SHORT STATURE AND MOTOR DEVELOPMENT IN CHILDREN AGED 2-5 YEARS OLD

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ABSTRACT

Background: Short stature is defined as a child's height below < -2 SD based on age. Epidemiologic data shows a high percentage of Indonesian toddlers with short stature. There is fast motoric development in children above two years old. If there is a disruption in motor development, the impact will have a long-term effect on growth and development.

Aim: This research aimed to determine the relationship between short stature and motor development in children aged 2-5 years.

Method: This study used an observational analytic method with cross-sectional design and consecutive sampling techniques. There were 236 subjects in this study. Height was measured by stadiometer and short stature assessed by the WHO growth Chart, while the motor development was assessed using KPSP (Kuesioner Pra Skrining Perkembangan). Chi-Square test was used to analyze the data ($\alpha = 0.05$).

Results: Relationship between short stature and motor development variables showed a significant weak correlation ($P = 0,000$; $\phi = 0,377$) in children aged 2-5 years.

Conclusion: Short stature has a weak significant relationship with the motor development in children aged 2-5 years old.

Keywords : short stature, motor development

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INTRODUCTION

Short stature is a child's length or height lower than the normal height standard based on age and sex, which is below -2SD based on TB/U plots on WHO anthropometry. If the z-score is below -2SD, then the child is classified as short (stunted), whereas if the z-score is under -3SD, then the child is classified as very short (severely stunted).^{1,2,3}

When children are older than two years, their development, especially motor development, will increase rapidly. This phenomenon makes it easier for a child to be measured for a possible delay to their motor development aspects when they are more than two years of age.⁴ In their development, several factors are expected to cause short stature conditions in children. These causes are divided into eight groups: endocrine, chromosomal, nutritional, skeletal, idiopathic, chronic diseases, iatrogenic and intrauterine.^{2,5}

Short stature in children can be one of the risk factors of increased mortality and imbalance between bodily functions, such as cognitive, motoric, and others. Because of the many causes and effects of short stature, the Ministry of Health has launched several programs in effort to prevent short stature in children, such as the Medium Term Development Plan Program in 2015-2019. This program tries to improve the nutritional status of the

society in national construction, which is prioritized in four programs. One of them is to reduce the prevalence of stunted infants.^{3,6,7,8,9}

In 2018, the percentage of stunted toddlers had decreased to 30.8% (11.5% severely stunted children and 19.3% stunted children) with the highest percentage in East Nusa Tenggara province, 42.6%.⁶ Short stature is a nutritional problem with the largest proportion compared to the problem other nutrition and stunting is one of its forms.

METHOD

This research used an observational analytic method, and the design was cross-sectional. This study aimed to determine the relationship between short stature and motor development in children aged 2-5 years old. Data collection was done once without following up on measurements. This research was conducted in six public health centers in Kupang City, namely Puskesmas Naioni, Alak, Oesapa, Oebobo, Bakunase, and Pasir Panjang.

The study population comprised all children aged 2-5 years old, both of short and not short stature in Kupang City. Sampling used non-probability sampling technique, consecutive sampling. Consecutive sampling was done so that every subject, both short and non-short stature who came to the six public health

centers would be measured. If there were overlapping health community schedules, the researcher chooses a health community with a higher number of short stature toddlers.

Samples were 236 subjects— 118 subjects with short stature and 118 subjects, not short stature. Data analysis used chi-square test with a significance level of 5% and a phi coefficient to determine the strength.

RESULTS

Table 1. Basic Characteristics of Research Subjects

Variable	Number of Respondents (n = 236 = 100%)		Total (n / %)
	Appropriate (n / %)	Not appropriate (n=116) (n / %)	
Gender			
Male	50 / 21,1%	57 / 24,2%	107 / 45,3%
Female	70 / 29,7%	59 / 25%	129 / 54,7%
Total	120 / 50,8%	116 / 49,2%	236 / 100%
Age based on KPSP Classification			
24 months	25 / 10,6%	29 / 12,3%	54 / 22,9%
30 months	28 / 11,9%	8 / 3,4%	36 / 15,3%
36 months	22 / 9,3%	25 / 10,6%	47 / 19,9%
42 months	12 / 5,1%	20 / 8,5%	32 / 13,6%
48 months	13 / 5,5%	25 / 10,6%	38 / 16,1%
54 months	12 / 5,1%	5 / 2,1%	17 / 7,2%
60 months	8 / 3,4%	4 / 1,7%	12 / 5,1%
Total	120 / 50,8	116 / 49,2 %	236 / 100%

Notes : Appropriate : all aspects of motor development are appropriated based on age at KPSP

Not appropriate : at least one aspect is not appropriated

Table 1 shows that most subjects by gender were female, 129 children (54.7%). In the study, the percentage obtained with each age, is 22.9% aged 24-29 months, 15.3% aged 30-35 months, 19.9% aged 36-41 months, 13.6% aged 42-47 months, 16.1% aged 48-53 months, 7.2% aged 54-59 months, and 5.1% aged 60 months.

