

## Research Article

# How Does Birth Weight Affect the Development of Preschool Children? A Cross-Sectional Study

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**Abstract.** Child development needs to regularly monitored to know that children are developing according to their age stage. A history of low birth weight (LBW) can increase the risk of impaired child development, but it is worth noting that child development is determined by many factors, one of which is the environment. This study aimed to examine the relationship between history of LBW and the development of preschool age children (aged 3-5 years). This was a descriptive correlation study with a cross-sectional design. 80 children of the total 100 population were involved, which consisted of preschool children in a rural village in Indonesia. There were 29 children (36.3%) with a history of LBW who were at an appropriate developmental stage, and nine children (11.3%) were at a doubtful developmental stage. There were 31 children (38.8%) who did not have a history of LBW who were at an appropriate developmental stage and 11 (13.8%) who were at a doubtful developmental stage. The p-value obtained was 0.779. Therefore, there was no relationship between a history of LBW and the development of preschool age children (aged 3-5 years). A higher proportion of children with a history of normal birth were at a doubtful developmental stage than of those with a history of LBW. In addition, we found that the majority of boys aged four years required strong stimulation in gross motor skill development. Developmental optimization through play stimulation should be done in all areas of child development regardless of birth weight history.

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## 1. Introduction

Human development is defined as a process of behaving and adapting by improving behavior to increase life competence [1]. Emotional and behavioral aspects play an important role in childhood development [2]. Objectively, child development can be assessed by measuring gross motor, fine motor, speech, and language, as well as socialization/independence [3]. The stages of development in children cause changes and are different for each child. The first stage in child development can determine the

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next stage of childhood development [4], therefore, it is important for parents to provide optimal stimulation in the child's early life (early childhood).

Suboptimal childhood development can be caused by several factors such as lack of stimulation [5], genetic and chromosomal abnormalities [6], race and nationality [7], the history of pregnancy (particularly in the third trimester) and childbirth and low birth weight [8]. Low birth weight (LBW) is the most common cause of infant mortality in the prenatal period [9]. LBW babies born weighing less than 2500 grams [10], which can occur due to premature birth (gestational age of less than 37 weeks), stunted fetal growth (IUGR), or a combination of both [11]. A woman needs to get adequate nutritional intake as a provision in preparing for her pregnancy later [12]. The lacking fulfillment of the nutritional needs of pregnant women can affect the fetus during pregnancy. Adequate nutrition during pregnancy can improve the growth and development of the fetus to prevent the occurrence of LBW.

The prevalence of LBW is currently estimated at 15.5% of all births in the world [11]. A systematic analysis estimated that 20.5 million livebirth were LBW babies and 91% often occur in developing countries which are considered to have low-and-middle socioeconomic status, mainly southern Asia [13]. In 2018, the prevalence of LBW in Indonesia was 6.2% and Central Java Province, Indonesia, was 6.0% [14]. Babies with a history of LBW have a 2-5 times higher risk for developmental deviations compared to normal babies [15]. Another study by Setyaningrum found that a history of LBW increases the risk of developing social-emotional disorders by 3.6 times compared to children who do not have a history of LBW [16].

The results of Health Research and Development Agency showed that the index of development of children aged 36-59 months in Indonesia amounted to 88.3%, equivalent to Vietnam in 2014; whereas in Central Java province, it was recorded at 90.6%, equivalent to Thailand in 2015. The data depicts that Indonesia is lagging behind some ASEAN (Association of Southeast Asian Nations) countries else. The development index is measured based on literacy, physical, social, emotional, and learning abilities. Nationally, literacy is the weakest development index in Indonesia, then social-emotional, followed by learning abilities. The highest aspect is physical ability, which is assessed by the ability to pick up small objects on the floor and play without complaining of pain [17].

Physical ability indicates good motor development, especially gross motor skills. This development is related to the child ability to move large muscles, the ability to crawl, stand, sit, or walk [17]. Research by Ananditha showed that gross motor development in toddlers is correlated with the child's age, gender, and history of premature birth [18].

