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Anthropometric Parameters among Children Under 6 Years with Stunting

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Abstract

Anthropometric measurement is a quantitative measurement as a nutritional status and can describe composition of the body. Stunting is when children have a low height-for-age. There are potential causes of stunting in Indonesia, including factor maternal nutritional status, breastfeeding practice, complementary feeding practice, exposure to infection, and related distal determinants such as education, dietary pattern, health care, and water sanitation hygiene. The objective of the research was to assess the association between gender, age and anthropometric parameters (weight-for-age, weight-for-height, body mass index for age) among children-under-six-years with stunting. The research used a cross sectional method which used documentation research of gender, weight, height or length and age reports of 25.158 children under six years. The anthropometric parameters of the children were categorized using weight-for-age (WAZ), weight-for-height (WHZ), body mass index for age. This research used spearman rank test and binary logistic regression to analyze association between gender, age, weight-for-age, weight-for-height, body mass index for age, and height or length-for-age. **Results:** There were male 14.027 (55.8%), 2-6 years 15.789 (62.8%), with normal anthropometric parameter (weight- for-age, weight-for-height, and body mass index for age in stunted children. There was no significantly correlation between the children's gender and height-for-age (□=0.096) and OR 0.993 (0.933- 1.056). Furthermore, there was low significantly correlation between age, anthropometric parameter (weight-for-age WAZ, weight-for-height WHZ and body mass index for age) with height-for-age (□=0.000). Stunted children who had normal nutritional status were 0.469 times more likely to experience stunting.

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INTRODUCTION

Stunting is a condition as a result of chronic restriction of a child's potential growth by the cumulative effects of inadequate intake and poor health conditions that result from poverty. This restricted growth is an important cause of morbidity and mortality in infants and children (Chirande et al., 2015). Children are classified as stunting if their length or height according to their age is lower than the national standards (Permenkes, 2020). According to "*The Conceptual Framework of the Determinants of Child Undernutrition*," "*The Underlying Drivers of Malnutrition*," the main causes of nutritional problems in children, including stunting, are low nutritional intake and health status. Stunting is one of the nutritional problems in the world nowadays, especially in poor and developing countries (Black, Pérez-Escamilla, & Rao, 2015). Stunting is a problem because it is associated with an increased risk of illness and death, not optimal brain development, resulting in delayed motor development and mental growth retardation (Torlesse, Cronin, Sebayang, & Nandy, 2016). Child stunting reduction is the first of goals in The Global Nutrition Targets for 2025 (Beal, Tumilowicz, Sutrisna, Izwardy, & Neufeld, 2018). Early-life stunting is correlated to negative functional outcomes, and growth deficiency in infancy and early childhood is frequently permanent, leading to short stature in adolescence and adulthood. Stunting is linked to a higher risk of infant mortality, increased infection vulnerability, and delayed cognitive and psychomotor growth(Akombi et al., 2017; Mediani, 2020). Stunting has long-term effects, such as lower academic performance, decreased workability, and poor pregnancy outcomes. Stunting affects approximately one-third of children under five worldwide, with a higher incidence in low-resource countries in Sub-Saharan Africa and South Asia (Pradhan, Dhital, & Subhani, 2016; Sitorus, Natalia, Purba, Mutahar, & Fujianti, 2019).

According to WHO, in 2018, more than 20% of children under 5 years of age, namely around 165 million children, were stunted. Meanwhile, at the Asian level, Indonesia is in the fifth rank of the highest stunting prevalence. Based on the results of the 2016 *Basic Health Research* for the National scale, the prevalence of stunted children under five in Indonesia is 37.2%, if the stunting problem is still above 20%, so it is a public health problem (Sitorus et al., 2019).

In Ethiopia, evidence indicates that malnutrition affects children as early as the first 12 months of life when development stalls due to inadequate infant feeding practices (Mengesha, Vatanparast, Feng, & Petrucka, 2020). Identifying the possible determinants of chronic undernutrition is a critical step in reducing the burden of stunting to effectively achieve the Accelerated Stunting Reduction targets (Mediani, 2020). There are numerous potential causes of stunting in Indonesia, including factor maternal nutritional status, breastfeeding practice, complementary feeding practice, exposure to infection, and related distal determinants such as education, dietary pattern, health care, and water sanitation hygiene (Abreha, Walelign, & Zereyesus, 2020). The research objective was to find out the nutritional status of children who experienced stunting.