Table 2. Results of the Analysis of the Relationship between Short Stature and Motor Development in Children Aged 2-5 Years Old

Shot Stature	Motor Development		Total n (%)	P value
	Appropriate Number of Respondents n (%)	Not appropriate Numbers of Respondents (n) Percentage (%)		
Ya	36 (30,5)	82 (69,5)	118 (100)	0,00
Tidak	84 (71,2)	34 (28,8)	118 (100)	
Total	120 (50,85)	116 (49,15)	236 (100)	

Based on the results of the Chi-Square statistical test, the value of $p = 0,000$. This finding shows that a p -value < 0.05 means there was a significant relationship between short stature and motor development in children aged 2-5 years. The contingency coefficient value is 0.377, which means that the correlation was positive, but the strength was weak. the number of study subjects was 236 children with 118 short stature and 118 non-short stature, while 120 children experienced appropriate motor development and 116 children experienced inappropriate motor development. Of the

118 short stature children, 36 children experienced appropriate motor development, and 82 children experienced inappropriate motor development.

Table 3. Results of the Analysis of the Relationship between Short Stature and Aspects of Motor Development in Children Aged 24 Months Old based on KPSP Classification

Category	Type of Motoric		Short Stature		P Value
			Yes	No	
Can children take off their clothes such as: shirt, skirts, or pants? (hats and socks are not included).	Fine motor ; socialization and independence	Appropriate	17 (31,5)	24 (44,4)	0,007
		Not appropriate	11 (20,4)	2 (3,7)	0,369

Table 3 shows that the highest percentage of short stature children who have inappropriate motor development was 22.2%, the ability of children to walk upstairs by themselves in an upright position or holding on to a wall or banister. In the study of children aged 24-29 months, one aspect of motor development that shows a significant relationship was the ability of children to take off their clothes such as shirts, skirts, or pants with a value of $p = 0.007$ (≤ 0.05). The value of the phi coefficient was -0.396, which means it is negative and has a weak strength.

Table 4. Results of the Analysis of the Relationship between Short Stature and Aspects of Motor Development in Children Aged 36 Months Old based on KPSP Classification

Category	Type of Motoric		Short Stature		P value (Phi Coefficient value)
			Yes n (%)	No n (%)	
Make a straight line down at least 2.5 cm. Command the child draw another line next to the line.	Fine motor	Appropriate	12 (25,5)	25 (53,2)	0,007 (-0,394)
		Not appropriate	8 (17)	2 (4,3)	

Based on Table 4, the highest percentage of short stature children who had inappropriate motor development was 19.1%. Children can pedal a tricycle at least three-meters distance. In this study, with an age range of 36-41 months, one aspect of motor development showed a relationship with a value of $p = 0.007$ (≤ 0.05), which is the ability to make straight lines down along 2.5 cm. The value of the phi coefficient in this aspect was -0,394, which means it is negative and has a weak strength.

Table 5. Results of the Analysis of the Relationship between Short Stature and Aspects of Motor Development in Children Aged 54 Months Old based on KPSP Classification

Category	Type of Motoric		Short Stature		P value (Phi Coefficient Value)
			Yes n (%)	No n (%)	
Do not help the child and do not tell the name of this picture, tell the child to draw like this example on the blank paper provided. Give 3 chances. Can children draw like this example?	Fine motor	Appropriate	2 (11,8)	11 (64,7)	0,022 (-0,555)
		Not appropriate	3 (17,6)	1 (5,9)

Based on Table 5, the highest percentage of short stature children who have inappropriate motor development was 17.6%, which is the aspect of children's ability to draw plus signs according to the example on KPSP. The same aspect also found there was a relationship between the condition of short stature and aspects of this motor development with a value of $\phi = -0.555$, which means negative and has moderate strength.

DISCUSSION

The results of the study obtained demographic data that is explained descriptively. It was found that there are more children aged 2-5 years who have appropriate motor development compared to those who do not. Based on table 5.1, there were 50.9% of 236 children with appropriate motor development. In that

50.9%, 29.7% were female. In this study, the most significant number of research subjects by gender are women, 129 children. Based on population distribution data in the city of Kupang in 2018 there were 20,327 boys under age five and 19,837 girls under age five.¹⁰

The study (Table 1) showed that around 45.7% or as many as 59 girls experience inappropriate motor development. As many as 53.3% of the total number of boys experience inappropriate motor development. In a study conducted by Ananditha in 2017, it was found that there was a relationship between sex and motor development. The majority of male children were found to suspected have delayed gross motor development. The growth of motion function between male and female has differences which then affect each motor's ability.¹¹

