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A History of Low Birth Weight and the Incident of Stunting in Children Under Five

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Abstract

The leading cause of infant mortality in Indonesia was low birth weight at 28.2% in 2022. Children under five years old with a history of low birth weight have a higher risk of experiencing growth delays and non-communicable diseases as adults. This research contributed to determining the relationship between a history of low birth weight and the incidence of stunting in children under five. The research design used a case-control with a retrospective approach using maternal and child health books. The sampling technique in this research was simple random sampling. Samples were taken from 238 children under five years old in Wonosari, Special Region of Yogyakarta, Indonesia. Data analysis used the Somers test which showed that there was a relationship between a history of low birth weight and the incidence of stunting in children under five with p = 0.000, the direction of the relationship was positive, and the strength of the relationship was strong, a score of r = 0.560. The OR = 17.907, which means that children under five years old with a history of low birth weight have a 17.907 times risk of experiencing stunting. Children under five years with low birth weight are at greater risk of stunting than children under five years with normal birth weight.

Keywords: *Low Birth Weight; Stunting; Toddlers*

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1. Introduction

The number of infant mortality in Indonesia was 20,882 infants in 2022 based on the Maternal Perinatal Death Notification (MPDN), Ministry of Health (Kementerian Kesehatan, 2024). The leading cause of 28.2% of infants' mortality in 2022 was low birth weight (LBW). In Indonesia, 3.3% of infants experienced LBW in 2022 (Kementerian Kesehatan, 2023). The prevalence of LBW infants in the Special Region of Yogyakarta in 2022 was 6.4% and 7.2% in Gunungkidul Regency (Dinas Kesehatan DIY, 2022). Gunungkidul Regency is the second-largest prevalence of low birth weight infants after Yogyakarta city.

Infants with low birth weight have a higher risk of experiencing growth retardation, infectious diseases, developmental delays, and mortality during infancy and childhood (World Health Organization, 2020). Low birth weight infants have a greater risk of stunting and developing non-communicable diseases as adults. Infectious diseases in adulthood that may be experienced by LBW infants are diabetes, hypertension, and heart disease (Kementerian Kesehatan, 2023). One of the impacts of low birth weight is Stunting. It is a nutritional status based on the index of Body length according to age (PB/A) or height according to age (TB/A) and has a Z-score value of <-2 SD to -3 SD (Putranto, 2020). Stunting is the first place of the nutritional status trend of toddlers in Indonesia at 21.6% according to data from the Indonesian Nutritional Status Survey (SSGI) in 2022 (Kementerian Kesehatan, 2022c). The prevalence of stunting under five years old in DI Yogyakarta was 16.4% in 2022. The highest prevalence of stunting toddlers in DI Yogyakarta is in Gunungkidul Regency at 23.5%, where this figure is higher than the prevalence in the province and nationally (Dinas Kesehatan DIY, 2023).

Stunting has an impact on the risk of increasing child morbidity and mortality. Stunted children experience suboptimal brain development which will cause slow mental growth and delayed motor development (Kementerian Kesehatan, 2023). According to Mustakim, et al. (2022), stunting is associated with suspected developmental delay among children 1-3 years of age. Nearly half of all mortality in children under 5 is attributable to undernutrition; undernutrition puts children at higher risk of dying from common infections, increases the

frequency and severity of such infections, and delays recovery (UNICEF, 2024).

The research conducted by Murti, et al. (2020) stated that most infants with low birth weight also experience stunting, as many as 23 children under five years old (71.9%). Alba, et al. (2021) stated that there is a significant relationship between a history of low birth weight with the incidence of stunting (p-value = 0.000). The results of the study by Maineny, et al. (2022) showed that low birth weight had a significant relationship with the incidence of stunting in children aged 12-59 months (p-value = 0.001). Research by Febria, et al. (2022) stated that there is a relationship between a history of low birth weight and the incidence of stunting in toddlers (p-value = 0.037). Badjuka (2019) showed that there is a significant relationship between the incidence of low birth weight and the incidence of stunting with a p-value = 0.000.

The results of a previous study conducted by researchers on January 23, 2024, obtained data from the last 5 years of 260 (15.5%) children under five years with a history of low birth weight and 319 (18.9%) toddlers with stunting in two health center work areas in Gunungkidul, Special Region of Yogyakarta, Indonesia. According to the Gunungkidul Regency Health Office, the two health centers have the highest prevalence of stunting in Gunungkidul Regency. Research on the relationship between a history of low birth weight and stunting in toddlers has never been conducted. Based on the background description above, the research problem is clear; similar research needs to be updated with new references from international journals, transparent research gaps, rational research solutions, the need to provide contributions to this research, and good article structure.

