Original Article

Relation Between Birth Weight and Stunting Nutritional Status among 2-59 Months Old Children

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Abstract

Introduction: *Stunting remains a major global nutritional challenge for children, with a prevalence of 21.3% in 2019. Low birth weight (LBW) has been recognized as one of the risk factors for stunting. Despite various interventions, stunting continues to be a major public health concern because of its long-term impact on child growth and development. This study was conducted to evaluate the association between birth weight and stunting status in children aged 2-59 months, and to describe their characteristics in the working area of Samigaluh 1 Health Center.*
Method*: This case-control study utilized secondary data obtained from children' growth monitoring records at the Integrated Healthcare Center and Maternal and Child Health (MCH) handbooks.*
Results*: Among the 80 subjects, 27 children (67.5%) were stunted at the ages of 2-24 months, and 13 children (32.5%) were stunted at ages 25-59 months. Stunting occurred in 21 boys (52.5%). Bivariate analysis using the Chi-square test revealed a significant relationship between LBW and stunting status (p value = 0.009; OR = 13.000; CI = 1.576-107.228).*
Conclusion*: The study established a significant association (p<0.05) between LBW and stunting status. Children with LBW were at 13-fold increase of stunting than normal birth weight. Stunting was also more prevalent among boys.*

Keywords: *Children, Low birth weight, Stunting*

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Hubungan Berat Badan Lahir dengan Status Gizi Stunting pada Anak Usia 2-59 Bulan

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Abstrak

Pendahuluan: *Stunting masih menjadi masalah nutrisi pada anak di seluruh dunia, dengan prevalensi 21,3% (2019). Berat badan lahir rendah (BBLR) merupakan salah satu faktor risiko stunting. Stunting masih menjadi permasalahan kesehatan karena memiliki efek jangka panjang pada pertumbuhan dan perkembangan anak. Tujuan penelitian ini untuk menilai hubungan berat badan lahir (BBL) dengan status gizi stunting pada anak usia 2-59 bulan dan karakteristiknya berdasarkan jenis kelamin di wilayah kerja Puskesmas Samigaluh 1.*
Metode*: Desain penelitian berupa kasus-kontrol yang diambil dari data sekunder yaitu data timbang balita di Posyandu dan Buku Kesehatan Ibu dan Anak (KIA).*
Hasil*: Dari total 80 anak, stunting dialami oleh 27 anak (67,5%) pada usia 2-24 bulan dan 13 anak (32,5%) pada usia 25-59 bulan. Stunting terjadi pada 21 anak laki-laki (52,5%). Uji Chi-square pada analisis bivariat menunjukkan adanya hubungan antara BBL dengan status gizi stunting (p value = 0,009; OR = 13,000; CI = 1,576-107,228).*
Kesimpulan*: Penelitian menunjukkan adanya hubungan yang signifikan antara BBL dengan status gizi stunting (p<0,05), yaitu anak dengan BBLR berisiko 13 kali lipat lebih besar untuk mengalami stunting dibandingkan dengan anak tidak BBLR. Stunting banyak terjadi pada anak laki-laki.*

Kata Kunci: *Anak, Berat badan lahir rendah, Stunting*

Introduction

Children with stunting experience impaired linear growth due to prolonged malnutrition, beginning from the prenatal period through the first 24 months of life, resulting in height below the expected range for age. Stunting is defined by comparing height or length with the WHO median standard for age and sex, with Z-scores below –2 SD indicating stunting.[1] Stunting remains a prevalent global nutritional concern, with a reported global prevalence of 21.3% in 2019 and 27.67% in Indonesia during the same period.[2] In 2018, the prevalence of stunting in Yogyakarta Province exceeded 21.04%, and Kulon Progo was recognized as the highest occurrence.[3] The central government designated this region for targeted stunting interventions between 2017 and 2019, including an intervention village in Samigaluh District.[4] Data obtained from Samigaluh 1 Health Center indicated stunting rates of 24.5% in 2018, 21.5% in 2019, and 20.7% in 2020. Nationally, the prevalence of stunting in Indonesia continues to exceed the WHO threshold, which recommends that the prevalence of childhood nutritional problems not exceed 20%.[5]

