CHANGES IN LENGTH/HEIGHT DEFICIT LEVEL CHILDREN TO STUNTING IN INDONESIA

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ABSTRACT

Background: Stunting is the most prevalence form of childhood undernutrition, with an estimated 155 million children worldwide falling below 2 SD from the WHO standard length/height-for-age median in 2016. Child stunting and linear growth faltering have declined over the past few decades and several countries have made exemplary progress. This study aimed to examine if Indonesia had made progress in reducing childhood stunting based on data taken from Basic Health Research (Riskesdas) in 2013 and 2018, respectively.
Subjects and Method: These were two cross-sectional studies conducted in 2013 and 2018, respectively. Samples of 30,616 and 28,727 children were selected from Basic Health Research (Riskesdas) in 2013 and 2018, respectively. The dependent variable was deficit in height for age (cm) as compared with the WHO standard for stunted and normal children by age. The difference in mean deficit of height for age between 2013 and 2018 for both male and female children was tested by t-test.
Results: Mean deficit of height for age in 2018 male children (Mean= 2.89; SD= 2.92) was smaller than that in 2013 (Mean= 3.86; SD= 3.55), and it was statistically significant ($p< 0.001$). Likewise, mean deficit of height for age in 2018 female children (Mean=2.87; SD= 3.01) was smaller than that in 2013 (Mean= 3.84; SD= 3.61), and it was statistically significant ($p< 0.001$).
Conclusion: Mean deficit of height for age as compared with the WHO standard in 2018 is smaller than that in 2013 for both male and female children under five years of age. Indonesia has made progress in reducing childhood stunting based on data taken from Basic Health Research (Riskesdas) in 2013 and 2018, respectively.

Keywords: stunting, height deficit, catch-up growth, linear growth retardation, children

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BACKGROUND

Stunting is a condition of failure to thrive in children under five due to chronic malnutrition which results in the child's height being too short for his age. The definition of short and very short is nutritional status based on the index of Height for Age (HAZ). Short toddlers (stunting) can be known when a toddler has been measured in length or height, then compared with the standard, and the results are below normal. Short toddlers are toddlers with nutritional status based on length or height according to age when compared to the 2006 WHO-MGRS (Multicentre Growth Reference Study) standard,

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the z-score value is less than -2SD and is categorized as very short if the z-score is less from -3SD (WHO, 2006).

The negative impact that can be caused by nutritional problems in the growth period before the age of 2 years in the short term is disruption of brain development, intelligence, impaired physical growth, and metabolic disorders in the body. Whereas in the long term the bad consequences that can be caused are decreased cognitive abilities and learning achievement, decreased immunity so that it is easy to get sick, and a high risk for the emergence of diabetes, obesity, heart and blood vessel disease, cancer, stroke, and disability in old age. and uncompetitive work quality which results in low economic productivity (de Onis and Branca, 2016).

Stunting in children under five is still a problem in several developing countries today. According to WHO, the prevalence of stunted toddlers becomes a public health problem if the prevalence is 20 percent or more. The prevalence rate of stunting in children under five in Indonesia according to Basic Health Research (Riskesdas) data in 2007 and 2013 relatively did not experience much change, namely 36.8 percent and 37.2 percent (Ministry of Health RI, 2007, 2013). The prevalence of stunting under five in 2018 decreased by around 6 percent compared to 2013 to 30.8 percent (Ministry of Health, 2018). This is because reducing the prevalence of stunting is one of the national development priorities listed in the main targets of the 2020-2024 National Medium-Term Development Plan. The target for reducing the prevalence of stunting (short and very short) in children under 5 years old is 14 percent by 2024 (Bappenas, 2020).

So far, it is known that the prevalence of stunting is high, but it is not known how much change occurs in the difference or deficiency (deficit) in height (HAD) achieved by Indonesian children under the WHO normal limit (HAZ= -2SD). Based on this, it is necessary to study whether the change in prevalence from 2007 to 2013 is indeed a bad situation or there has been improvement. The measure used here is the absolute height-for-age deficit. The rate of change measured using the parameter of the level of deficit experienced by children under five in 2007 and 2013. If the level of deficit is getting smaller, actually there has been an improvement even though the prevalence has not changed. Likewise with the prevalence of stunting from 2013 to 2018, how much decreased the deficit level in 2018 resulted in a decrease in the prevalence of stunting.

