

Original Research Article

The Effect of Low Birth Weight Incidence toward Stunting and Developmental Disorders of Toddlers

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Abstract: Background: Low birth weight (LBW) is a condition in babies, which occurs when the bodyweight is < 2500 grams. Furthermore, it poses more threat to toddlers under the age of 2 years where it causes several developmental and growth disorders, such as stunting. Their condition continues to worsen up to the age of 5 when their immune system is not improved. Stunting is characterized by shortness and can be diagnosed based on the anthropometric index of the body length for age (PB/U) or height for age (TB/U) with a limit (z-score) below the standard deviation (< -2 SD). **Method:** The data used for this study consists of primary and secondary data. The primary data were collected using an interview approach by filling a questionnaire, while the secondary data were obtained with a KMS (Card towards Health) book for toddlers with a total of 107 samples. **Result:** The results showed that LBW has a significant effect on stunting, but it has no effect on developmental disorders. It also has a significant effect through stunting on developmental disorders, but it has no effect on stunting through developmental disorders.

Keywords: Low Birth Weight, Stunting, Developmental Disorders.

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INTRODUCTION

Stunting is a growth and developmental disorder in toddlers caused by chronic malnutrition and characterized by a low height for age index. Malnutrition can occur during pregnancy or immediately after birth, but it is only expressed after 2 years (TNPK, 2017). Furthermore, it is a public health problem with a prevalence ratio of 1:3 children in developing countries. The World Health Organization (WHO) Child Growth Standard Book (WHO, 2009) revealed that the condition can be diagnosed based on the anthropometric index of body length to age (PB/U) or height to age (TB/U) with a limit (z-score) below the standard deviation (< -2 SD). Widanti (Widanti, 2016) reported that stunting is mainly caused by malnutrition problems originating from poverty, women's political, cultural, and social status. It causes developmental delays in children with or without underlying diseases. The toddler phase is a golden period that is characterized by accelerated physical, intellectual, mental, and emotional growth. Moreover, providing physiological and biological love and care, such as nutrition, hygiene, immunization, vitamin A and quality

health services as well as stimulation help to increase children's survival and optimize their quality as the next-generation in Indonesia. The phase is also a critical period with a high risk for various diseases, malnutrition, as well as lack of affection and stimulation, which have negative effects that span into adulthood and old age.

Growth and development delays have a negative impact on the next life cycle (Kemenkes RI, 2016) because they must pass through a phase of development before proceeding to the next. For example, a child cannot walk before learning how to stand. Therefore, when the development of the legs and other body parts related to standing function is hampered, it causes the inability to stand (Depkes, 2017). Stunting causes cognitive and motor decline in children where their physical growth, mental development, and health status are hampered. It also leads to an average Intelligence Quotient (IQ) score for lateness, which tends to be eleven points lower than normal children. The condition increases the susceptibility to diseases, such as Non-Communicable Diseases (PMT) as well as the risk of overweight and

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obesity (Setiawan *et al.*, 2018). Therefore, this study aims to determine the effect of 1) LBW (low birth weight) on stunting toddlers; 2) LBW on the developmental disorders; 3) stunting on developmental disorders through LBW; and 4) developmental disorders on the incidence of stunting through LBW in the Putat Jaya Public Health Center, Surabaya.

METHOD

This is a retrospective study with a cross-sectional approach, which was conducted at the Putat Jaya Public Health Center, Surabaya. The sample population consists of 150 stunting children, and a total of 107 respondents were then selected using the predetermined criteria. The instruments used include the Card towards Health (KMS) as well as questionnaires and observations. Subsequently, a Developmental Pre-Screening Questionnaire (KPSP), which has been evaluated through validity and

reliability tests, was administered to the samples. The test result showed that it was reliable, and this was indicated by the reliability coefficient value of Cronbach's alpha > r 0.60. An ethics approval request letter was then sent to the Brawijaya University Malang, and Kesbang Linmas (Nation Unity and Community Protection) East Java Province, Surabaya City. It was also sent to the Surabaya City Health Office, Public Health Centers, and various cadres. Furthermore, an informed consent approach was used for the respondents, and the data obtained consisted of primary and secondary data. Statistical analysis was then carried out using the Windows SPSS version 25 program, after which a data interpretation was performed.