Stunting has serious long-term consequences for an individual's future. It impairs brain development, leading to reduced cognitive ability, and hinders physical growth, which can decrease productivity and weaken the immune system. Collectively, these effects contribute to a less capable and less productive population. LBW significantly increases the risk of stunting, with affected children having a 6.95 times higher risk of being stunted.[6] In Yogyakarta Province, the prevalence of LBW has shown an upward trend, from 4.86% in 2017 to 5.52% in 2018 and 5.7% in 2019. A similar increase was observed in Kulon Progo

Regency, with LBW prevalence rising from 6.69% in 2017 to 7.09% in 2018 and 7.50% in 2019. This study therefore aimed to assess the association between low birth weight and stunting using existing data.

Methods

This research applied a quantitative analytical design using a case–control approach with purposive sampling. The study population included all children aged 2–59 months whose weight was recorded at the Integrated Healthcare Center (Posyandu) of Samigaluh 1 Health Center, Kulon Progo Regency, between January 1, 2020, and July 31, 2021 (n = 916). From this population, 80 respondents were selected, consisting of 40 children with stunting (cases) and 40 non-stunted children (controls). Inclusion criteria for the case group were children aged 2–59 months classified as stunted, with available birth weight data and a Maternal and Child Health (MCH) handbook. Inclusion criteria for the control group were children aged 2–59 months not classified as stunted, with available birth weight data and an MCH handbook. Children residing outside the working area of Samigaluh 1 Health Center were excluded.

The categorization of stunting and non-stunting was determined based on children's height, weight, and age. The assessment employed the standard anthropometric table for nutritional status evaluation and anthropometric indices in accordance with the Regulation of the Minister of Health of Republic of Indonesia (Permenkes RI) No. 2/2020, the WHO length increments table, and the age-specific growth rate table from the Indonesian Pediatric Society. Analysis of the data was conducted using both univariate and bivariate approaches. The univariate analysis was applied to illustrate the frequency distribution of stunted children aged 2-59 months by age and sex. The bivariate analysis employed the Chi-square test with a significance level of 0.05 ($\alpha = 0.05$) to between birth weight and stunting status. This study was approved by Ethical Comitte of Universitas Ahmad Dahlan Yogyakarta (approval number: 012110068).

Result

Respondents' Characteristic

The frequency distribution of participants by age, sex, and birth weight is presented in Table 1.

Table 1. Frequency Distribution of 2–59-Month-Old Children

Variable	Frequency (%)	p value
Age		
2-24 month	47 (58.8)	0.118
25-59 month	33 (41.3)	
Sex		
Male	43 (53.8)	0.502
Female	37 (46.3)	
Birth Weight		
LBW	11 (13.8)	0.000
Not LBW	69 (86.3)	

Table 1 shows that most participants were aged 2–24 months (n = 47; 58.8%), while 33 children (41.3%) were aged 25–59 months. Of the total sample, 43 (53.8%) were male and 37 (46.3%) were female. Eleven participants (13.8%) had a history of low birth weight (LBW), whereas 69 (86.3%) did not. Age and sex variables were normally distributed, whereas birth weight was not.

Univariate Analysis

Table 2 presents the frequency distribution of stunted children aged 2–59 months, categorized by age group and sex.

Table 2. The Respondents' Stunting Frequency Distribution

Variable	Frequency (%)	p value
Age		
2-24 month	27 (67.5)	0.027
25-59 month	13 (32.5)	
Sex		
Male	21 (52.5)	0.752
Female	19 (47.5)	

As shown in Table 2, stunting was more frequently among children aged 2–24 months (n = 27; 67.5%) compared to those aged 25–59 months (n = 13; 32.5%). Stunting occurred in 21 boys (52.5%) and 19 girls (47.5%). These findings indicate a significant variation between age and stunting, while no significant difference was observed by sex, which was normally distributed.

