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Differences in Development and Diet of Stunting and Non-Stunting Children in the Rowosari Health Center Work Area, Semarang, Indonesia

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ABSTRACT

Background: *Stunting in children aged 36-59 months is caused by the intake of energy and protein below the average RDA recommendation. This low consumption has an impact on different growth and development disorders.*
Objectives*: This study aimed to determine the differences in the development and diet of stunted and non-stunted children aged 36-59 months.*
Materials and Methods: *This was an observational study with a cross-sectional approach, which was carried out at the work area of the Rowosari Health Center. The sample population consisted of 67 children aged 36-59 months, which were selected using the simple random sampling technique. The characteristics of the subjects and mothers were then collected using a questionnaire. Meanwhile, data on the diet and child development were obtained with the 24-hour recall method and Developmental Pre-Screening Questionnaire (KPSP), respectively.*
Results: *The results showed that there were differences in the development as well as energy and protein adequacy level of stunted and non-stunted children with a p-value <0.05.*
Conclusion: *There were several deviant developments in non-stunted toddlers due to the lack of nutritional intake, stimulation, interaction with the environment as well as the low knowledge of mothers about child care patterns.*

Keywords: Stunting, diet, development, Semarang

BACKGROUND

Stunting is caused by various child development disorders[1] and it has affected 21.3% of children under the age of five years globally with a total of 144 million cases. Several studies showed that the condition is more prevalent in Asian and African countries[2]. The 2018 Basic Health Research (Riskesdas) and the 2019 Indonesian Toddler Nutritional Status Survey (SSGBI) reported that there was a decrease in the stunting rate from 30.8% to 27.7%[3,4]. However, it is still a health problem because its prevalence is above the WHO standard of 20 %[4].

Adequate nutrition, health conditions, protection, and safety factors play an important role in children's development, especially at an early age[5]. The occurrence of stunting during this period can affect the structure and function of the brain where a reduced number of cells causes growth delays. A survey by the Health Ministry of Indonesia revealed that 16% of children under five years experienced fine and gross motor development disorders, hearing loss, decreased intelligence as well as speech delays with a total of 0.4 million cases[6]. At the age of 36-59 months, only 6-7 toddlers have reached the appropriate growth stage[5]. Furthermore, a previous study showed that faltering growth before birth and 18 months after gestation is associated with poor language and motor development[7]. Stunting children aged 2, 5, and 9 years have lower verbal scores and IQ of 4.6 points compared to others[8]. Several studies also revealed that they have lower scores in all aspects of development[9]. A study in Kalasan showed that stunting children are 3.9 times more at risk of developing suspect than others with normal growth[10].

Nutrient intake plays an important role in supporting the development of children[11], hence, low consumption of energy and protein causes growth failure[12]. This was evident in 45.7% of the sample population having an energy intake <70% AKE, while 36.1% were <80% RDA[13]. Furthermore, a previous study revealed that toddlers with low consumption are 7.5 times more at risk of experiencing stunting[14]. A study in Brazil also reported that the intake of protein must meet the nutritional needs of children. Toddlers are 1.59 times at risk of experiencing stunting when their protein intake is below the nutritional adequacy level[15].

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Semarang is one of the cities in Central Java with the lowest stunting prevalence of 21.0%[16], but the rate was reduced by 1.7% in 2018 and 2.5% in 2019. However, due to the pandemic, there was a 3.13% increase in the rate with a total of 384 children under the age of five in 2020[17]. Tembalang is one of the affected districts in Semarang City, which had the highest prevalence of 10.11%[18]. During the pandemic, the intervention administered was ineffective[17] and it had a negative impact on the monitoring of children's growth[19]. The diversity of food for stunting children is still lacking, especially during prenatal feeding and exclusive breastfeeding[20]. Therefore, this study aims to determine the differences in the development as well as the diet of stunted and non-stunted toddlers aged 36-59 months in Tembalang District, Semarang City.

MATERIALS AND METHODS

This was an observational study with a cross-sectional design, which was carried out in December 2021. The sample population consisted of toddlers aged 36-59 months living in the working area of the Rowisari Health Center, Tembalang District, Semarang City, and the size was calculated using the Lemeshow formula. Furthermore, the study location was in Meteseh Village 3, 4, and 16 where a total number of 67 children was selected using the simple random sampling technique.

The subjects who entered the stunting group as many as 12 children, while those who entered the non-stunting group as many as 55 children. We included children aged 36-59 months living in the working area of the Rowosari health center, living with parents / caregivers, born enough months, agreeing to be respondents by signing *informed consent*. We exclude those who had not in place during the study and had congenital abnormalities.