However, more in-depth evidence is needed because there are many other factors that contribute to child development. Therefore, we conducted a survey in an urban village in rural Indonesia in July 2020. The results of developmental observations using the Indonesian child development prescreening questionnaire (*Kuesioner Pra Screening Perkembangan* or KPSP) on 7 children aged 3-5 years with a history of LBW found 3 suspected problems of children in aspects of language and motor development; the other 4 children had normal development.

## 2. Methods and Equipment

### 2.1. Methods

This study used a descriptive correlation design with a cross-sectional approach, by analyzing whether there is a relationship between the history of LBW (independent variable) and child development (dependent variable). Total population in this study were 100 children aged 3-5 years in Rejosari Village, Subdistrict Mijen of Demak Regency, Central Java Province of Indonesia. We determine the inclusion criteria as follows: (a) willing to participate; (b) do not have a mental illness; (c) children that fostered by their own parents. We exclude the children who were sick and have a behavioral disorder.

Data collection in this study was conducted from December 20, 2020 to January 5, 2021. We start with arrange on management of survey permits from Faculty of Nursing and Rejosari Village. After that, we make preparations by establishing health protocols to prevent transmission of the Covid-19 viruses. Then we conducted a home visit to fill out questionnaires and review a child's development. Respondents in this study that eligible with inclusion and exclusion criteria were 80 children aged 3-5 years consisting of those who have a history of LBW and not LBW. Approximately 22 days with each day we analysis 4-5 child's development used KPSP in 20 minutes start from 9 am.

### 2.2. Equipment

The instrument used in this study was questionnaires: A and B. The questionnaire A consists of demographic data including gender, initial name, age, education, birth weight, current weight, and height. Questionnaire B is the Indonesian child development prescreening questionnaire (*Kuesioner Pra Screening Perkembangan* or KPSP), which is consisted of 10 questions according to the child's age with response categories of "yes" and "no". The results were categorized as "appropriate developmental stage" if

TABLE 1: Characteristics of respondents in December 2020 (n=80).

Characteristics respondents	of Frequency	Percentage (%)
<b>Gender</b>		
Male	41	51.2
Female	39	48.8
<b>Education</b>		
School	50	62.5
No school	30	37.5
<b>Age</b>		
3 years	26	32.5
4 years	27	33.8
5 years	27	33.8
<b>Birth Weight</b>		
LBW	38	47.5
No LBW	42	52.5
<b>Child development</b>		
Appropriate	60	75.0
Doubtful	20	25.0

the score was 9-10, “doubtful developmental stage” if the score is 7-8, and “possible deviation developmental stage” if the score is < 6.

We screening four aspects (fine motor, gross motor, language, and social personality) of development to determine whether it is in appropriate developmental stage or not. These four aspects, among others (a) fine motor done by assessing eye and hand coordination using small objects, (b) gross motor done by assessing such as sitting and walking skill that doing with large muscle movements, (c) language done by hearing, understanding and using language, and (d) social personality done by assessing adjustment in society and personal needs. We used the help of tools that needed in accordance with the child’s age such as paper, cubes, balls, and pencils. Finally, we reviewing and telling children to do activities such as gross motor, fine motor, social personality, and language.

### 3. Results

The result of the univariate analysis is presented in Table 1, which is a table of frequency distribution. Table 2 presents the results of a bivariate analysis between the history of birth weight and development of children aged 3-5 years.

TABLE 2: The relationship between the history of LBW and the development of children aged 3-5 years in December 2020 (n=80).

Birth weight	Child development						p value
	Appropriate		Doubtful		Total		
	F	%	F	%	F	%	
LBW	29	36.3	9	11.3	38		<b>0.779</b>
No LBW	31	38.8	11	13.8	42		

TABLE 3: Characteristics of doubtful developmental stage in children with a history of no LBW (n=11).