With the prevalence rate of stunting under five in 2007, 2013 and 2018 which was still above 30%, what is the actual height deficit level according to absolute age from the WHO normal limit for Indonesian children under five? This analysis aims to obtain an overview of changes in the level of the length/height deficit in stunted children from 2007, 2013, 2018.

SUBJECTS AND METHOD

1. Study Design

This study is a descriptive analytic study with data sources from the Basic Health Research (Riskesdas) in

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2007, 2013 and 2018 which were collected using a cross-sectional.

2. Population and Sample

The population of this study were all children under five aged 0-59 months at the 2007 2013 and 2018 Riseksdas. The samples analyzed were stunted children aged 0-59 months who had complete data and met the inclusion criteria of the study. The number of samples analyzed from Riskesdas 2007, 2013, and 2018 data were 11,446, 30,616, and 28,727 children, respectively.

3. Study Variables

The dependent variable is the change in the level of height deficit in stunted children under five. The independent variables are age, gender, family economic status.

4. Operational Definition of Variables

The nutritional status of children is determined based on the HAZ indicator, where the length/height value of each child is converted into a standardized value (Z-score) according to age using WHO anthropometric standards for children under five. Furthermore, the Z-score is categorized as stunting if the value is <-2 SD (WHO, 2006). Children with z score HAZ <-6 SD or > 6 SD were not included in the analysis. The level of deficit in length/height was obtained by calculating the difference in the absolute length/height (cm) of children from the Riskesdas measurement against the WHO standard -2 SD limit, according to age (days) and gender.

Measurement of length/height of children under five was carried out using a portable length/height measuring instrument with a measuring capacity of two meters and an accuracy of 0.1 cm. Measurements were carried out by enumerators with a health education background who had been trained to take measurements of length/height before.

Children's ages were grouped into 11 groups: 0 months, 1-5 months, 6-11 months, 12-17 months, 18-23 months, 24-29 months, 30-35 months, 36-41 months, 42-47 months, 48-53 months, and 54-59 months. The average value of the difference (deficit) in length/height of stunting children will be displayed according to that age group.

The economic status of the family was categorized according to quintiles. Quintile 1 (lowest economic level), quintile 2 (lower middle class), quintile 3 (middle), quintile 4 (upper middle), quintile 5 (top). To get a picture of the length/height deficit according to the economic level, it is done by calculating the average difference in length/height according to the economic level of stunted children under five.

5. Data Analysis

Data analysis was carried out through the stages of editing, data cleaning, and statistical analysis. To analyze the characteristics of the study subjects, univariate analysis using descriptive statistics was used. To see the difference in the average level of deficit in length/height according to age group and deficit in length/height according to economic status between 2007 and 2013 and 2013 and 2018, bivariate analysis was used using the mean independent sample T-test difference. In carrying out this processing and

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analysis we use the IBM SPSS Satistics 25 statistical program.

6. Research Ethics

Basic Health Research in 2007, 2013 and 2018 has received research ethics approval from the Health Research Ethics Commission of the Health Research and Development Agency, Ministry of Health of the Republic of Indonesia.

RESULTS

The distribution of respondents under five according to the characteristics of Riskesdas 2007, 2013 and 2018 is presented in Table 1. The proportion of children under five by gender is almost balanced between boys and girls. The proportion of stunted children under five in Riskesdas 2007 and 2013 was relatively the same, while in Riskesdas 2018 there was a significant decrease. Based on economic status, the distribution of respondents is more in the middle to the lowest group.