Bivariate Analysis

The data show that 10 children (25%) had both low birth weight (LBW) and stunt-

Table 3. The Correlation Between Birth Weight and Stunting Nutritional Status

		Stunting Nutritional Status		Total	p value	OR (95% CI)
		Stunting	Not Stunting			
		n (%)	n (%)	n (%)		
Birth Weight	LBW	10 (25)	1 (2.5)	11 (13.75)	0.009	13,000 (1.576-107.228)
	Not LBW	30 (75)	39 (97.5)	69 (86.25)		
Total		40 (100)	40 (100)	80 (100)		

ing, 1 child (2.5%) had LBW without stunting, 30 children (75%) were stunted without LBW, and 39 children (97.5%) had neither condition. Chi-square analysis demonstrated a significant correlation of birth weight and stunting incidence among children aged 2–59 months in the working area of Samigaluh 1 Health Center (p = 0.009). Odds ratio (OR) in this study was 13.0 (95% CI: 1.576–107.228), demonstrating that children with LBW were 13 times higher to experience stunting than normal birth weight.

Discussion

The frequency distribution of stunting among 2–59-month-old children in the study showed significant variations by age (p value <0.05). The data in Table 2 illustrates that stunting was most prevalent in children aged 2-24 months than aged 25-59 months. The research aligns with the findings of by Putri & Qomariyah, as well as other studies.[7-10] However, few studies have specifically examined stunting within the 2–59-month age group by subdividing children into 2–24 months and 25–59 months. This study therefore provides novel insights by analyzing stunting across these age categories. Notably, stunting was most common among children aged 2–24 months, emphasizing the need for early interventions, as stunting becomes increasingly difficult to reverse beyond the age of two years.[11] Univariate analysis of stunting distribution by sex, showing that stunting was more occur among boys than girls. This result aligns with Pristya et al., who also observed the prevalence of stunting was higher in boys.[12] However, the difference was not significant (p > 0.05), indicating no meaningful disparity.[11] Similarly, Enardi et al. found no significant difference in stunting prevalence between male and female children in Bangka Belitung Province, although the proportion of stunted boys was slightly higher.[13]

Stunting is influenced by multiple factors (Figure 1). Indirect factors include inadequate sanitation, low parental education, limited access to healthcare services, and food insecurity. Direct factors relate to child health and birth status, such as LBW and preterm. Shekar et al. highlighted the contribution of infection history and birth status in increasing the risk of malnutrition.[14] Children born with LBW have been shown to be at greater risk of stunting, with studies reporting a 1.23-fold increase in risk.[15] Sutarto et al. found that stunting was a 2.6 times greater among children with LBW than normal birth weight.[16] Similarly, Nainggolan et al., in a study at West Bandung Health Center, reported that newborns with LBW have 25-fold greater risk of stunted than to infants with normal weight at birth.[17]

This study was to investigate the association between stunting status in children aged 2–59 months and a history of LBW. As shown in Table 3, a statistically significant correlation was observed (p = 0.009). This finding is align with previous research in Yogyakarta, which also reported an association between LBW and stunting (p = 0.013; OR = 5.25). A study by Sutarto et al., likewise demonstrated that association between LBW and stunting among children (24–59 months) was significant. In addition, Aryastami et al., using multivariate analysis, identified LBW as the strongest predictor of stunting among Indonesian children aged 12–23 months (OR = 1.74).[19] In the present study, the odds ratio was 13.0 (95% CI: 1.576–107.228), suggests that children with LBW were 13-fold greater likelihood to be stunted than normal birth weight.

Enardi et al. reported that the high prevalence of stunting among children under 24 months is consistent with evidence showing that stunting typically starts during the initial 3 months of life.[13] During this critical period, inadequate complementary feeding following a decline in breastfeeding may lead to digestive problems and increased susceptibility to infections, resulting in nutritional deficiencies. Stunting may also originate prenatally

