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ANALYSIS OF DETERMINANT FACTORS OF LOW BIRTH WEIGHT (LBW) INCIDENCE

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ABSTRACT

Low Birth Weight (LBW) is a public health indicator that reflects the maternal nutritional status, pregnancy health, and the quality of maternal health services. LBW increases the risk of infant death, neonatal morbidity, growth disorders, and chronic diseases later in life. In the city of Depok, the prevalence of LBW has increased over the past three years despite relatively good access to services, indicating complex determining factors. This study aims to analyze the determinant factors of LBW incidence. The research used a mixed methods design, with the quantitative phase conducted using a casecontrol design on mothers who gave birth to low birth weight babies and babies with normal birth weight. Quantitative data were collected through questionnaires and analyzed using logistic regression, quantitative data collection was a questionnaire that had undergone validity and reliability testing, with a Cronbach's Alpha value of 0.946.. The qualitative phase was conducted using Convergent Parallel through in-depth interviews with mothers, families, and healthcare workers. Qualitative analysis used Braun & Clarke's thematic analysis technique. Quantitative findings showed that low maternal education, low economic status, at-risk maternal age, high parity, short birth spacing, inadequate weight gain, suboptimal antenatal visits, and pregnancy-related medical risks were significantly associated with LBW ($p < 0.05$). Maternal education was identified as the most dominant factor. Qualitative results revealed that low health literacy, limited family support, and barriers to accessing information contributed to LBW incidence. Low birth weight in infants is influenced by the interaction of maternal, socioeconomic, and environmental factors.

Keywords: determinant factor; low birth weight; pregnancy

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INTRODUCTION

Low Birth Weight (LBW) is an important indicator in public health as it reflects maternal nutritional status during pregnancy and the quality of maternal healthcare services received. Globally, LBW remains a serious issue, with an estimated one in seven infants born with low birth weight (Krasevec et al., 2022). The prevalence of this condition is still relatively high in Southeast Asia, including Indonesia (Erasun et al., 2021). In Indonesia, the prevalence of LBW in 2023 was recorded at 3.9%, making it one of the major contributors to morbidity and mortality in the neonatal period (Kementerian Kesehatan, 2024; Wulandari et al., 2022). The high incidence of LBW is generally associated with complex interactions between maternal biological factors, fetal conditions, and environmental and socioeconomic influences that contribute to intrauterine growth restriction (Arabzadeh et al., 2024; Shaohua et al., 2022).

In Depok City, the phenomenon of LBW shows a concerning trend. Despite relatively good access to healthcare services, the incidence of LBW has increased over the past three years. Data indicate an increase from 273 infants (0.65%) in 2021 to 350 infants (1.10%) in 2024 (Dinas Kesehatan Kota Depok, 2024). The Depok City Hospital, as the main referral facility, handles a large proportion of these cases. This situation highlights the need for more in-depth studies to identify determinant factors that consistently contribute to LBW, so that interventions can be more effective and targeted.

Previous studies have shown that the determinants of LBW are multifactorial, including maternal age at risk, education level, economic status, and adherence to Antenatal Care (ANC) visits (Islam et al., 2024; Kassie et al., 2025; Arsyi et al., 2022). However, quantitative approaches alone are often insufficient to fully capture the social and cultural aspects influencing maternal health behaviors, such as food taboos or psychological pressures within the family environment (Tsegaye et al., 2021; Dadi et al., 2020). Therefore, this study applies a mixed methods approach to integrate statistical analysis with an in-depth exploration of maternal experiences through qualitative methods.

This study aims to comprehensively analyze the determinant factors of LBW at Depok City Hospital in 2025. Specifically, it focuses on identifying dominant medical and sociodemographic risk factors, as well as exploring the accumulation of vulnerabilities experienced by mothers during pregnancy through in-depth interviews. The findings are expected to contribute scientifically to the development of maternal health programs, particularly in strengthening preconception education and early detection of LBW risk in healthcare facilities.

