International Journal of Scientific Research in Science and Technology
Available online at : www.ijsrst.com
Print ISSN: 2395-6011 | Online ISSN: 2395-602X
doi : https://doi.org/10.32628/IJSRST52411143

The Association of Family Income, Birth Length, and Energy Intake with The Incidence of Stunting in Cibungbulang Sub-District

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ARTICLEINFO

Article History:
Accepted: 01 Feb 2024
Published: 04 Feb 2024

Publication Issue :
Volume 11, Issue 1
January-February-2024
Page Number :
389-397

ABSTRACT

Stunting is a developmental disorder in toddlers characterized by H/A index z-score of less than -2SD. Based on the results of SSGI 2022, the prevalence of stunting among toddlers in Bogor Regency reached 24.9 percent. This study aimed to determine the relationship between family income, birth length, and energy intake with the incidence of stunting among toddlers in Cibungbulang District. The sample was 151 toddlers aged 24 – 59 months who were selected by systematic random sampling. Intake data were collected with 24-hour food recall, stunting by measuring heights, and other data were collected by interview using questionnaires. Most of the toddlers were male (57.6%) with fathers aged >35 year (58.3%) and graduated from senior high school (34,4%) and mothers aged 21 – 35 years (70.2%) with high school diploma or its equivalent (34.4%). Most of the children-under-five had families with income below the regional minimum wage (88.1%), normal birth length (80.8%), adequate and excessive energy intake (53.6%). A total of 41.7 percent of toddlers were stunted. There were significant relationships between family income (p=0.022), birth length (p=0.040), and energy intake (p=0.040) with the incidence of stunting in toddlers (p<0.05). It can be concluded that family income, birth length, and energy intake are related to the incidence of stunting in toddlers aged 24 – 59 months in Cibungbulang District. Maternal nutrition intake needs to be monitored carefully during pregnancy and home food gardening program should be promoted to increase food availability and income thus ensuring optimal children development.

Keywords: Stunting, Income, Birth Length, Energy Intake

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I. INTRODUCTION

Stunting is one of the developmental disorders among toddlers due to chronic malnutrition, especially during the first 1000 days of life. It is characterized by a body length-for age (L/A) or height-for-age (H/A) index z-score that is less than -2SD that indicates the child's height is shorter than the average height of children at the same age. Globally, United Nation target to end all forms of hunger, achieve food security and improved nutrition and promote sustainable agriculture. One of the indicators is to reduce the prevalence of stunting in children under five. Based on the National Long-Term Development Plan (RPJPN in Bahasa) 2025-2045 towards *Indonesia Emas 2045* (Golden Indonesia 2045), Indonesia plans to reduce the prevalence of stunting in children under five to 13.5 percent by 2025 and 5 percent by 2045 [1]. Those targets show that stunting is still a nutritional problem that receives special attention from the government.

The lack of protein intake associated with stunting cause deficiency of essential amino acids in the body. It interferes with mTORC1 (mammalian target of rapamycin complex 1) mechanism, which plays a role in regulating skeletal muscle growth, chondral plates, l nervous systems, cells, and other important organs. In addition, the disruption due to amino acid deficiency also disrupt iron metabolism, suppress protein and lipid synthesis, and inhibit the immune system, making children prone to infections. Malnutrition is also associated with decreased IGF-1 synthesis and reduced insulin sensitivity, which can worsen when the BMI of stunted patients increases as they grow up [2]. In relation to the development, stunted toddlers have 4 times greater risk to experience delays in motor, fine and gross, and language skills developments [3]. Due to impaired emotional development, stunted children tend to lose interest to their environments, making their social development also hampered [4].

Stunting affects its patients until they grow up. The long-term effects include increased risk of non-communicable diseases, accumulation of fat tissue in the abdominal area, decreased fat oxidation, insulin resistance, and decreased energy expenditure. Adults with history of childhood stunting have greater risks of developing diabetes, hypertension, dyslipidemia, and obesity [5]. In the case of obesity, toddlers who experience stunting and rapid weight gain over the next 2 years have higher risks of being overweight and obese when growing up. In addition to the physical impacts, research in Jamaica shows that children who are stunted tend to experience anxiety, depression, and lower self-esteem at the age of 17 [6]. Malnutrition problems that persist into adulthood can affect productivity, as lower BMI is associated with greater number of absents and lower productivity [2].