The free variables in this study were development and diet, while the bound variables were stunting and not stunting. Stunting is determined through the results of measurements of height compared to age in the ≥ -2 elementary school assessment standards WHO[3]. The samples' nutritional status was obtained using a stadiometer Seca 213 with TB/U indicators, which were then interpreted according to anthropometric standards[21]. Meanwhile, their development was assessed using the Child Development Pre-screening Questionnaire (KPSP)[22]. The dietary data were collected using the Recall method for 3x24 hours, after which the food ingredient composition was calculated with a nutrisurvey to determine the number of macronutrients consumed[23]. It was then compared with the RDA and all the data were analyzed using Chi-Square statistical test.

RESULTS

Table 1. Distribution of Respondents' Characteristics

Variable	Stunting		Non-stunting		Total	
	N	%	N	%	N	%
Gender						
Male	6	9.0	40	59.7	46	68.7
Female	6	9.0	15	22.4	21	31.3
Children Age						
36-46 months	6	9.0	22	32.8	28	41.8
47-59 months	6	9.0	33	49.3	39	58.2
Mother's Age						
25-35 years	12	17.9	47	70.1	59	88.1
>36 years	0	0	8	11.9	8	11.9
Mother's Job						
Working	1	1.5	23	34.3	24	35.8
Housewife	11	16.4	32	47.8	43	64.2
Mother's Education Level						
Junior and Senior High School	10	14.9	45	67.2	55	82.1
S1 and Equal	2	3.0	10	14.9	12	17.9

Table 1 shows that 59.2% of the samples were male, and 49.3% were between 47-59 months, which was the most aged group. Furthermore, 70.10% had mothers aged 25-35 years, while 55.2% had housewife mothers. 67.1% of the parent have a junior high and high school education background, and they were all in the non-stunting group.

Table 2. Differences in the development of stunting and non-stunting children

Nutritional status	Child development	P-Value*

	Deviant		Normal				
	n	%	n	%	n	%	
Stunting	11	16.4	1	1.5	12	17.9	0.008
Non-stunting	26	38.8	29	43.3	55	82.1	

A high deviant child development occurred in the non-stunting group where 38.8% of the samples were affected compared to the stunting category with 16.4%, as shown in Table 2. The chi-square test result showed that there were differences in the development in the two groups with p<0.05.

Table 3. Differences in the energy adequacy level of stunting and non-stunting children

Energy Adequacy Level	Nutritional status						P-Value*
	Stunting		Non-stunting				
	n	%	n	%	n	%	
Lack	12	17.9	33	49.3	45	67.2	0.006
Adequate (appropriate with AKG)	0	0	22	32.8	22	32.8	

Table 3 shows that 46.3% of the children in the non-stunting group had good energy adequacy level compared to the stunting category with 17.9%. Furthermore, the fisher's exact test results revealed that there were differences in the levels recorded in the two groups (p <0.05).

Table 4. Differences in protein adequacy levels for stunting and non-stunting children

Protein Adequacy Level	Nutritional status						P-Value*
	Stunting		Non-stunting				
	N	%	N	%	N	%	
Lack	11	16.4	17	25.4	28	41.8	0.000
Adequate (appropriate with AKG)	1	1.5	38	56.7	39	58.2	

Table 4 revealed that 25.4% of the children in the non-stunted group had good protein adequacy compared to the stunting category with 16.4%. The results of the chi-squarest showed that there were differences in the level of energy adequacy in the two groups (p <0.05).

DISCUSSION

Subject characteristics

The sample population consists of 59% male and 49.3% were aged 47-59 months. Furthermore, 55.2% of the children had a housewife mother of which 67.1% had junior and senior high school education background. A previous cross-sectional study in Ethiopia identified 410 toddlers in a critical growth and development period between 6-59 months. The results showed that the factors affecting stunting include gender, birth weight < 2.5 kg, low active visits of mothers to integrated service posts, and inappropriate complementary feeding.[24] Mugianti (2018) reported that the growth and development of boys are more influenced by the environment, hence, they can easily experience the condition due to psychological conditions. The growth process is primarily dependent on the ability of the caregivers to meet their nutritional needs.[25] Meanwhile, a study in Ghana showed that stunting was more common in girls than boys aged >2-5 years.[26] This was because the child received an adequate amount of breast milk, but the feeding was improper. Although growth can be achieved after the conditions change, malnourished children never reach optimal level.[26]