METHOD

This study applied a mixed methods design with a convergent parallel approach, in which quantitative and qualitative data were collected and analyzed simultaneously, and the results were then compared and integrated through a triangulation process. Furthermore, the results from both approaches were integrated to provide a comprehensive understanding of the determinants of low birth weight (LBW). This study was conducted at Khidmat Sehat Afiat (KiSA) Regional General Hospital, Depok City. In the quantitative phase, a total of 212 respondents were included, divided into two groups: 106 respondents as the case group and 106 respondents as the control group. The case group consisted of all mothers who delivered low birth weight (LBW) infants at Depok City Regional General Hospital in 2025 and met the study's inclusion criteria, using a total sampling technique. Meanwhile, the control group (mothers who delivered infants with normal birth weight) was selected using stratified systematic random sampling, where the control population was grouped based on the month of delivery, and samples were then selected systematically using an interval value (k = 4) from each medical record unit until the required quota for each monthly stratum was fulfilled. In the qualitative phase, the study involved 17 informants selected using a snowball sampling technique, consisting of mothers, family members, and healthcare professionals such as midwives and nutritionists. Qualitative data analysis was conducted using thematic analysis based on Braun and Clarke, starting from the coding process to the identification of main themes. The instrument used for quantitative data collection was a questionnaire that had undergone validity and reliability testing, with a Cronbach's Alpha value of 0.946. Quantitative data analysis included univariate analysis to describe frequency distributions, bivariate analysis using the Chi-Square test, and multivariate analysis using logistic regression with the enter method to identify the most dominant factors. This study was submitted for approval to the research ethics committee to ensure that all research procedures were conducted in accordance with applicable ethical guidelines and standards. The ethics committee is responsible for reviewing and ensuring that the study is carried out using appropriate methods and is safe for all participants. This study obtained ethical approval from Universitas Nasional with ethical clearance number No. 116/e-KEPK/FIKES/XI/2025.

RESULT

Responden Characters

Univariate analysis aims to describe the frequency distribution of the variables in the study. The dependent variable in this study is the incidence of low birth weight (LBW), which consists of the LBW group (106 cases) and the non-LBW group (106 controls).

Table 1.
Frequency Distribution of LBW (n=212)

BBLR	f	%
LBW	106	51.0
Non LBW	106	50.0

Table 2.
Frequency Distribution of Case and Control Groups Based on Independent Variables (n=212)

Respondent Characteristics	Control Group		Case Group	
	f	%	f	%
Economic Status				
High	57	53,8	25	23,6
Low	49	46,2	81	76,4
Maternal Education Level				
High	42	39,6	11	10,4
Middle	51	48,1	43	40,6
Low	13	12,3	52	49,1
Occupation				
Unemployed	55	51,9	38	35,8
Employed	51	48,1	68	64,2
Access to Health Services				
Easy	106	100,0	105	99,1
Difficult	0	0,0	1	0,9
Maternal Age				
Not at risk	72	67,9	40	37,7
At risk	34	32,1	66	62,3
Marital Status				
Married	106	100,0	106	100,0
Parity				
2-4 children	66	62,3	51	48,1
1 or > 4 Children	40	37,7	55	51,9
Birth Spacing				
>2 years	66	62,3	47	44,3
<2 years	40	37,7	59	55,7
Gestational Weight Gain				
> 10 Kg	68	64,2	40	37,7
< 10 kg	38	35,8	66	62,3
Antenatal Care Visits				
Standard	78	73,6	43	40,6
Not standard	28	26,4	63	59,4
Pre-pregnancy Medical Risk				
None	77	72,6	40	37,7
Present	29	27,4	66	62,3
Pregnancy Medical Risk				
None	67	63,2	23	21,7
Present	39	36,8	83	78,3
Caffeine Consumption				
No	63	59,4	49	46,2
Yes	43	40,6	57	53,8
Exposure to Cigarette Smoke				
Not exposed	42	39,6	29	27,4
Exposed	64	60,4	77	72,6
Alcohol Consumption				
No	106	100,0	99	93,4
Yes	0	0,0	7	6,6
Drug Use				
No	106	100,0	106	100,0
Yes	0	0,0	0	0,0
Food Taboos				
No	76	71,7	65	61,3
Yes	30	28,3	41	38,7

Table 2, the LBW case group was predominantly characterized by low socioeconomic and educational status, despite having easy healthcare access. Significant maternal risk factors included high-risk age and parity, short birth spacing, inadequate gestational weight gain, sub-standard antenatal care, and both pre-existing and pregnancy-related medical risks. Furthermore, these mothers experienced higher exposure to environmental risks, notably secondhand smoke (72.6%) and caffeine consumption (53.8%), with minor alcohol use and no drug use reported.