The results also found that the highest percentage of children with inappropriate motor development was 12.3% of the total study subjects. This highest percentage was found in children aged 24 months according to age classification based on KPSP with a range of 24-29 months of age. In research by Ananditha, there was a linear increase and decrease between age and motor development, so there was a relationship between age and gross motor development

of children. Ananditha's study with a sample of 55 children also found that the gross motor development of children at the age of 24-35 months has a three times greater risk for developmental disorders due to age maturity and stimulation patterns that parents may have just realized to apply.¹¹ In contrast to this study, increasing age does not guarantee an increase in the number of children with appropriate motor development. However, there were similarities which indicate that children aged 24-29 months have risk of developmental disorders that is three times greater than other ages.¹²

From the results of the study, the relationship between short stature and motor development in children aged 2-5 years has a value of $p = 0.00$ ($p \leq 0.05$). This suggested that there was a significant relationship between short stature and motor development in children aged 2-5 years. This study also showed that the strength of the relationship between short stature and motor development in children aged 2-5 years was weak. this weak relationship is thought to be influenced by genetic factors, stimulation patterns, and other factors that can also affect the relationship between the two variables. This is consistent with research by Rezky, Utami, and Andinawati in 2017, which showed that there was a relationship between nutritional status and the gross

motor development of preschool-aged children in the work area Kalisongo health community¹³. Research by Kasenda, Sarimin, and Obnibla showed a relationship between nutritional status and motor development of preschoolers in GMIM Solafide Kindergarten, Minahasa Regency.⁹ These studies prove that growth disorder can cause developmental disorders similar to the results obtained from this study.

From the results, it was found that there is a significant relationship between short stature and three aspects of motor development, each of which was found at age 24 (Table 3), 36 (Table 4), and 54 months (Table 5). Two of the three aspects have a negative and weak relationship. In contrast, the other one has a negative and medium strength relationship. Variations in growth and development may cause this difference. It can trigger differences in the maturity of the nervous system and muscles experienced by each child, and variations in the application of stimulation patterns by parents that can trigger variations in developmental delay well.^{7,13,14} This delay can be caused by an imbalance between stimulation and/or other factors such as hormonal, external environment besides family and others.

Motor stimulation is an essential factor in increasing a child's motor skills. Inadequate stimulation can cause motor

skills to be inhibited because the stimulation is an initial stimulus provided by parents/caregivers and affects the speed of motor development.^{7,15,16} This was evidenced in research by Hairunis et al. in 2018, which showed that growth stimulation is associated with toddler development. Knowledge and education of parents/caregivers also become an important factor in determining whether the stimulation given to a child is good. Knowledge of good health will make the mother apply a good pattern of stimulation.⁷

The child's nutritional status also plays a role in motor development, therefore if the child suffers from malnutrition, the child may experience inhibition of nerve and muscle cells' proliferation or growth and lead to impaired motor development processes.^{7,17} Based on data from the Kupang City population health profile in 2018, only 23,3% of infants aged <6 months received exclusive breastfeeding, and 51.5% of toddlers receiving health services.¹¹ The data shows that there are still many toddlers in Kupang City whose nutritional status is problematic, which can be one of the triggers for short stature and motor delay.

Hormones in children determine how a child's motor ability can develop, for example, in children with TSH

deficiency or growth hormone can cause motor delays due to inhibition of metabolic processes in cells or cell growth processes that can cause weakness of the muscular and nervous systems. Deficiency of these two hormones can also disrupt the myelination process in the nervous system, so it disrupts the process of developing motor skills.^{18,19}

Unlike the case in other aspects, there was no significant relationship between the short stature and these motor aspects. This is thought to be caused by many children who are included in the short stature's type of normal variation, so most children aged 30, 42, 48, and 60 months do not experience a motor delay.^{2,7} The absence of a significant relationship can also occur if the number of samples is inadequate to create the significance of the relationship between the two variables. Or it could be because most children do experience short stature in the type of pathology, but because of the support of motor stimulation and regular exercise, their motor development is not hampered.²⁰

CONCLUSION

Based on the research results on the relationship between short stature and motor development in children aged 2-5 years in 6 health centers in Kupang City

with 236 respondents conducted in July 2019, it can be concluded as follows:

1. Short stature has a weak significant relationship with the motor development of children aged 2-5 years.
2. The number of non-short stature children aged 2-5 years who experience motor development delay is 34 out of 236 (28.8%) children. Those who do not experience motor development delay are 84 out of 236 children (71.2%).
3. The number of short stature children aged 2-5 years who experience motor development delay is 82 out of 236 children (69.5%). Those who do not experience motor development delay are 36 out of 236 children (30.5%).
4. In the age classification of KPSP, certain aspects of motor development have a negative relationship between short stature and motor development, those are:
 - The ability of children to take off their clothes such as shirt, skirts or pants at 24 months of age with a weak strength of relationship;

- The ability to draw a straight line down at least 2.5 cm at 36 months of age with a weak strength of relationship; and
- The ability of children to draw the "added" sign according to the example on KPSP at the age of 54 months with moderate strength of the relationship.

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