2. Method

This research used a quantitative research type with a case-control research design and a retrospective approach. This research was conducted in two Puskesmas (Community Health Center) working areas in Gunungkidul Regency, Special Region of Yogyakarta, Indonesia, and was implemented in May - June 2024. Simple random sampling was used for the sampling technique. The population in this research was 750 toddlers in two Puskesmas working areas in Gunungkidul Regency, Special Region of Yogyakarta. Slovin's formula was used to determine the sample size. This was a total of 238 toddlers in two Puskesmas areas in Gunungkidul Regency, Special Region of Yogyakarta who met the inclusion criteria. The sample in this research was divided into two groups, namely the case group and the control group with a ratio of 1: 1. The case group sample in this research was 119 toddlers who had a history of low birth weight. The control group sample in this research was 119 toddlers who did not have a history of low birth weight with the criteria of birth weight > 2500 grams.

The variables used in this research were independent variables and dependent variables. The independent variable of the research was a history of low birth weight and the dependent variable of the study was the incidence of stunting.

The instrument used was the Maternal and Child Health Book (KIA). The KIA book has a sensitivity value of 84.5%, a specificity value of 96.9%, and a consistency level of 81.9% (Lutfiya, 2019).

The inclusion criteria used were children under five years (aged 6-60 months), toddlers with exclusive breastfeeding, and must have a KIA book with complete birth records. The exclusion criteria used were toddlers born with premature rupture of membranes and toddlers born to mothers with a parity of more than four.

Toddlers can be considered to be stunted if the Z-score value on the PB/U or TB/U index is less than -2 SD according to the gender graph (male and female) and age (0-24 months, 24-60 months) (Kementerian Kesehatan, 2022a).

Data were analyzed using the Somers and Mantel-Haenszel tests on SPSS version 25. This research was conducted after passing the ethical test from the health research ethics committee of Muhammadiyah University of Purwokerto with registration number: KEPK/UMP/261/III/2024.

3. Results and Discussion

This research had the results of respondent characteristic data, description of toddlers with a history of low birth weight and stunting, and the relationship between a history of low birth weight and the incidence of stunting, odds ratio, and coefficient correlation.

Respondent characteristics Based on Table 1, it is known that the majority of gender in the case group is male, with as many as 65 toddlers (54.6%). The majority of the gender in the control group is male, of 63 toddlers (53%). The majority of respondents ages in the case group are >24-60 months, of 93 toddlers (78.2%). The majority of respondents ages in the control group are >24-60 months92 toddlers (77.3%).

Based on Table 2, it is known that there are two groups; a case group, respondents with a history of low birth weight with a total of 119 toddlers (50%), and a control group, respondents without a history of low birth weight with a total of 119 people (50%). The Z-Score value of respondents showed that 174 toddlers were stunned (73.1%), while 64 toddlers (26.9%) were not stunted.

Table 3 shows a relationship between a history of low birth weight and the incidence of stunting in two working areas of the Gunungkidul Regency Health Center (Pusesmas), Special Region of Yogyakarta. The analysis revealed a statistically significant relationship (p = 0.000) with a strong positive correlation (Correlation Coefficient = 0.560). Additionally, the Odds Ratio (OR) was 17.907 (95% CI: 7.307–43.884), indicating that low birth weight increases the risk of stunting by 17.907 times.

Table 1. Respondent Characteristics Based on Gender and Age

Characteristics	Case (n=119)		Control (n=119)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Gender				
Male	65	54.6	63	53
Female	54	45.4	56	47
Age				
6-24 months	26	21.8	27	22.7
>24-60 months				
	93	78.2	92	77.3

The majority of gender in the characteristics of respondents in the case and control groups of this research were male. The research conducted by Pradnyaditha, et al. (2021) stated that stunted and non-stunted toddlers were mostly male. According to Eliati, et al. (2021), male toddlers are at greater risk of experiencing stunting than female toddlers due to differences in nutritional needs. Sartika, et al. (2021) stated that more boys (22.7 %) experience stunting than girls (18.4%). Gender determines the amount of nutritional needs for children. According to Umar, et al. (2021), boys have greater nutritional needs than girls because boys have a high metabolism and are more active. The average nutritional needs of boys are 2,457 kcal while girls have nutritional needs of 2,125 kcal.