Table 3.
Association Between Independent Variables and LBW

Variabel	BBLR						OR (95% CI)	P value
	Tidak BBLR (n=106)		BBLR (n=106)		Total			
	f	%	f	%	f	%		
Economic Status								
High	57	53,8	25	23,6	82	38,7	3,769	0.000
Low	49	46,2	81	76,4	178	61,3	(2,09 – 6,7)	
Maternal Education Level								
High	42	39,6	11	10,4	53	25,0	-	
Middle	51	48,1	43	40,6	94	44,3		0,000
Low	13	12,3	52	49,1	65	30,7		
Occupation								
Unemployed	55	51,9	38	35,8	93	43,9	1,930	0,027
Employed	51	48,1	68	54,2	119	56,1	(1,1 -3,3)	
Access to Health Services								
Easy	106	100,0	105	99,1	211	99,5	0,498	1.000
Difficult	0	0.0	1	0,9	1	0,5	(0,435 – 0,570)	
Maternal Age								
Not at risk	72	67,9	40	37,7	112	52,8	3,494	0,000
At risk	34	32,1	66	62,3	100	47,2	(1,9 – 6,1)	
Parity								
2-4 children	66	62,3	51	48,1	117	55,2	1,779	0,038
1 or > 4 Children	40	37,7	55	51,9	95	44,8	(1– 3)	
Birth Spacing								
>2 years	66	62,3	47	44,3	113	53,3	2,071	0,013
<2 years	40	37,7	59	55,7	99	46,7	(1,1 – 3,5)	
Gestational Weight Gain								
> 10 Kg	68	64,2	40	37,7	108	50,9	2.953	0,000
< 10 kg	38	35,8	66	62,3	104	49,1	(1,6 – 5,1)	
Antenatal Care Visits								
Standard	78	73,6	43	40,6	121	57,1	4,081	0,000
Not standard	28	26,4	63	59,4	91	42,9	(2,2 – 7,2)	
Pre-pregnancy Medical Risk								
None	77	72,6	40	37,7	117	55,2	4,381	0,000
Present	29	27,4	66	62,3	95	44,8	(2,4 – 7,8)	
Pregnancy Medical Risk								
None	67	63,2	23	21.7	90	42,5	6,200	0,000
Present	39	36,8	83	78.3	122	57,5	(3,3 – 11,3)	
Caffeine Consumption								
No	63	59,4	49	46,2	112	52,8	1,7	0,074
Yes	43	40,6	57	53,8	100	47,2	(0,9 – 2,9)	
Exposure to Cigarette Smoke								
Not exposed	42	39,6	29	27,4	71	33,5	1.742	0,081
Exposed	64	60,4	77	72,6	141	66,5	(0,9 – 3,1)	
Alcohol Consumption								
No	106	100,0	99	93,4	205	96,7	-	0,14
Yes	0	0,0	7	6,6	7	3,3		
Drug Use								
No	76	71,7	65	61,3	141	66,5	1,598	0,146
Yes	30	28,3	41	38,7	71	33,5	(0,8 – 2,8)	

Table 3 demonstrates that LBW incidence is significantly associated with low socioeconomic and educational status, maternal employment, and alcohol consumption. Furthermore, all evaluated maternal factors were significant predictors of LBW, including high-risk age and parity, birth spacing under 2 years, inadequate gestational weight gain and ANC visits, as well as pre-pregnancy and gestational medical risks. Conversely, healthcare access, caffeine consumption, smoke exposure, and food taboos showed no significant association with LBW.