Table 1. Characteristics of Respondents

Characteristics	basic health research 2007		basic health research 2013		basic health research 2018	
	Total	Percentage	Total	Percentage	Total	Percentage
Gender						
Male	14,543	51.4	38,206	50.6	44,235	50.9
Female	13,770	48.6	37,368	49.4	42,721	49.1
Nutritional status category (TB/U)						
Stunting	11,446	40.4	30,616	40.5	28,727	33.0
Normal	16,867	59.6	44,958	59.5	58,229	67.0
Economic status						
Bottom	6,973	24.7	11,368	15.0	19,641	22.6
Lower Middle	6,269	22.2	13,643	18.1	18,199	20.9
Intermediate	5,683	20.1	16,235	21.5	17,281	19.9
High School	4,998	17.6	18,956	25.1	16,014	18.4
Top	4,360	15.4	15,372	20.3	15,821	18.2
Age group (months)						
0	249	0.9	1,072	1.4	1,307	1.5
1-5	1,996	7.0	5,808	7.7	6,913	7.9
6-11	2,620	9.3	6,943	9.2	8,982	10.3
12-17	3,355	11.8	7,000	9.3	8,193	9.4
18-23	2,205	7.8	7,647	10.1	8,634	9.9
24-29	3,541	12.5	6,999	9.3	8,586	9.9
30-35	2,356	8.3	7,530	10.0	8,997	10.3
36-41	3,993	14.1	7,672	10.2	8,360	9.6
42-47	2,306	8.1	8,373	11.1	9,232	10.6
48-53	4,269	15.1	8,316	11.0	8,758	10.1
54-59	1,423	5.0	8,214	10.9	8,994	10.3
Total	28,313	100.0	75,574	100.0	86,956	100.0

Table 2 presents the average length/height deficit of stunted children under five based on the characteristics of sex, economic status and age group. The age group will be discussed in a separate sub-chapter. It

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can be seen that during a decade there has been a change in the level of deficit in height attainment of stunted children under five, where in 2007 the height of stunted children under five in Indonesia, both male and female, when compared with the growth standards of the WHO, experienced a deficit (deficit).) about 4.9 cm. In 2013 it was getting better with a height gain deficit of about 3.9 cm. In 2018 the achievement of height is getting closer to the standard with a smaller difference, which is about 2.9 cm.

Based on economic status, in 2007 the height deficit of stunting children under five in Indonesia was relatively the same, namely around 4.8 cm for all levels of economic status. In 2013 and 2018 we began to see differences where children living with better economic levels achieved better height, indicated by the smaller difference in height with standard.

Table 2. Average length/height deficit of stunted children under five according to the characteristics of Riskesdas 2007, 2013, 2018

Characteristics	basic health research 2007		basic health research 2013		basic health research 2018	
	Mean	SD	Mean	SD	Mean	SD
Gender						
Male	-4.85	3.77	-3.86	3.55	-2.89	2.92
Female	-4.82	3.80	-3.84	3.61	-2.87	3.01
Economic status						
Bottom	-4.82	3.74	-4.16	3.52	-3.09	2.99
Lower Middle	-4.89	3.81	-3.87	3.60	-2.87	2.94
Intermediate	-4.80	3.76	-3.72	3.52	-2.76	2.86
High School	-4.78	3.80	-3.70	3.52	-2.83	3.00
Top	-4.89	3.85	-3.84	3.74	-2.70	3.05
Age Group (month)						
0	-2.58	2.12	-1.64	1.56	-1.83	1.55
1-5	-3.13	2.23	-3.05	2.23	-2.57	2.08
6-11	-3.68	2.53	-3.29	2.43	-2.48	2.09
12-17	-3.93	2.84	-3.32	2.64	-2.57	2.19
18-23	-4.59	3.18	-3.95	3.04	-3.14	2.63
24-29	-4.81	3.58	-3.68	3.46	-2.71	2.91
30-35	-4.94	3.58	-3.98	3.64	-2.88	3.03
36-41	-5.47	4.11	-4.09	3.77	-3.11	3.24
42-47	-5.26	4.21	-4.10	4.04	-2.95	3.34
48-53	-5.86	4.55	-4.52	4.41	-3.07	3.41
54-59	-5.71	4.63	-4.20	4.39	-3.12	3.60

Table 3 and Table 4 show the difference in the average length/ height deficit of stunted children under five to reach the normal standard limit of -2 SD between 2007 and 2013 and 2013 and 2018. The length/ height deficit of stunting children under five in Indonesia from the WHO standard between Riskesdas in 2007 and 2013 showed a significant difference ($p<0.001$). It can be seen that there is an improvement in the achievement of the height of the population of children under five in

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Indonesia, both based on gender and family economic status. Although the prevalence of stunting is still above 30 percent, the average height achievement of stunted children under five in 2013 has increased by around 0.99 cm compared to the previous 5 years.

