2013; Shrivastava & Shrivastava, 2013).

This study found that most regions with a poverty percentage lower than The Regional Medium-Term Development Plan (RPJMD) target have a low prevalence of LBW. As shown in Figure 5, 10 out of the 12 regions with lower poverty percentages also had a low prevalence of LBW. Furthermore, a deeper analysis of regions with high LBW prevalence revealed that

the average poverty percentage in high-LBW areas (83,6%) was higher than that in areas with low poverty percentages (53,5%). This indicates a positive relationship between the poverty percentage and LBW prevalence.

From 2015 to 2019, poverty decreased in West Java. However, in 2020, the situation worsened owing to the prolonged COVID-19 pandemic. Poverty is more prevalent in rural areas than in urban ones. Rural poverty is attributed to limited access to basic services, economic opportunities, infrastructure, and lifestyle pattern.

Table 3. Multivariate analysis of selected factors with low birth weight

Variables	p-value	OR (95% CI)
Percentage of preterm birth	0,049*	1,251 (0,974 – 1,607)
Percentage of parity 1 and ≥4	0,025*	0,268 (0,085 – 0,838)

*significant (p<0,05)

As shown in Table 3, preterm birth was found to be a risk factor for low birth weight (OR: 1,251, 95% CI: 0,974–1,607), meaning that mothers who gave birth prematurely were almost 1,25 times more likely to deliver a low birth weight baby. This finding is supported by several other studies, including one conducted by Sutan et al., (2014) in Malaysia, which also identified preterm birth as a risk factor for low birth weight. During the first trimester, organ systems, such as the heart, liver, kidneys, brain, and nerves, begin to form. In the second trimester, growth in length and weight began. In the third trimester, the baby starts to move, and the growth in length and weight gain continues. Biologically, as gestational age increases, fetal growth and development also improve. Therefore, if a baby is born before the optimal gestational age (37–42 weeks), its length and weight may not have reached their maximum potential (WHO, 2023).

A high percentage of parity served as a protective factor against the increased prevalence of LBW (OR, 0,268; 95% CI, 0,085–0,838). Thus, regions with a high parity percentage have a 73,2% chance of avoiding high LBW rates. This indicates that non-risky parity does not necessarily mean that offspring will not experience LBW. This may occur if regions with a high percentage of mothers with high parity also have high food security scores. Food-insecure areas are a major predictor of LBW and are associated with poor dietary quality and decreased nutritional status in women, particularly poor nutritional status during pregnancy. If this is not properly addressed, such as by ensuring adequate nutritional intake for pregnant women, it may result in the birth of low birth weight babies (UN ACC/SCN & IFPRI, 2000).

A study by Kaur et al., (2019) on pregnant women in rural Malaysia reported that low parity is associated with a reduced prevalence of LBW. Women who have given birth four or more times may experience impaired uterine function, particularly in terms of blood vessel function, due to excessively high parity. Repeated pregnancies can cause damage to the uterine blood vessel walls, affecting nutrient delivery to the fetus in subsequent pregnancies and potentially leading to growth disturbances, which may result in LBW. Based on the data and theories mentioned above, parity and LBW are related because the reproductive organs in primiparous women (parity 1) are not yet fully prepared to sustain and accommodate pregnancy, while in women with parity ≥4, the reproductive organ function declines, contributing to LBW (Wiknjosastro, 2002).

This study had several limitations. The dependence on secondary data means that not all macro factors affecting the prevalence of LBW can be explored, owing to limited data availability. Future ecological studies should focus on using more up-to-date and comprehensive data to investigate the relationship between macro factors and LBW prevalence. Future longitudinal studies should be conducted to better understand the connections between these factors and the prevalence of LBW.

Conclusion

Bivariate analysis results indicated that maternal age at risk percentage, percentage of preterm birth, percentage of MUAC <23,5 cm, percentage parity at risk, food security score, percentage of maternal low education, and percentage of poverty are associated with LBW. Logistic regression analysis identified that the preterm birth percentage has a significant impact increased the risk of low birth weight in West Java

Based on this study, interventions are needed to improve healthcare access for pregnant women, strengthen education on reproductive health and nutrition, alleviate poverty through economic support, and foster collaboration between the health, education, and social welfare sectors to prevent low birth weight and pregnancy complications. Future research should focus on individual-level studies and explore the maternal health and healthcare access factors affecting LBW.

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