RESULTS

Distribution of Mother's Characteristics

Table-1: Distribution of Mother's Characteristics

Variable	Category	Total (n)	Percentage (%)
Age	< 20	0	0
	20 – 35	76	71
	> 35	31	29
Education	Elementary School	13	12,1
	Junior High School	26	24,3
	Senior High School	65	60,7
	University	3	2,9
Occupation	Housewife	87	81.3
	Entrepreneur	8	7.7
	Private Employee	12	11.2
	Others	0	0
Family income	< Regional Minimum Wage (< IDR 4.300.000)	67	62,6
	> Regional Minimum Wage (> IDR 4.300.000)	40	37,4

Table 1 shows the characteristics of the parents (mother) of the respondents, most of them 76 mothers (71%) are aged 20-35 years, the majority 65 mothers (60.7%) have a high school education background,

almost all 87 mothers (81.3%) work as a housewife. Most of the respondents' families 67 mothers (62.6%) have an income less than the city's minimum income.

Distribution of Toddler Characteristics

Table-2: Distribution of Toddler Characteristics

Variable	Category	total (n)	centage (%)
Age	36 – 48 months old	68	63,6
	49 – 60 months old	39	36,4
Gender	Male	65	60,7
	Female	42	39,3

Table 2 shows the respondents' characteristics based on their age and gender where 68 toddlers were

within the age range of 36-48 months (63.6%), while 65 were male (60.7%).

Distribution of LBW Incidence Variables (X)

Table-3: Distribution of LBW Incidence Variables (X)

Variable	Category	total (n)	centage (%)
Baby Birth Weight (X)	1000 – 1500 gram	0	0
	1500 – 2499 gram	10	9,3
	2500 – 4000 gram	97	90,7

Table 3 shows the incidence of LBW, which revealed that it occurred in 97 and 10 toddlers weighing

2500-4000 grams (90.7%) and 1500-2499 grams (9.3%).

Distribution of Stunting Incidence Variables (Y)

Table-4: Distribution of Stunting Incidence Variables (Y)

Variable	Category	total (n)	centage (%)
Stunting Incidence (Y)	Very short	10	9,3
	Short	14	13,1
	Normal	83	77,6

Table 4 shows that stunting occurred in normal 83 (77.6%), short in 14 (13.1%), and very short toddlers in 10 (9.3%).

Distribution of Developmental Disorder Variable (Z)

Table-5: Distribution of Developmental Disorder Variable (Z)

Variable	Category	total (n)	centage (%)
Developmental Disorder (Z)	Suitable (S)	54	50.5
	Doubtful (M)	35	32.7
	Deviation (P)	18	16.8

Table 5 shows that the developmental disorders were suitable for the development of 54 toddlers (50.5%), doubtful in 35 (32.7%), and deviations in 18 (16.8%).

Bivariate Analysis Results on the Effect of LBW incidence on stunting

Table-6: Results of Bivariate Analysis Effect of LBW incidence on stunting

Variable	Category	Very Short		Short		Normal		Total		p Value
		n	%	n	%	n	%	n	%	
		Baby Birth Weight (X)	1000 – 1500	0	0	0	0	0	0	
	1500 – 2499	10	9.3	14	13.1	0	0	24	100	
	2500 – 4000	0	0	0	0	83	77.6	83	100	

Table 6 shows that a significance value of 0.005 (< 0.05) was obtained from the Pearson

Correlation test, which indicates that LBW has a significant effect on the incident of stunting.

Bivariate Analysis Results on the Effect of LBW incidence on developmental disorders

Table-7: Results of Bivariate Analysis Effect of LBW incidence on developmental disorders

Variable	Category	Suitable		doubtful		Deviation		Total		P Value
		n	%	n	%	n	%	n	%	
		Baby Birth Weight (X)	1000 – 1500	0	0	0	0	0	0	
	1500 – 2499	3	2.8	6	5.6	1	0.9	10	100	
	2500 – 4000	51	47.7	29	27.1	17	15.9	97	100	

Table 7 shows that LBW has no significant effect on developmental disorders, which was indicated by the significance value of 0.198 (>0.05) obtained from the Pearson correlation analysis.

Multivariate Analysis Results on the effect of stunting on developmental disorders in toddlers through the LBW incidence

Table-8: Results of Multivariate Analysis on the effect of stunting on developmental disorders in toddlers through the LBW incidence

Variable	P Value	Beta Coefficient
LBW (X) toward stunting (Y)	.005	.191
LBW (X) toward developmental disorders (Z)	.198	-.115
Stunting (Y) toward developmental disorders (Z)	.011	-.330

Table 8 shows the beta coefficient values obtained from the Path Analysis test, which revealed a direct effect (X on Z) = -0.115 and an indirect effect (X through Y on Z) = (0.191*0.330) = -0.063. Furthermore, the indirect effect was greater than the

direct effect, which indicates that LBW has a significant effect on developmental disorders through stunting.