Table 2. Description of Toddlers with a History of Low Birth Weight and Stunting Incidents

Variable	Frequency (n)	Percentage (%)
Birth Weight History		
No Low Birth Weight	119	50
Low Birth Weight	119	50
Z-Score Value		
No Stunting	64	26.9
Stunting	174	73.1

The majority of respondents ages in the case and control groups in this research were in the age range of more than 24-60 Months. The results of this research are similar to the research conducted by Sujianti & Pranowo, (2021) which stated that stunted toddlers are mostly in the age range of 24-59 months. Stunting in toddlers often occurs in the age range of 12-59 months, because toddlers in this age range are already active food consumers and have high physical and psychological activity (Kurniawati & Yulianto, 2022). Research by Umar, et al. (2021) stated that most children aged 3-5 years (74.1%) experience stunting. Toddlers need balanced nutritional intake in terms of quantity and quality. Entering the age of three years, growth slows down and problems begin to appear while toddler activities begin to increase. As the child gets older, the amount of nutritional needs that must be met also increases.

The weight of the body weighed one hour after birth is called birth weight. Low birth weight (LBW) is an infant with a birth weight of less than 2500 grams (Hockenberry et al., 2018). Newborns with a weight of less than 2500 grams regardless of gestational age and gestation are called low birth weight. Low birth weight is divided into two types, namely low birth weight due to delivery at a gestational age of less than 37 weeks (premature) and low birth weight due to intrauterine growth retardation or called fetal growth retardation (PJT) in babies born at a gestational age of more than 37 weeks. Birth weight can be an important indicator of infant growth. In line with Badjuka (2019), low birth weight is an important indicator of newborn survival and is associated with a greater risk of growth and development in children in the long term.

Table 3. Relationship between History of Low Birth Weight and Incidence of Stunting, Odds Ratio and Coefficient Correlation

Variable	N	*P-value*	*Coefficient Correlation (r)*	*Odds Ratio (OR)*	95% CI
History of LBW Stunting Incident	238	0.000*	0.560	17.907**	7.307 – 43.884

* Somers'd
** Mantel-Haenszel

Infants with low birth weight have lower long-term health risks. At the beginning of birth, low birth weight can cause mortality. In addition, LBW babies are at risk of growing and developing more slowly than babies born with normal weight. Low birth weight requires special care because it causes body system problems such as body temperature instability, nutritional and gastrointestinal problems, immunological immaturity, hypoglycemia, and liver problems. Management of low birth weight that can be conducted is respiratory support, body temperature regulation, protection against infection, hydration, nutrition, and sensory stimulation (Kusumadewi, 2023). Prevention and control of low birth weight are carried out significantly to reduce infant mortality. Prevention and control efforts can be carried out through health education, supervision and monitoring, prevention of hypothermia in infants, measurement of maternal nutritional status during pregnancy, and preparation for antenatal care (Novitasari et al., 2020).

Low birth weight can be caused by poor maternal nutrition both before and during pregnancy. Meanwhile, the parity that can cause low birth weight in infants most often occurs in the first parity and parity of more than four. This is following the causes of low birth weight, namely maternal, fetal, placental, and environmental factors (Kementerian Kesehatan, 2022b). Harper, et al. (2023) argued that overweight BMI, maternal hypertension, child hunger in the household, and tobacco use were significantly associated with low birth weight. Birth weight affects the height of toddlers, which is greatest between the first six months of age. If in the first six months of age, the nutritional status of toddlers can be maintained and improved, the height of toddlers can grow normally and can prevent stunting at a later age (Sholihah, 2023). Children with low birth weight tend to experience stunting, but it can occur in children with normal birth weight as well. This is because stunting can be seen from the nutritional intake received by children during growth. To improve the nutritional status and health of children, a good nutritional intake pattern is needed for pregnant women, infants, toddlers, and children to achieve optimal growth (Febria et al., 2022).

Birth weight can be an important indicator of infant growth. Infants with low birth weight will experience difficulties in growth and development and are likely to experience a decline in intellectual function. Low birth weight is associated with mortality, morbidity, and future malnutrition events, so low birth weight is an indicator of public health. Toddlers with a history of low birth weight can experience stunting due to chronic malnutrition during the first thousand days of life (Suarnianti, 2020).

Stunted is a nutritional status based on the body length index according to age (PB/A) or height according to age (TB/A). The results of measuring stunted children are below the threshold (Z-Score) -2 SD to -3 SD in the anthropometric standards for assessing children's nutritional status (Putranto, 2020). This research used Z-Score values based on body length for age (PB/A) or height for age (TB/A) to determine nutritional status in toddlers. Stunting is defined as short or very short if the child's length or height is less than -2 SD on the WHO growth curve and is caused by irreversible conditions such as malnutrition, and repeated or chronic infections during the first 1000 days of life (Susanti, 2022).