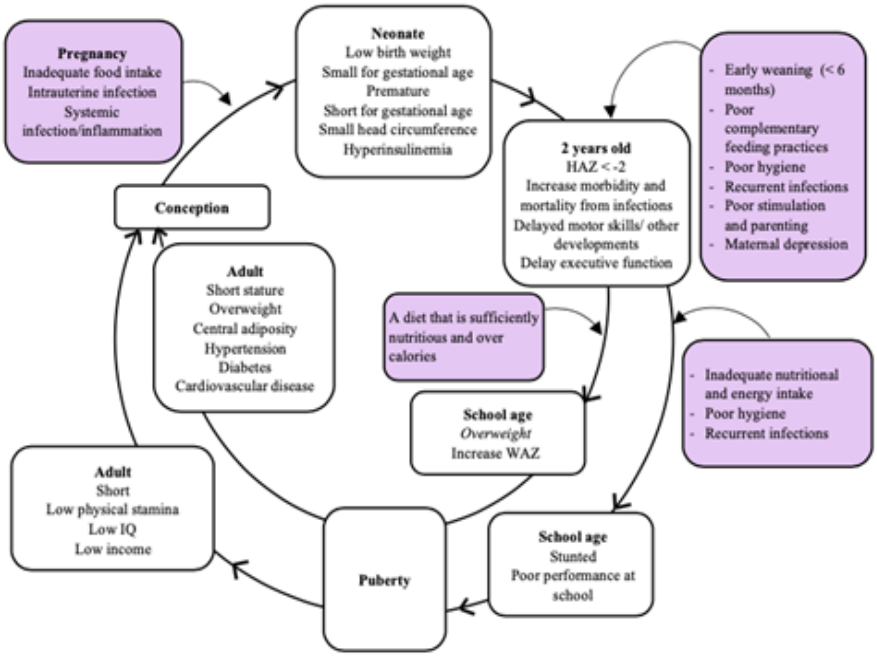

Figure 1. The vicious cycle of stunting. Modified from Millward et al.[18]

and persist throughout the first two years of life, with prevalence rising from an estimated 20% at birth to 58% by 18–23 months.[20] Maternal factors play a critical role, shorter maternal stature increases the risk of intrauterine growth restriction and LBW. While poor nutrition in short-statured mothers, along with a restrictive intrauterine environment, may impair nutrient transfer to the fetus, leading to growth problems from the beginning of life.[21] These conditions place children at greater risk of infection and impaired nutrient absorption, ultimately contributing to stunted growth during early childhood (0–23 months).[22]

The higher prevalence of stunting among males supports previous research indicating that boys generally have poorer nutritional status than girls. Evidence suggests that boys are more susceptible to both stunting and wasting, partly due to greater vulnerability to infectious diseases arising from differences in immune and endocrine function. Girls typically demonstrate stronger immune responses and higher antibody production, whereas boys are more prone to infections that contribute to malnutrition through loss of appetite and impaired nutrient absorption. Moreover, leptin levels—important for immune regulation—are generally higher in girls. Social factors may also play a role, including earlier weaning and greater energy expenditure among boys.[23,24] Together, these biological and social factors contribute to the increased prevalence of malnutrition and its impact on stunting in male children. The influence of malnutrition on stunting is illustrated in Figure 2.

According to findings from a study in Lampung, Indonesia, the children aged 6–59 months with LBW were 2.28 times at higher probability of stunting relative to normal birth weight ($p = 0.005$). In Teluknaga District, Banten Province, Kusumawati et al. also identified infant birth weight as the most significant predictor of stunting, with an odds ratio of 3.12. These results highlight that LBW substantially increases the risk of growth and developmental problems in early childhood. Moreover, LBW infants are more vulnerable to malnutrition, which contributes to increased susceptibility to infections and impaired absorption of essential micronutrients.[25]

The association of LBW and childhood malnutrition may be influenced by the higher incidence of infectious diseases in LBW children. A weakened immune system increases susceptibility to illness and exacerbates malnutrition by reducing appetite, impairing nutrient absorption, and promoting catabolism. In addition, infections can cause excessive nutrient loss through vomiting or diarrhea.[27] Birth weight is therefore a critical determinant of postnatal growth, and ensuring adequate, high-quality nutrition during the initial thousand days of life is essential to prevent growth impairment. Optimizing nutrition