Objective

To assess the association between gender, age, weight-for-age (WAZ), weight-for-height (WHZ), body mass index-for-age and height-for-age (HAZ).

METHODS

The research used a cross sectional which used documentation research of gender, weight, height or length and age reports of 25.158 children under six years in all of Public Health Center at Malang Regency 2019. The anthropometric parameters of the children were categorized using weight-for-age (WAZ), weight-for-height (WHZ), body mass index for age. This research analysis used spearman rank test to analyze association between gender, age, weight-for-age, weight-for-height, body mass index for age, and height or length-for-age.

The measurements of anthropometric parameters (weight and length/ height) in the anthropometric parameter reports were obtained using standardized procedures from the Ministry of Health. Anthropometric parameters Z score and the prevalence of stunting and severe stunting based on the WHO reference values (WHO, 2009). The anthropometric parameters were defined as the proportion of the children whose length or height-for-age (HAZ), weight-for-height (WHZ), weight-for-age (WAZ), and body mass index (BMI) for age and score more than two standard deviations below the median of population standard (or above the referent median of WHZ). For calculation of BMI, the following formula was used. BMI = body weight

(kg)/ body height (m^2). Children's characteristics included age and gender from children.

Ethical Issues : Ethical approval was obtained from Health Research Ethics Committee, State Polytechnic of Health Malang, Indonesia Reg. No 158/KEPK-POLKESMA/2021. All data obtained were anonymized.

Statistical Analysis

Quantitative parameters are presented as descriptive. Statistical analysis bivariate using Spearman rank test and multivariate analysis using binary logistic regression to analyze association between gender, age, weight-for-age, weight-for-height, body mass index-for-age, and height or length-for-age. All analyses were calculated using SPSS 26 with $p < 0.05$ and 95% confidence interval

Table 1. Research Subject Characteristic

Description	f (%)
Gender	
Male 14.027 (55.8)	
Female	11.131 (44.2)
Age	
0 - 6 month	1.037 (4.1)
6 - 24 month	8.332 (33.1)
2 – 6 years	15.789 (62.8)
Anthropometric parameter: height-for-age (HAZ)	
Stunted	17.927 (71.3)
Severe stunted	7.231 (28.7)
Anthropometric parameter: weight-for-age (WAZ)	
Severely underweight	1.171 (4.7)
Underweight	5.630 (22.4)
Normal	17.744 (70.5)
Risk obesity	613 (2.4)
Anthropometric parameter: weight-for-height (WHZ)	
Severely wasted	26 (0.1)
Wasted	854 (3.4)
Normal	16.535 (65.7)
Possible risk of weight	7.743 (30.8)
Anthropometric parameter: body mass index-for-age	
Severely wasted	15 (0.1)
Normal	23.780 (94.5)
Possible risk of overweight1.363 (5.4)	

(Source: Secondary Data; 2019)

RESULT

The research used a cross sectional which used documentation research of gender, weight, height or length and age reports of 25.158 children under six years in all of Public Health Center at Malang Regency, Indonesia with 25,158 children under-six-years.

Demographic characteristic of stunted children under six years old in Malang Regency is shown in Table 1. The sample consisted of male 14.027 (55.8%) and female 11.131 (44.2%) children under six years. Most of the children were of 2- 6 years old and counted as many as 15.789 (62.8%). According to the level of severity based on indicator of anthropometric parameters height-for-age (HAZ) 17.927 (71.3%) from all children under-six-years were stunted. Meanwhile, using other anthropometric parameter: weight-for-age (WAZ) 17.744 (70.5%), weight-for-height (WHZ) 16.535 (65.7%) and body mass index-for-age 23.780 (94.5%) of the stunted children was categorized into normal nutritional status.