Based on interviews and observations, the causes of stunting that the researcher found in this research were inadequate nutritional factors and environmental factors such as inadequate sanitation. Children who obtain enough energy will experience growth and development appropriate to their age, but if the amount of energy consumed during childhood is lacking, it will have an impact on children's health (Yuwanti et al., 2021). The difficulty of clean water sources and poor sanitation can cause stunting in children. This is in line with research conducted by Mukaramah & Wahyuni, (2020) that poor environmental hygiene conditions have an impact on the health of toddlers, especially through infectious diseases.

Based on the results of the data analysis, a significant relationship was obtained between a history of low birth weight and the incidence of stunting, indicating a strong correlation and a positive or unidirectional relationship between these variables. This is in line with the research of Relica & Mariyati, (2024) which showed that the increasing risk of low birth weight also increases the risk of stunting. This research was not in line with the research of Migang, et al. (2023) which found that a history of low birth weight has a very weak relationship with the incidence of stunting. This study obtained results from the Odds Ratio value that toddlers who have a history of low birth weight are at risk of stunting by 17.907 times. This is in line with the research of Yuliani, et al. (2022) stating that there is a relationship between stunting and low birth weight. In addition, there is a tendency for groups with low birth weight to be at risk of stunting by 3.539 times compared to groups that do not have low birth weight. Some research showed a significant relationship between low birth weight and the incidence of stunting in children aged 6 to 23 months (Addae et al., 2024). This finding is in line with Wati (2021) research which found that there is a

significant relationship between low birth weight and stunting. With an Odds Ratio value = 5.278, it means that the risk of stunting in toddlers with a history of low birth weight is 5.278 times greater than in toddlers with a history of normal birth weight. Toddlers who have sufficient nutrients, especially foods high in calcium, protein, and zinc, can prevent toddlers from malnutrition and reduce the risk of toddlers experiencing stunting.

According to Aboagye, et al. (2022) that children with low birth weight were more likely to be stunted [aOR= 1.68, 95% CI = 1.58–1.78]. It can be concluded that low birth weight has a significant correlation with the incidence of stunting in children aged 12 to 60 months. Low birth weight was associated with stunting but not severe stunting (Harper et al., 2023).

Contrary to the research conducted by Trisiswati, et al. (2021), there was no relationship between low birth weight and the incidence of stunting in infants under two years of age in 10 villages in Pandeglang with a p-value of 0.144 and an Odds Ratio value of 1.6 (95% CI: 0.848-3.019). Research conducted by Mariyami & Sanjaya, (2022) regarding the relationship between low birth weight and the incidence of stunting has a p-value = 0.014, which means that there is a relationship between low birth weight and the incidence of stunting. Research by Maineny, et al. (2022) stated directly that there is a relationship between low birth weight and the incidence of stunting (p-value = 0.001). Research by Komalasari, et al. (2020) showed no relationship between low birth weight and stunting incidence with a p-value of 0.743. The 95% CI value = 0.087-1.525 indicates that low birth weight incidence remains at risk of stunting incidence so efforts are still needed to maintain the nutrition of toddlers with a history of low birth weight.

According to Abbas et al., (2021) children with low birth weight are more prone to stunting in toddlerhood. Maternal care before and during pregnancy and in the first 1000 days is an important time to intervene to address nutritional status problems. In children. In line with the research of Khan, et al., (2019), children who have a history of low birth weight tend to experience stunting with an Odds Ratio = 1.56 (1.21-2.01), and targeted nutritional interventions are needed. Research by Aboagye, et al. (2022) showed that children with low birth weight are more likely to experience stunting. Stunting is higher in children with low birth weight (42.2%), compared to children with normal birth weight (30.7%). Furthermore, it showed that low birth weight is a major determinant of nutritional problems in children. Thus, special policies are needed to improve the nutritional status of toddlers. Research by Thurstans, et al. (2022) showed that in many cases, children with low birth weight can result in stunting so preventive interventions for mothers and newborns are needed.

This research has limitations related to factors causing stunting that cannot be controlled, including the mother's age during pregnancy, illness during pregnancy, pregnancy spacing, frequency of pregnancy check-ups, nutritional status, hemoglobin levels, maternal employment status, maternal education, energy intake level, parenting patterns, family income, and food diversity.

4. Conclusions and Suggestions

The relationship between a history of low birth weight and the incidence of stunting in children under five years in two health center areas has a positive relationship direction and a strong correlation between variables. Children under five years old with low birth weight are at greater risk of stunting than children under five years old with normal birth weight. It needs efforts to prevent the birth of low birth weight infants and improve the nutrition of toddlers to reduce the incidence of stunting. Further researchers are expected to be able to examine other factors that influence the incidence of stunting by controlling the confounding factors above.

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