Table 3. Differences in Mean Deficit Length/Height of Stunting Toddlers to Reach the -2 SD Limit

Characteristics	Basic health research 2007		Basic health research 2013		95% CI		p
	Mean	SD	Mean	SD	Lower	Upper	
Gender							
Male	-4.85	3.77	-3.86	3.55	-1.12	-0.91	<0.001
Female	-4.82	3.80	-3.84	3.61	-1.09	-0.86	<0.001
Economic status							
Bottom	-4.82	3.74	-4.16	3.52	-0.84	-0.54	<0.001
Lower Middle	-4.89	3.81	-3.87	3.60	-1.20	-0.87	<0.001
Intermediate	-4.80	3.76	-3.72	3.52	-1.25	-0.91	<0.001
High School	-4.78	3.80	-3.70	3.52	-1.33	-0.96	<0.001
Top	-4.89	3.85	-3.84	3.74	-1.36	-0.94	<0.001
Age Group (month)							
0	-2.58	2.12	-1.64	1.56	-1.19	-0.13	0.014
1-5	-3.13	2.23	-3.05	2.23	-0.24	0.14	0.584
6-11	-3.68	2.53	-3.29	2.43	-0.55	-0.18	<0.001
12-17	-3.93	2.84	-3.32	2.64	-0.72	-0.37	<0.001
18-23	-4.59	3.18	-3.95	3.04	-0.86	-0.42	<0.001
24-29	-4.81	3.58	-3.68	3.46	-1.28	-0.86	<0.001
30-35	-4.94	3.58	-3.98	3.64	-1.26	-0.76	<0.001
36-41	-5.47	4.11	-4.09	3.77	-1.60	-1.14	<0.001
42-47	-5.26	4.21	-4.10	4.04	-1.45	-0.88	<0.001
48-53	-5.86	4.55	-4.52	4.41	-1.74	-1.23	<0.001
54-59	-5.71	4.63	-4.20	4.39	-2.04	-1.32	<0.001

Based on Table 4, it can be seen that the body length deficit of stunting children under five in Indonesia between Riskesdas in 2013 and 2018 shows a significant difference ($p < 0.001$). There was an improvement in the achievement of the height of the population of children under five in Indonesia with an average increase in the achievement of length/height of about 0.97 cm both based on gender and family economic status.

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Table 4. Differences in Mean Deficit Length/Height of Stunting in Children Badan Reach the -2 SD Limit

Characteristics	Basic health research 2013		Basic health research 2018		95% CI		p
	Mean	SD	Mean	SD	Lower	Upper	
Gender							
Male	-3.86	3.55	-2.89	2.92	-0.90	-0.76	<0.001
Female	-3.84	3.61	-2.87	3.01	-1.01	-0.86	<0.001
Economic status							
Bottom	-4.16	3.52	-3.09	2.99	-1.08	-0.89	<0.001
Lower Middle	-3.87	3.60	-2.87	2.94	-1.02	-0.80	<0.001
Intermediate	-3.72	3.52	-2.76	2.86	-0.96	-0.73	<0.001
High School	-3.70	3.52	-2.83	3.00	-0.92	-0.67	<0.001
Top	-3.84	3.74	-2.70	3.05	-1.11	-0.81	<0.001
Age Group (month)							
0	-1.64	1.56	-1.83	1.55	-0.27	0.33	0.839
1-5	-3.05	2.23	-2.57	2.08	-0.59	-0.31	<0.001
6-11	-3.29	2.43	-2.48	2.09	-0.95	-0.68	<0.001
12-17	-3.32	2.64	-2.57	2.19	-0.85	-0.59	<0.001
18-23	-3.95	3.04	-3.14	2.63	-0.86	-0.59	<0.001
24-29	-3.68	3.46	-2.71	2.91	-1.05	-0.75	<0.001
30-35	-3.98	3.64	-2.88	3.03	-1.09	-0.78	<0.001
36-41	-4.09	3.77	-3.11	3.24	-1.16	-0.83	<0.001
42-47	-4.10	4.04	-2.95	3.34	-1.25	-0.90	<0.001
48-53	-4.52	4.41	-3.07	3.41	-1.40	-1.02	<0.001
54-59	-4.20	4.39	-3.12	3.60	-1.05	-0.67	<0.001