Multivariate Analysis Results on the effect of developmental disorders on the stunting incidence in toddlers through the LBW incidence

Table-9: Multivariate Analysis Results on the effect of developmental disorders on the stunting incidence in Toddlers through the LBW incidence

Variable	P Value	Beta Coefficient
LBW (X) toward developmental disorders (Z)	.198	-.115
LBW (X) toward stunting (Y)	.005	.191
developmental disorders (Z) toward stunting (Y)	.011	-.330

Table 9 shows the beta coefficient value obtained from the Path Analysis test, which revealed a direct effect (X on Y) = 0.191 and an indirect effect (X through Z on Y) = (-0.115*0.330) = 0.037. Furthermore, the indirect effect was smaller than the direct effect, which indicates that LBW has no significant effect on stunting through developmental disorders.

Birth weight is closely related to fetal, neonatal, and post-neonatal mortality as well as infant and child morbidity. It is also related to long-term growth and development among toddlers. The effects of LBW are often passed to offsprings, which include the expression of less developed anthropometric measurements. Muqni *et al.* (Muqni *et al.*, 2012) reported that birth weight is an important predictor used for determining the short-term status of infants between the age of 12-60 months.

DISCUSSION

Bivariate Analysis Results on the Effect of LBW incidence on stunting

This result is in line with Mardani, Wetasin & Suwanwaiphatthana (Mardani *et al.*, 2015) that LBW is one of the factors that cause stunting in early childhood. In developing countries, LBW infants are more susceptible to intrauterine growth retardation due to increased maternal malnutrition and infection rates compared to other developed countries. Babies with the condition are at more risk of having low anthropometric measurements during adulthood (Rahmawati *et al.*, 2017). This finding is consistent with Paudel *et al.* (Paudel *et al.*, 2012) in Nepal that there is a relationship between a history of LBW and stunting where children with the condition are 4.47 times at risk of stunting than toddlers with normal birth weight.

Consequently, the growth of infants needs to be monitored by weighing and measuring their height and head circumference. A normal birth weight is within the range of 2,500 to 4,000 grams. Values below 2,500 grams are categorized as LBW, while values above 4,000 grams are referred to as macrosomia. In infants and toddlers, body weight is an indicator of their physical development and nutritional status, hence, an understanding of these factors is needed (Hanum, 2019).

LBW can also occur in mothers with low socioeconomic status and are unable to provide nutritious food, education, and other basic needs for their children. Some families find it difficult to help their children reach their age-appropriate level of growth and development. Furthermore, toddlers from low socioeconomic families are often younger compared to others from high socioeconomic families. This is in line with Cameron & Hovander in Maryuani, Anik (Anik, 2010) that babies with low socioeconomic parents have lower body weight compared to others with high status.

Arifin *et al.* (Arifin *et al.*, 2012) stated that LBW children with inadequate food consumption and sanitation services as well as infections during their growth period are at greater risk of experiencing stunted growth. Other factors that cause stunting include maternal age < 20 years as well as mothers who are not physically and mentally ready for pregnancy. This is in line with Huriah (Huriah *et al.*, 2014) that mothers aged <25 years old are 1.54 times at risk of having stunted children during pregnancy compared to other aged >25 years old. This is inconsistent with a similar study in Ghana where stunted growth was observed in older mothers within the age range of 35-44 years (Darteh *et al.*, 2014). Fikawati *et al.* (Sandra *et al.*, 2017) stated that there are differences between the stunting

interpretation in children under and above the age of two. The condition is categorized as ongoing among toddlers under 2 years, while it is described as being hampered or delayed in children over 2 years. This indicates older toddlers are at greater risk of experiencing stunting when they are not treated early. Furthermore, its prevalence among children causes immune disorders, which increases their vulnerability to diseases, such as pneumonia, diarrhea, sepsis, meningitis, tuberculosis, and hepatitis (de Onis & Branca, 2016).

Bivariate Analysis Results on the Effect of LBW incidence on developmental disorders

This study's result revealed that the developmental disorders experienced by toddlers were not caused by LBW. However, the condition requires special attention, specifically during the toddler period where they learn new things quickly. Mastering the developmental tasks of this age group requires a solid foundation during its formation as well as guidance from parents. Several interventions that can enhance the growth and development of toddlers need to be administered optimally by parents and other family members, such as parental stimulation and nutrition. Providing low stimulation, as well as inadequate levels of care at home, often disrupt their growth process. Mother's education is one of the factors that affect gross and fine motor development (Sitoresmi *et al.*, 2015). Furthermore, the level of stimulation from home and the environment also has a significant effect on their development. Highly educated parents need to provide greater intellectual stimulation and create an environment that facilitates child development. Mothers are the primary caregivers, hence, their level of education has a significant effect on a child's growth (Giagazoglou *et al.*, 2007).