Confounding Variable Assessment

Confounding variables were tested by removing them one by one starting from the highest p-value. If the OR changed by ≥10%, the variable was considered a confounder and retained. After selection, caffeine consumption, birth spacing, and smoke exposure were removed (change ≤10%).

Table 4.
Initial Modeling of All Independent Variables

Variable	B	P-Value	OR Value	95% CI
Economic Status	1,115	0,011	3,050	1,295 – 7,180
Maternal Education Level		0,12		
Maternal Education Level (1)	0,992	0,042	2,696	1,038 – 7,003
Maternal Education Level (2)	1,696	0,003	5,452	1,768 – 16,810
Occupation	0,647	0,115	1,909	0,855 – 4,263
Access to Health Services	0,934	0,024	2,545	1,128 – 5,741
Maternal Age	0,469	0,233	1,598	0,740 – 3,451
Marital Status	0,192	0,630	1.212	0,553 – 2,656
Parity	0,655	0,136	1.925	0,813 – 4,560
Birth Spacing	0,969	0,032	2.636	1,089 – 6,380
Gestational Weight Gain	0,817	0,044	2.264	1,024 – 5,009
Antenatal Care Visits	1,158	0,005	3.184	1,410 – 7,188
Pre-pregnancy Medical Risk	0,059	0,886	1.061	0,473 – 2,381
Pregnancy Medical Risk	0,491	0,241	1.635	0,719 – 3,716
Caffeine Consumption	0,586	0,198	1.797	0,736 – 4,389
Exposure to Cigarette Smoke	1,115	0,011	3,050	1,295 – 7,180
Alcohol Consumption		0,12		
Drug Use	0,992	0,042	2,696	1,038 – 7,003
Food Taboos	1,696	0,003	5,452	1,768 – 16,810

After removing confounding variables one by one from the model, caffeine consumption, birth spacing, and exposure to cigarette smoke were excluded. The change in OR values for the remaining variables was ≤10%. Thus, the final model results are as follows:

Table 5.
Final Modeling of Confounding Variables for Determinants of LBW in Depok City, 2025

Variable	B	P-Value	OR Value	95% CI
Economic Status	1,139	0,008	3,050	1,347 – 7,248
Maternal Education Level		0,009		
Maternal Education Level (1)	0,983	0,038	2,696	1,055 – 6,774
Maternal Education Level (2)	1,686	0,002	5,452	1,828 – 15,942
Maternal Age	0,906	0,022	2,545	1,140 – 5,375
Minimum Antental Visits	1,038	0,019	2.636	1,188 – 6,712
Pre-pregnancy Medical Risk	0,820	0,040	2.264	1,037 – 4,970
Pregnancy Medical Risk	1,182	0,004	3.184	1,472 – 7,217
Gestational Weight gain	0,613	0,157	1,846	0,790 – 4,313
Parity	0,547	0,152	1,729	0,817 – 3,657
Food Taboos	0,708	0,108	2,030	0,855 – 4,821
Occupation	0,686	0,090	1,986	0,898 – 4,395

Multivariate analysis revealed that six variables were significantly associated with LBW incidence. Low maternal education emerged as the most dominant determinant, increasing the risk of LBW by 5.4 times. Other significant predictors included pregnancy medical risks, low economic status, inadequate antenatal visits, high-risk maternal age, and pre-pregnancy medical risks. This model

explained 54.4% of the variation in LBW incidence, after controlling for four confounding variables: food taboos, occupation, gestational weight gain, and parity.

Qualitative Results

Qualitative findings identified five themes contributing to LBW incidence: (1) suboptimal preconception readiness marked by chronic diseases, unplanned pregnancies, and lack of early screening; (2) poor pregnancy experiences involving inadequate nutrition, medical complications, and limited family support; (3) high rates of emergency and premature deliveries with complications like PROM; (4) socio-environmental constraints, notably low income and secondhand smoke exposure; and (5) complex barriers to LBW prevention, including cultural food taboos, maternal dual-role fatigue, and limited healthcare education.