The results showed that the mothers' nutritional education and knowledge is one of the factors related to child outcomes. Children with an educated parent are often healthier and well-groomed compared to others. Therefore, the low level of mother's education has an impact on the prevalence of malnutrition among toddlers apart from other factors, such as income.[26] These findings are in line with a study in Laos and Thailand where stunting children have mothers and caregivers without formal education.[27,28]

Children development

Table 2 shows that abnormal development is prevalent in non-stunted children where 38.8% were affected compared to stunted toddlers with 16.4%. The chi-square test indicated that there were differences in the development based on the incidence of stunting (p<0.05). This finding is in line with Nahar (2020) that there were developmental variations in the cognitive, motor, language, and socio-emotional function of both groups[9]. Putri (2018) also revealed that there were significant differences in the growth of stunted and non-

stunted children in Semarang Regency[29]. Stunting toddlers experience slow and short skeletal growth, hence, good nutrition is needed at an early age. Based on the level of energy and protein adequacy, nutritional intake in this study was still lacking. These nutrients are greatly needed from birth to the age of 2 or 3 years, and the fastest period is the first 6 months of life[30].

The meta-analysis revealed that stunting children aged 36-59 months in various developing countries experience poor development[31]. This difference causes growth inhibition of the brain cells, fibers, and connectors, thereby leading to overall developmental delays[32]. A previous study reported that the functional connectivity of the brain can function as a neural pathway, where biological difficulties have an impact on cognitive development. These findings provide an understanding of the pathways, which serves as a link between impaired growth and poor cognitive outcomes. Furthermore, this reveals the widespread adverse effects of malnutrition on children's brain development, consequently, more efficient intervention can be developed[33].

Energy Adequacy Level

Based on energy adequacy levels, the majority of the toddlers were included in the low category, as shown in Table 3. Furthermore, most of the children with deficiency were in the non-stunted group, accounting for 49.3% of the total population. The fisher's exact test showed that there were differences in the energy adequacy level of the stunted and non-stunted groups with a p-value <0.05. This finding is in line with Adani and Nidya (2017) as well as Damayanti that there are variations in the consumption of energy, protein, zinc, iron, exclusive breastfeeding history as well as the development of stunted and non-stunted children[34]. This study is also consistent with Mahfouz et al (2021), which obtained similar results where there were differences between the consumption level of both groups[35]. Three-quarters of the sample population lack energy and the daily intake of stunted toddlers was lower than that of others[36]. Mugianti (2021) reported that children with low consumption are 0.146 times more at risk of experiencing stunting compared to others with sufficient adequacy level[25]. At an early age, sufficient energy and nutrients intake lead to healthy growth and development of the brain, bones, and immune system[37]. Differences in nutritional intake of stunted and non-stunted children are caused by the type of food consumed and irregular eating patterns with fewer portions, which can contribute to growth failure[38,39].

Protein Adequacy Level

Table 4 shows that 56.7% of the toddlers were included in the category of protein adequacy levels, but the non-stunted group had higher levels compared to the stunting category. The chi-square test results revealed that there were differences in the development of both groups with a p-value <0.05. Furthermore, this finding is in line with Yuristi et al (2019) that there are variations in the protein intake of stunted and non-stunted children[40]. This is also consistent with Sharm S et al (2020) that approximately 85% of children under 5 years have more than 70% of the recommended protein intake[41]. Solihin R et al (2013) reported that every 1% increase in toddlers' protein adequacy level elevates the z-score of BH/A by 0.0024 units[12].

Protein plays an essential role in the building of new tissues as well as maintaining, repairing, and replacing damaged parts. The intake of nutrients that helps in brain growth and development includes energy, protein, certain types of fat, and iron. Children with long-lasting protein deficiency often experience stunting in height despite the presence of adequate energy[42,36]. However, there are some short children with a good intake of the nutrient. Protein consumption is not directly related to height, but it can serve as an indicator of previous food intake[43].

LIMITATION

This study was only carried out at Rowosari Health Center, hence, it did not describe the stunting state of Semarang City. Furthermore, some respondents did not understand the child's intake because they were not the main caregiver or the food were not provided by them.

CONCLUSION

The result showed that there were differences in the development as well as the energy and protein adequacy levels of stunted and non-stunted children aged 36-59 months in the Rowosari Health Center's working area. Furthermore, more deviant developments were observed in the non-stunted toddlers due to the

lack of nutritional intake, stimulation, interaction with the environment as well as the mother's low knowledge of parenting patterns.

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