Table 2 above shows that cross-tabulation results between gender and age with anthropometric parameters in children who are stunted are primarily male with normal nutritional status. The result of cross-tabulation between gender and stunting showed no correlation between gender and stunting, which was proven by the value of $\alpha = 0.096$. Meanwhile, the result of cross-tabulation between age and stunting showed a correlation, which was proven by the values of $\alpha = 0.000$ and $r = 0.085$ (very low correlation). The highest number of severe stunting in the age of 6-24 months was 2800 children (11.1%) and categorized stunting in the age of 36- 72 month are 7304 children (29%). The result of cross-tabulation between anthropometric parameters, weight-for-age (WAZ), weight- for- height (WHZ) and body mass index-for-age any correlation with the value of $\alpha = 0.000$ and majority of children-under-six years with stunting in normal nutritional status.

DISCUSSION

The research showed that there was no correlation between gender and stunting, which was proven by the result of p value =0.096 ($p > 0.05$) and

Table 2. Analysis Demographic and Anthropometric Parameters In Stunting Children

Description	Bivariate Analysis		Multivariate Analysis	
	Severely stunted	Stunted	OR	P value
Gender				
Male	4091 (16.3)	9936 (39.5)	0.993	0.814
Female	3140 (12.3)	7991 (31.8)	(0.933 – 1.056)	
	$\alpha = 0.096$ r = 0.010			
Age				
0-6 month	369 (1.5)	668 (2.7)	1.122	0.015
6-24 month	2800 (11.1)	5532 (22.0)	(1.023- 1.230)	
24- 36 month	1631 (6.5)	4423 (17.6)		
37- 72 month	2431 (9.7)	7304 (29.0)		
	$\alpha = 0.000$ r = 0.085			
Anthropometric Parameters (Weight-For-Age (WAZ)				
Severely underweight	852 (3.4)	319 (1.3)	6.018	0.000
Underweight	2037 (8.1)	3593 (14.3)	(5.640 – 6.421)	
Normal	4165 (16.6)	13579 (54.7)		
Obesity	177 (0.7)	436 (1.7)		
	$\alpha = 0.000$ r = 0.237			
Weight For Height (WHZ)				
Severely wasted	13 (0.1)	13 (0.1)	0.208	0.000
Wasted	199 (0.8)	655 (3.7)	(0.193 – 0.223)	
Normal	3727 (14.8)	12808 (50.9)		
Possible risk of weight	3292 (13.1)	7743 (30.8)		
	$\alpha = 0.000$ r = 0.200			
Body Mass Index- For Age				
Severely wasted	1 (0.004)	14 (0.06)	0.122	0.000
Normal	6308 (25.07)	17472 (69.4)	(0.107 - 0.141)	
Possible risk of overweight	922 (3.7)	441 (1.8)		
	$\alpha = 0.000$ r = 0.202			

(Source: Secondary Data; 2019)

r=0.010. Then, there was no correlation between gender and stunting in children under six with a value of α=0.618. Accordingly, gender is not a factor that affects the incidence of stunting (Abeway, Gebremichael, Murugan, Assefa, & Adinew, 2018; Hasegawa, Ito, & Yamauchi, 2017; Yaya, Odusina, Uthman, & Bishwajit, 2020). In general boys children were more likely than girls to be lower than standard normal nutritional status (Harding, Aguayo, & Webb, 2018). Male children had a significantly higher risk of being stunted and severely stunted than their female counterpart. This gender based health inequality maybe as result of community specific cultures, on other hand females are culturally expected to be less active and stay at home with their mothers near food preparation (Akombi et al., 2017). Similar research on the description of nutritional status in children, the measurement of nutritional status according to sex in children shows that the frequency of girls who have a good nutritional status is greater than that of boys; it is because growth occurs faster in girls and slower in boys (Hasegawa et al., 2017). There are differences in fat tissue in men and women and differences in skinfold thickness between girls and boys, which researchers stated that women are thicker than men. In general, it appears that girls are fatter than boys. The above matters will not only affect body weight and height but also their nutritional status (Akombi et al., 2017).