DISCUSSION

This study demonstrates that low birth weight (LBW) is a multifactorial outcome influenced by the interaction of socioeconomic, maternal, environmental, and behavioral factors. Among these, maternal education emerged as the most dominant determinant, indicating that cognitive capacity and health literacy play a central role in shaping maternal behaviors and pregnancy outcomes (Wulandari et al., 2022; Islam et al., 2024).

Socioeconomic factors, particularly low maternal education and poor economic status, were significantly associated with increased risk of LBW. Mothers with low education had more than fivefold higher risk of delivering LBW infants, while low economic status increased the risk threefold. These findings suggest that structural inequalities limit access to adequate nutrition, healthcare services, and health-related knowledge (Aslamiah et al., 2024; Supriyatun, 2020). Qualitative findings revealed the phenomenon of "hidden hunger," where mothers consume energy-dense but nutrient-poor foods, leading to insufficient protein and micronutrient intake essential for fetal growth (Martinson & Choi, 2019). Economic hardship also contributes to increased physical workload, further compromising maternal physiological capacity during pregnancy (Arabzadeh et al., 2024a).

Maternal factors were identified as proximal determinants of LBW. Medical complications during pregnancy, such as hypertension, preeclampsia, and anemia, significantly increased the risk of LBW by disrupting uteroplacental circulation and fetal oxygenation (Chung et al., 2022; Amsalu et al., 2023). Inadequate antenatal care (ANC) utilization and high-risk maternal age (<20 or >35 years) further exacerbated these risks (Mita et al., 2022; Kozuki et al., 2024). Many LBW cases were associated with iatrogenic prematurity, where early delivery was required to prevent severe maternal complications. Limited adherence to ANC schedules reflects gaps in early risk detection, consistent with the Health Care Utilization Theory (Pedersen et al., 2013).

Environmental and sociocultural factors also contributed to LBW. Food taboos, particularly restrictions on protein-rich foods such as fish and eggs, reduced maternal nutritional intake during pregnancy (Tsegaye et al., 2021). In addition, exposure to secondhand smoke increased the risk of fetal hypoxia through vasoconstriction and reduced oxygen transport (Setyowati, 2023; Wang et al., 2022). These findings align with Transcultural Nursing Theory, which emphasizes the influence of cultural values and family authority on health behaviors (Leininger).

Multivariate analysis confirmed that maternal education acts as a key upstream determinant linking socioeconomic status, maternal health, and environmental exposure. Higher education enhances problem-solving capacity, health-seeking behavior, and the ability to filter harmful cultural beliefs (Panico et al., 2023; Wulandari et al., 2022). Thus, LBW can be understood as the cumulative result of limited maternal capacity to manage risks throughout pregnancy.

Qualitative findings highlighted that mothers with LBW infants faced complex challenges from preconception to childbirth, including unplanned pregnancies, chronic illness, poor nutrition, psychological stress, and limited family support. Social support, particularly from spouses, plays a protective role in improving maternal outcomes (Afaya et al., 2021; Kassie et al., 2025). Maternal resilience, supported by adequate knowledge and emotional stability, is crucial in coping with these challenges (Zhou et al., 2020; Katufi et al., 2020).

Overall, LBW is not merely a clinical condition but reflects broader social determinants and maternal resilience. Effective prevention requires integrated interventions, including early risk screening, improved ANC quality, maternal education, economic empowerment, and culturally sensitive family-based approaches (Krasevec et al., 2022; Kemenkes RI, 2019).

CONCLUSION

This study confirms that low birth weight (LBW) is a multifactorial outcome driven primarily by low maternal education, which limits a mother's capacity to manage health risks, access care, and adopt positive health behaviors. Beyond education, the likelihood of LBW is significantly compounded by pre-pregnancy and gestational medical risks, low socioeconomic status, and inadequate antenatal care. Qualitative insights further highlight that economic constraints and cultural food taboos critically restrict maternal protein intake. Ultimately, this research answers the study's core question by demonstrating that LBW is not merely a clinical issue, but a consequence of accumulated social, economic, and cultural vulnerabilities.

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