Christiari, *et al.* (Christiari *et al.*, 2013) reported that there is a significant relationship between mother's knowledge about early stimulation and children's motor development. Toddlers whose mothers have little knowledge about early stimulation are at greater risk of experiencing suspected motor skill delays compared to others with well-informed parents. Nutrition and parental stimulation are needed in facilitating a child's growth and development process. Toddlers that are provided with adequate nutrition and direct stimulation from parents often experience optimal growth (Soetjningsih & Ranuh, 2016). Other confounding factors, such as genetics, amount and intensity of attention, emotions, child-mother interactions, early stimulation, and psychosocial factors can be hidden by the actual development of toddlers.

Multivariate Analysis Results on the effect of stunting on developmental disorders in toddlers through the LBW incidence

The mother's inadequate nutritional intake during pregnancy causes malnutrition, which has a

negative effect on the fetus, such as miscarriage, premature birth, stillbirth, LBW, decreased intelligence, and impaired development. This is consistent with Umboh and Adrian (Umboh, 2013) that the fetal-maternal environment affects the fetus's development. Furthermore, impaired nutritional intake during pregnancy by a malnourished mother can lead to the birth of babies with LBW. Brown and Pollit reported that the effect of malnourishment on developmental disorders was preceded by a decrease in nutritional status. This low-status causes various disorders that are characterized by slow neuronal maturation and motor movements, as well as poor intelligence and slow social responses (Ernawati *et al.*, 2014). Children with a history of LBW are at a risk of future growth and development retardation, which is often experienced during the first few years of life. Growth is related to the problem of size, number, and change in size, which is assessed through weight and length. Development is an increase in the body structure and functional capacity, which becomes more complex in a regular and predictable pattern due to the maturation process (Soetjningsih & Ranuh, 2016).

It was assumed that the greater the stunting experienced by the children, the more the developmental delays that occur. This was because it is closely related to the processes of growth and development, which affect each other. LBW newborns grow slowly depending on the quality and quantity of food as well as the digestive disorders they experience. These babies also experience more growth and slower organ development. Furthermore, the situation is exacerbated when they lack energy and nutrient intake combined with poor parenting, which often cause infectious diseases (Wibowo & AP, 2014). Hilaire Marjorie *et al.* (Hilaire *et al.*, 2021) stated that LBW toddlers that received treatment and survived up to 24 months experienced delays in gross motor, cognitive, and language development. This is consistent with Oudgenoeg *et al.* (Oudgenoeg-Paz *et al.*, 2017) that infants with a history of preterm birth or LBW are at risk of impaired cognitive and motor development.

Multivariate Analysis Results on the effect of developmental disorders on the stunting incidence in toddlers through the LBW incidence

Development is the maturation process of body organs, such as mental development and children's attitude (Soetjningsih & Ranuh, 2016). The Indonesian Ministry of Health (Depkes, 2017) stated that development is a process related to the relationship between central nervous system maturity and the organs it influences, such as the neuromuscular system, speech, emotion, and socialization.

It was assumed that toddlers with developmental delays do not always experience stunting along with a history of LBW. This was evident from several influencing factors including the mother's

education level, where the majority of the respondent's mother had the Senior High School level. Furthermore, this can be caused by a lack of experience and the right way to educate their children. Toddlers also play a key role in their learning experiences, which does not involve their parents. Another factor is the mother's occupation, where most of the respondents' mothers were housewives, which involves working at home and taking care of their children. They have a role in meeting the basic needs, and this has an impact on the babies' development.

The Ministry of Health (Kesehatan & Indonesia, 2019) stated that the stimulation of children's growth and development is carried out by parents or caregivers as well as other family members and community groups. This stimulus can be administered in various ways, such as inviting children to play, singing, freedom, no execution as well as the use of simple and safe games. Meanwhile, lack of stimulation can cause deviations in growth and development or permanent inhibition. Adolph *et al.* (Adolph *et al.*, 2011) reported that there are three ways of ensuring successful motor development, namely (1) carrying out a convoy, (2) an attitude that is embedded in a physical environment rich in sensory information, which also requires perception for effective action, and (3) culturally appropriate motor development from parenting.

CONCLUSION

The occurrence of LBW increased the risk of stunting among toddlers in the work area of Putata Jaya Health Center, Surabaya. This is indicated by the significance value of 0.005 (< 0.05) obtained from the Pearson Correlation test.

LBW has no effect on developmental disorders in toddlers, which was indicated by the significance value of 0.198 (> 0.05) obtained from the Pearson Correlation test. Stunting has a significant effect on toddler development disorders through the incidence of LBW. This is indicated by the significance value obtained from the Path Analysis test where the indirect effect (-0.063) was greater than the direct effect (-0.115).

Developmental disorders have no significant effect on the stunting of toddlers through LBW. This is indicated by the significance value obtained from the Path Analysis test where the indirect effect (0.037) was lesser than the direct effect (-0.191).

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