Stunting is an indicator of long- standing malnutrition. There is linked to maternal nutritional and

environment factors and has been described as a form of adaptation to social environment (Saleemi, Ashraf, Mellander, & Zaman, 2001). Although many studies have been conducted on the anthropometric parameters as nutritional status in children-under-six-years, less information can be found about growth and nutritional status under six years because of this data only from children. Among the most important reasons for this lack of information, it is the difficult to interpret anthropometric data in these age groups. It contains the rapid changes in somatic growth, problems of dealing with variations in maturation, and difficulties separating normal variations from those associated with health risks (Pradhan et al., 2016). Furthermore, the use and interpretation of indicator anthropometric parameters such as height-for-age z scores (HAZs) for characterizing growth patterns have been a debated subject (Akombi et al., 2017). Moreover, it showed that using Z scores standard from Indonesia Ministry of Health. The research results show that age is associated with the incidence of stunting with a p-value of 0.000 ($p<0.05$) and OR 1.1 (1.023-1.230). Children aged 2-6 years are at greater risk of stunting due to the child's diet used since an early age besides the weaning period at 2 years of age. So that, the child is at risk of nutritional problems, and long-term problems can become stunted. Short-term indicators of nutritional status were weight-for-age WAZ, and long-term was height-for-age HAZ.

The research results showed if children-under-six years with stunting have normal/good nutritional status, using anthropometric parameter weight-for-age (WAZ), weight- for height (WHZ) and body mass index- for- age. It was because stunting is related to chronic nutritional problems indicators of children based on the height-for-age (HAZ). Nutritional problems for children-under-six- years can cause severe problems for their health, delay in growth and development, cognitive development. It can be concluded that children under-six years who have low nutritional status can have stunting problems with OR 0.122 (0.107- 0.141) and p value= 0.000 ($p>0.05$). Stunting in children is a chronic impact of macro and micronutrient deficiency, especially during the first 1000 days of life. It can cause the emergence of irreversible disruption in children's physical development, which causes a decrease in cognitive and motor skills and a decrease in work performance. If the disorders of growth and development in children due to malnutrition do not get intervention early, they will continue into adulthood(Akombi et al., 2017; Shekar et al., 2017).

It is due to nutritional deficiencies, which occur for a long time, and there is a slowdown in growth (Chattopadhyay et al., 2019). Meanwhile, the growth of weight according to age is acute. It was in a short time which was very sensitive in the environment change. For example, when the family environment prepares adequate nutrition/food intake, body weight will quickly increase or others.

This research has some limitations. Being a cross sectional research, using documentation research conclusions regarding causal relation could not be drawn. Anthropometric parameter has a low sensitivity that occur at the time of measurement. In addition, this research using data from different public health centers that might have differences in measurement technique, measurement tools and personnel that potentially leads to lower accuracy.

CONCLUSION

In this research it can be concluded that

1. There is no significantly correlation between the children's gender and height-for-age ($\alpha=0.096$).
2. There is low significant correlation between age and stunting anthropometric parameter based on height-for-age with $\alpha=0.000$, r= 0.085 and OR 1.122 (1.023- 1.230).
3. There is low correlation between anthropometric parameter (weight- for-age WAZ, weight-for-height WHZ, and body-mass-index for age) and height-for age incidence of stunting with $\alpha=0.000$

SUGGESTION

For mothers who have children-under-six years, especially in infant and children, they can do screening risk of stunting, so it can be prevented by providing intake adequate from quantity and quality of food, macro and micronutrient and maintain the health of children from infectious disease especially in Gastrointestinal track infectious so that children can achieve a catch-up grow.

Then, planning the public strategies can help to control childhood undernutrition according to underlying factors. Health promotion about nutritional adequacy, especially responsive feeding, supplemen-

tary feeding, or practical feeding from mother to child, may improve children's nutritional status who can measure using indicator of anthropometric parameters.

Parents need to always maintain the health of their children-under-six years and provide a variety of foods with macro and micronutrient. Besides, the health public center can further improve the programs that have been implemented for the prevention and management of stunting. A more targeted program in providing interventions to overcome stunting and a proper evaluation should be implemented because there are still many stunted children under six years.

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