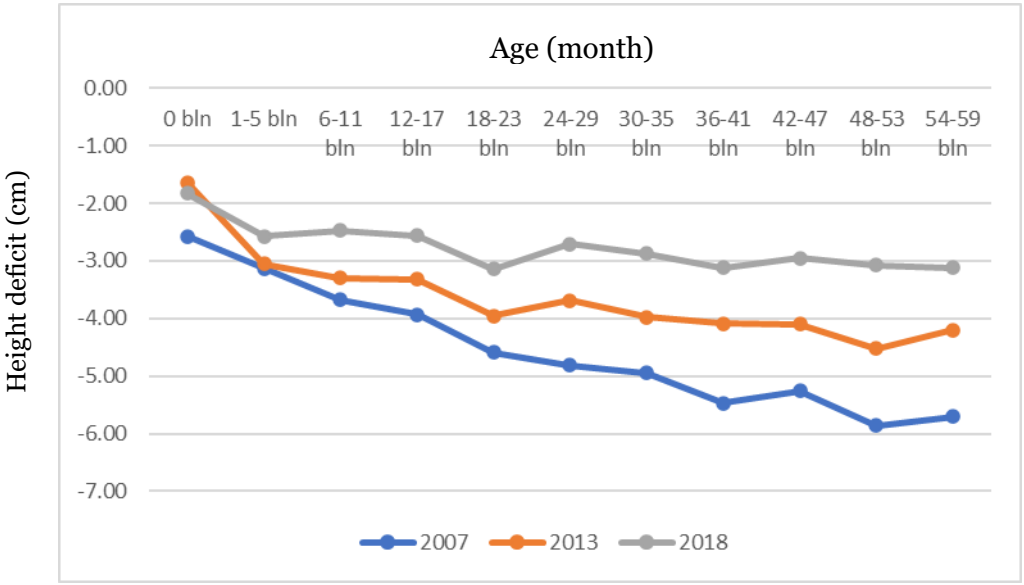

Figure 1. Average Deficit Length/Height of Stunting Toddlers

Figure 1 shows that the average body length deficit increases in the next age group, namely 1-5 months with a sharp downward slope of the curve. This is shown by data from the three surveys in 2007, 2013 and 2018. Although all three show a steep downward slope, there are significant

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changes from 2013 to 2018. The average body length deficit from the 2018 Riskesdas data shows a positive change compared to the two previous surveys. previous Riskesdas data. The mean length/height deficit in all age groups is getting closer to the standard.

The three datasets show that the growth deficit tends to level off in children aged 12-17 months. In the 18-23 month age group, the curve again slopes downwards. In the 24-29 month age group, the upward sloping curve shows that the length/height deficit is reduced compared to the 18-23 month age group, but the average value is not smaller than the previous age group. The relative length/height deficit curve continued to decline until the age of 59 months.

This finding confirms the findings of Victora et al. who performed an absolute height deficit (HAD) analysis which in his report stated that the mean HAD curve shows children starting with a mean height deficit of 0.8 cm (Victora et al., 2010). Likewise the report from Leroy et al. who conducted an analysis of 51 survey data in low- and middle-income countries (LMICs). The HAD curve shows that the growth deficit continues to increase after 18 months and continues until the age of 5 years (Leroy et al., 2014).

DISCUSSION

The results of the analysis of the three data from Riskesdas 2007, 2013 and 2018 show that the length/height deficit in stunted children occurs from the 0 month age group and the difference with the standard widens in the next age group. The deficit in length/height of children begins to widen from the age group of 1-5 months, where this age group is the age at which babies are recommended to be exclusively breastfed. This study only shows the magnitude of the deficit in the length/height of stunting children under five and the point at which the deficit begins to occur and is getting wider than the WHO growth standard. The researcher did not analyze the factors that influence the occurrence of the deficit.

The results of cross-sectional data analysis from the DHS Survey using absolute height-for-age differences (HAD) stated that between the ages of 24 and 60 months there were no signs of improvement or flattening of the HAD curve, but a continuous decline over time. The report concludes that there is no evidence of catch-up growth at the population level in the data set (Leroy et al., 2014, 2015). Although several studies show that catch-up growth at the population level does not occur, Indonesia has succeeded in narrowing the deficit in height at the population level in the last decade.