No	Characteristics of respondents			Developmental aspects			
	Gender	Age (years)	Education	Gross motor	Fine motor	Speaking/language	Emotional social
1	Male	3	No school				
2	Female	4	School				
3	Female	4	No school				
4	Male	4	School				
5	Male	4	No school				
6	Male	4	No school				
7	Male	4	School				
8	Male	5	No school				
9	Female	5	School				
10	Male	5	School				
11	Female	5	School				

Based on Table 1, the results showed that the majority of respondents were aged 4 years and 5 years as many as 27 (33.8%) respectively, male (41 children or 51.2%), and school (50 children or 62.5%). The majority of respondents had a history of normal birth weight (no LBW) (42 children or 52.5%) and 60 children (75%) were in "appropriate developmental stage" category.

Table 2 depicts the results of the analysis of the relationship between LBW history and child development. The *p* value is 0.779 (< 0.05), which means that there was no significant relationship between the history of LBW and the development of children aged 3-5 years. However, the crosstab table shows that the percentage of doubtful developmental stage is higher in children with a history of no LBW. Therefore, the researchers conducted a more in-depth analysis of children aged 3-5 years who were identified as having a doubtful developmental stage (Table 3).

Table 3 shows that children aged 3-5 years who were identified as having doubtful developmental stage were mostly boys aged 4 years and had attended school. Another aspect of development that still requires stimulation is gross motor skills.

## 4. Discussion

The results showed that the highest respondents were aged 4 and 5 years. A previous study conducted showed that children with LBW experienced developmental delays at the average age of 4 to 5 years [19]. In addition, Rahayu reported that infants with a history of LBW have a greater risk of developing developmental disorders in childhood, while children with a history of LBW are at risk of developing growth disorders until the age of 2 years and are at risk of developing developmental disorders in the first 5 years of life – the risk is getting higher when parents give lack of stimulation [20].

The majority of the respondents in this study were male. A study showed that the male gender was more prone to being born with LBW [21]. On the contrary, a study in Japan found a significant relationship between LBW and female gender [22]. Gender is related to the growth and development of toddlers. In general, the determining factors that affect the growth and development of children are genetic factors, one of which is gender, where at a certain age, males and females are very different in the amount of growth speed in physical proportions. Shokri et al. conducted a meta-analysis and found that the prevalence of LBW births was higher in girls (8.41%; 95% CI: 7.47-9.45) than boys (6.67%; 95% CI: 5.86-7.59) [11].

Most of the children in this study had attended school. Children who previously did not get early childhood education can affect the stage of child development. A study showed that children who participate in play groups from an early age can achieve faster development than children who do not participate in play groups [23]. The quality of schools coupled with the family environment can affect the development of children. Azwar stated that children with education will get better developmental stimulation than children who do not attend education and the quality of good teaching staff at school can optimize child development [24].

Most respondents do not have a history of LBW. Babies with LBW can have a greater risk of experiencing signal abnormalities and abnormalities in the structure of the brain when compared to babies with normal birth weight. Furthermore, LWB babies have a risk of inflammation or inflammation in the brain that can affect the quality and number of nerves and cells in the brain. This will affect the maturity of the brain and individual development. According to Soetjningsih, the factors that influence child development include genetic factors and environmental factors, which include prenatal and postnatal factors [25]. Therefore, children with a history of LBW need to get more attention to get enough stimulation to achieve optimal development.

Most of the respondents in this study consisted of children with normal development. Child developments that were assessed in this study consisted of the development of language, gross motor, fine motor, and social skills of children. The results of this study are in line with previous research which stated that infants with a history of premature or LBW are at risk for impaired cognitive and motor development [26]. Another study also stated that babies born with low weight, especially very low birth weight babies, have the potential to experience developmental disorders in later life due to abnormalities in the structure of the brain [27].

The relationship between the history of LBW and the development of children was analyzed by *Spearman*. The  $p$  value was 0.779, which means that the  $H_0$  is accepted or, in other words, there is no relationship between a history of LBW and the development of preschool children (aged 3-5 years). This result is on the contrary to the previous study who found that children with a history of LBW tend to experience growth and development delay ( $p$  0.007) [28]. Children with a history of LBW have a risk of acquiring growth and developmental retardation in later life, which is generally occurred in the first years of a child's life. Growth is an increase in size, weight, and height. Development is an increase in the ability of more complex body structures and functions in a regular and predictable pattern as a result of the maturation process [29]. Previous research showed that infants with a history of LBW can experience age-appropriate development as long as parents practice appropriate parenting methods [3]. This can be done by encouraging early childhood stimulation, building a positive interaction, and creating a safe and secure environment for child growth and development as well as regularly checking the mile stones with health professionals.