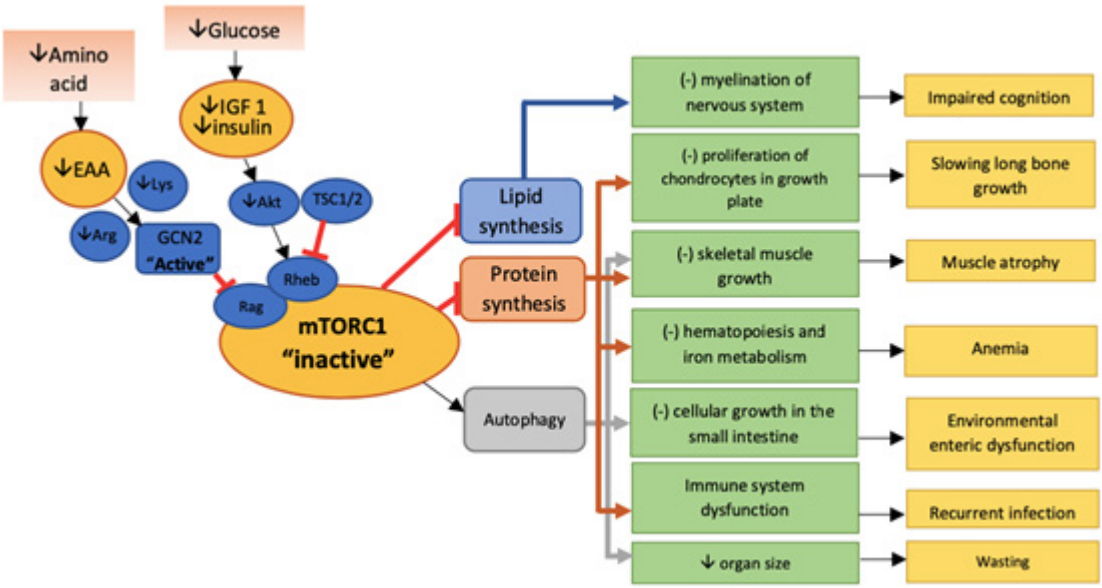

Figure 2. Soliman et al shown that mTORC1 complex role in pathophysiology of stunting.[26]

EAA=Essential Amino acids, Lys=Lysine, IGF 1=Insulin Growth Factor 1, TSC=Tuberous Sclerosis Complex, Rag=Ragulator complex, mTORC1= mammalian target of rapamycin complex.

in this critical window can lead to improved long-term health outcomes.[13]

The results of this study indicated that LBW were 13 times higher risk to be stunting compared to non-LBW children. This finding aligns with a meta-analysis which reported that LBW significantly increases the risk of stunting among children aged 0-60 months. Specifically, cross-sectional studies included in the analysis showed a 3.64-fold higher risk, while case-control studies indicated that LBW was demonstrated an association with a 6.95-fold higher risk of stunting compared to non-LBW.[6] Aryastami et al. likewise demonstrated that children who have LBW had a higher risk of being stunted than those with a birth weight ≥ 2.500 grams. These findings suggest that poor growth early in life is correlated with inadequate cognitive development and suboptimal growth of internal organs, potentially resulting in lower intellectual development and a greater susceptibility to chronic diseases in adulthood.[19]

According to Lukman et al., a child's birth weight is strongly associated to the mother's health and nutritional status before and during pregnancy. Therefore, adolescent nutrition prior to conception is an important for a healthy pregnancy.[28] Tampy et al. noted that infants with LBW are probably to exhibit slower growth and developmental progress during pregnancy. After birth, these children are also more prone to digestive problems, as they have difficulty absorbing fat and digesting protein. This condition leads to limited nutrient reserves in the body, which, if not promptly managed, can result in long-term nutritional issues such as stunting.[29]

Conslusion

In summary, this research identified a significant correlation between birth weight and incidence of stunting among children aged 2–59 months in the working area of Samigaluh 1 Health Center. Children with a history of low birth weight had a 13 times increased probability of stunting compared to those with normal birth weight. Stunting was most commonly found in children aged 2–24 months and occurred more frequently in males than females.

Conflicts of Interest

The authors declare no conflict of interest.

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