Pursuit of growth has been defined in several different ways in the literature, namely pursuit of absolute growth and pursuit of relative growth (Desmond and Casale, 2017). Both types of definitions compare a child's height with a WHO reference population benchmark. Absolute size expresses the difference in centimeters (cm), while relative size measures growth in standard deviations from the reference distribution. Absolute catch-up can be defined as

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the decrease over time in absolute height deficit, measured in cm, between individuals or populations with the mean of the reference for a healthy population. In other words, catch-up growth will occur if the difference or deficit in HAD decreases.

The problem of stunting at an early age, especially in the 1000 first days of birth, will have an impact on the quality of human resources. Stunting causes the organs of the body to not grow and develop optimally. Stunting was determined by measuring height for age, capturing the impact of poor diet and long-term infection. The life of a child from the time he is in the mother's womb until he is two years old (1,000 HPK) is a critical period in supporting optimal growth and development of children. Good environmental factors, especially in the early days of a child's life, can maximize the genetic potential (heredity) of the child so that the child can reach his optimal height. Supporting environmental factors are determined by various aspects or sectors. The direct causes of nutritional problems in children, including stunting, are low nutritional intake and health status.

Persistent length/height gain in each age group may be a long-term consequence of inadequate health, nutrition, and care experienced during the first 1000 days of birth, which may not be reversible with intervention after 2 years. The scale-up nutrition and programs that are carried out must be carried out with a target focus of 1000 first days of birth, even before that, namely on young women and expectant mothers. The presence of growth disorders during pregnancy contributes to the high rate of stunting in children under 5 years of age. Factors that were positively related to the pursuit of growth in children were maternal height, socio-economic level of the family, mother's and father's education, and households with two or more adult women. Negatively related factors were two or three or more preschool children in the household and infants being breastfed (Pradeilles et al., 2019).

The effect of nutritional interventions for children did not significantly affect changes in linear growth deficits in the short or medium term. Catch-up, by definition, is about eliminating the inhibiting conditions and subsequent higher-than-normal speed (i.e., changes in length or height with age). Longitudinal studies in Ethiopia, India, Peru, and Vietnam with samples of children experiencing stunting in early life and followed up to 12 years of age, reported that factors associated with growth improvement and impaired growth showed that growth after early childhood was responsive. to changes in the household and community environment and growth after childhood can result in improvements in children's cognitive development (Georgiadis et al., 2017).

And regarding the nutrition of young women as prospective mothers related to 1000 first day, from Christian and Smith (2018), it was stated that girls are most vulnerable to the influence of cultural and gender norms, which often discriminate against them, including regarding diet

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and physical activity, education and marriage. early childhood, affects the health and nutritional well-being of adolescents. The need for nutrients including energy, protein, iron, calcium, etc. increases during adolescence to support adequate growth and development where the speed of growth increases during puberty so that under optimal conditions it can catch up and in girls it can reach around 15– 25 percent of adult height.

Child nutrition and growth is part of early childhood development. It is important to use a set of measures and direct determinants that include the social and physical environment in which stunted children live. These determinants are nutrition, child development, child health, breastfeeding behavior, complementary feeding, food intake, child care, and home hygiene and health (Black et al., 2013). Further, research is needed to develop, refine, and validate measures and indicators for the required purposes. For example, there is a need to validate measures of child development in low- and middle-income countries, develop innovative markers of child development, and develop and validate behavioral measures such as anthropometry (Frongillo, Leroy and Lapping, 2019).

The results of the analysis show that although the stunting prevalence rate is still high, the average length/height deficit of stunting children under five has decreased from 2007 to 2018. What needs to be paid attention to is that the deficit in length/height of stunting children under five by age group continues to widen. of WHO growth standards. The height deficit starts from the first month after birth and begins to widen in the 1-5 month age group. Height deficits occurred in both boys and girls, from the lowest to the highest economic level.

It is recommended that specific interventions related to nutrition and health should be initiated long before the child is born to prevent stunting. Prevention efforts by providing interventions to young women as prospective mothers and pregnant women must continue to be carried out.

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