Under five children with a history of LBW can experience mental and physical disorders. Several studies revealed that the developmental stages of children born with a history of LBW have a possibility to deviate than children with normal birth weight [8]. There are serious developmental barriers in children with a history of LBW starting from the womb until 2 years old so that they may never gain the ideal weight. If the children do not get good care, delays can occur in both physical growth and development [30].

The result of this study indicates that there is no relationship between a history of LBW with the development of preschool children (aged 3-5 years). This result can be used to motivate parents in improving child care, especially those with a history of LWB, to optimize their child growth and development. Parents can maximize in providing good nutritional intake to children considering that nutritional intake has a vital role in growth and development. In addition, stimulation by those closest to children can also affect children optimal growth and development [5]. Tarnoto et al. (2018) suggested that

programs aimed at improving parents' ability of child care can be given to both parents who have children with a history of LBW or not [31]. The crosstab results in his study showed that children with developmental disorders are more common in children who do not have a history of LBW.

## 5. Conclusion

A history of LBW can affect children's growth and development, but many of them can normally grow and developed. This is because the growth and development of children has many determining factors. This study shows the importance of stimulating under-five children both in children with a history of LBW or not.

For nurses, the results of this study can be used as a reference to increase knowledge and understanding related to children's growth and development and the history of LBW. Health education is expected to be provided on an ongoing basis to families regarding the stimulation of children's growth and development. For educational institutions, the results of this study can be used as a reference in developing research, given that LBW is not a risk factor for developmental disorders. Children's growth and development can be influenced by stimulation from parents and families. For the community, the results of this study in particular can be useful for families to pay more attention to their children by providing more optimal health efforts so that children can achieve the process of growth and development according to their age. Parents are expected to have sufficient knowledge and are expected to be able to meet physical and psychological needs to optimize child development. For further researchers, this study can be developed by researching other factors that can affect children's development such as nutritional intake. It is hoped that other variables that are considered to affect child development can be added, for example, education about providing stimulation for the child's growth and development.

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## Conflict of Interest

The authors have no conflict of interest to declare

## References

- [1] Bellman M. Developmental assessment of children. *BMJ*. 346.
- [2] Nurkhoiri E. Perbedaan dan pertumbuhan antara balita riwayat bblr dengan balita berat lahir normal di wilayah kerja puskesmas payung sekaki. 2018;6:104–111.
- [3] Sekarkinanti L, Danefi D. Gambaran pertumbuhan dan perkembangan bayi dengan riwayat bblr di wilayah kerja upkd puskesmas pagerageung kabupaten tasikmalaya tahun 2017. *J Kesehat Bidkesmas Respati*. 2018;1:52–62.
- [4] Depkes. Stimulasi deteksi dan intervensi dini tumbuh kembang anak ditingkat pelayanan kesehatan dasar. Jakarta: Bakti Husada; 2012.
- [5] Jeong J, Mccoy C, Yousafzai AK, et al. Paternal stimulation and early child development in low- and middle-income countries. *Pediatrics*. 2016;138:20161357.
- [6] Thapar A, Stergiakouli E. Genetic influences on the development of childhood psychiatric disorders. *Psychiatry*. 2008;7:277–281.
- [7] Trent M, Dooley DG, Dougé J, et al. The impact of racism on child and adolescent health. *Pediatrics*. 2019;144. DOI: 10.1542/peds.2019-1765
- [8] Sujianti, S. Pertumbuhan dan perkembangan anak prasekolah yang menggunakan gadget di TK Islam Al Irsyad 01 Cilacap. 2014;34:52–58.
- [9] Mehdi AH, Ali M, Sultan AN, et al. Association of neonatal mortality with low birth weight. *Pakistan Journal Medical Health Science*. 2020;14:282–285.
- [10] Maryunani A. Asuhan bayi dengan berat badan lahir rendah (BBLR). Jakarta: TIM; 2013.
- [11] Shokri M, Karimi P, Zamanifar H, et al. Epidemiology of low birth weight in Iran: A systematic review and meta-analysis. *Heliyon*. 2020;6:3787.
- [12] Nengsih U, Djamhuri DS. Hubungan riwayat kelahiran berat badan lahir rendah dengan pertumbuhan anak usia balita. 2016;2:59–67.

- [13] Blencowe H, Krusevec J, de Onis M, et al. National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: A systematic analysis. *Lancet Global Health*. 2019;7:849–e860.
- [14] Riskesdas. Badan penelitian dan pengembangan kesehatan.
- [15] Kamadewi D. Hubungan antara bayi berat badan lahir rendah dengan gangguan perkembangan bicara di poliklinik tumbuh kembang anak RS.DR Sardjito Yogyakarta. *Journal Medical Science*. 35.
- [16] Setyaningrum ND. Hubungan kejadian BBLR dengan perkembangan sosial emosional anak prasekolah. Politeknik Kesehatan Kementerian Kesehatan Yogyakarta; 2018.
- [17] Health Research and Development Agency. Key results basic health research 2018. 2018.
- [18] Ananditha AC. Faktor-faktor yang berhubungan dengan perkembangan motorik kasar pada anak toddler. *Jurnal Keperawatan Muhammadiyah*. 2.
- [19] Rosyidah S, Mahmudiono T. Hubungan riwayat BBLR dengan perkembangan anak prasekolah (usia 4-5 tahun) di tk dharma wanita III karangbesuki Malang. *Amerta Nutrition*. 2018;2:66–73.
- [20] Zafira R. Mengenal dan memahami tumbuh kembang anak. Yogyakarta; 2011.
- [21] Susilowati E. Faktor risiko yang berhubungan dengan kejadian berat badan lahir rendah pada neonatus yang dirawat di RSUP Prof. Dr. R. D. Kandou periode Januari 2015-Juli 2016. *e-CliniC*. 2016;4. DOI: 10.35790/ecl.4.2.2016.14468
- [22] Arima K, Kasai Y, Sugimoto M, et al. Risk factors for low birth weight infants in Japanese pregnancies: A one-year study of 2551 cases in Tokyo. *International Journal of Pediatric & Neonatal Care*. 2017;2:1–6.
- [23] Maimon, E. Hubungan mengikuti kelompok bermain dan perkembangan anak. *Sari Pediatri*. 2016;15:232.
- [24] Azwar S. Sikap manusia, teori dan pengukurannya.
- [25] Wulandary ME. Hubungan berat badan lahir rendah (BBLR) terhadap keterlambatan perkembangan. Yogyakarta: Tesis FKIK UMY; 2012.
- [26] Moonik PHL. Faktor faktor yang mempengaruhi keterlambatan perkembangan anak taman kanak-kanak. 2015:124–132.
- [27] Khairina M. Faktor-faktor yang berhubungan dengan kejadian bayi berat lahir rendah (BBLR) di wilayah kerja puskesmas kecamatan cipayung kota depok provinsi jawa barat.

- [28] Chapakia MI. Hubungan riwayat berat badan lahir (BBL) dengan perkembangan motorik halus anak usia 2-5 tahun di posyandu gonilan kartasura [Skripsi]. Fak Kedokt Univ Muhammadiyah Surakarta.
- [29] Suryati, S. Faktor-faktor yang mempengaruhi kejadian bblr di wilayah kerja puskesmas air dingin. *Artik Penelit.* 2018;6:19–28.
- [30] Tonasih T, Kumalasary D. Faktor-faktor yang mempengaruhi kejadian berat bayi lahir rendah (BBLR) di puskesmas wilayah kecamatan harjamukti kota cirebon tahun 2016. *Jurnal Riset Kebidanan Indonesia.* 2018;2:21.
- [31] Tarnoto N, Tentama F, Pranungsari D. Intervention model of children growth and development to improve stimulation skills of parents with early child. *Advance in Social Science, Education and Humanities Research.* 2018;133:218–222.