Not only individuals, stunting also causes economic losses for a region or even a country. Research by Wulandari, 2023 [7] showed that Bangka Belitung Province lost approximately 219 billion to 987 billion rupiah (0.28 – 1.27 percent of GDP) within 5 years due to decreased productivity related to stunting. In addition, research by Suryana, 2023 [8] showed that Indonesia was estimated to lose 15 – 67.8 trillion or 0.89 – 3.99% of Indonesia's GDP due to stunting in toddlers and lost 381 billion – 1.7 trillion due to stunting.

Factors that affect the nutritional status of toddlers are divided into direct, indirect, and supporting factors. Factors that directly affect nutritional status of toddlers are food intake and infectious diseases. In a study by Fikawati, 2021 on toddlers in Jakarta, the result showed that energy intake was associated with stunting in toddlers [9]. Food availability in the household, diet and parenting patterns, hygiene

and sanitation practices, and health services affect toddlers' nutritional status indirectly. Furthermore, research by Agustin, 2021 [10] showed that family income was associated with the incidence of stunting among toddlers in Kediri, East Java. Family income will affect the family's ability to buy the food needed and availability of food in the house. Besides those factors, birth length is also known to affect the nutritional status of toddlers. Research by Lukman, 2021 [11] showed that birth length had a significant relationship with the incidence of stunting among toddlers in Indonesia. Birth length is one of the outputs of energy and other nutrients intake during the first 1000 days of life, which also determine children's growth and development in the future and even their health conditions as adults.

UNICEF together with WHO and World Bank estimated that around 22.3 percent or 148 million of children under fiver years old globally suffered from stunting with an estimated prevalence in Southeast Asia of 26.4 percent by 2022 [12]. Based on the 2018 Riskesdas (Basic Health Survey), the prevalence of stunting among toddlers in Indonesia reached 30.8 percent with the prevalence in West Java reached 31.1 percent [13]. The prevalence in Bogor Regency of the same year reached 32.86 percent, consisting of 11.98 and 20.88 percent of toddlers who were very short and short based on the height-for-age (H/A) index [14]. Meanwhile, based on the results of the Indonesia Nutrition Status Study (SSGI) in 2022, the prevalence of stunting in toddlers in Indonesia has decreased to 21.6 percent with the prevalence in West Java reached 20.2 percent and the prevalence in Bogor Regency reached 24.9 percent [15]. The prevalence in Bogor Regency, which exceeds the national prevalence, shows that stunting is still a problem that needs to be addressed together.

This study was conducted to determine the relationship between family income, birth length, and energy intake with the incidence of stunting in toddlers aged 24 – 59 months in Cibungbulang District, Bogor Regency, West Java.

II. METHODS AND MATERIAL

This study was a quantitative study with observational design and cross-sectional approach. Data on independent and dependent variables were collected simultaneously to determine the relationship between variables. The study was conducted in May 2023 in Cibungbulang Sub-district, Bogor Regency, West Java. The sample in this study were 151 toddlers aged 24 – 59 months who lived in the Cibungbulang area and were selected by systematic random sampling. Samples are randomly selected by following a predetermined system, such as distance between samples in the order.

The data collected in this study included anthropometric data, birth length, energy intake, family income, and supporting data which was the characteristics of toddlers. Height was measured using microtoise with an accuracy of 0.1 cm and energy intake was collected with 24-hour food recall. Other data were collected through interviews using questionnaires. Experienced and trained enumerators collected all data in this study.

The characteristics of samples in this study included the gender of toddlers as well as the age and education level of parents. Gender data were divided into male and female groups. Parents' ages were divided into three group, namely the <21 years group, 21 – 35 years group, and >35 years group. Data on the level of parents' education, both mother and father, were grouped into no education, elementary school, junior high school, senior high school, and university graduates.

The independent variables in this study were family income, birth length, and energy intake. Family

income were divided into under Bogor Regency minimum wage if it was less than Rp 4,520,212.00 and equal to the minimum wage if the income was Rp 4,520,212.00 or higher. Birth length data were categorised as short if the birth length was less than 48 cm and normal if the length was 48 cm or more. Energy intake were categorized into Deficient if the intake was less than 80 percent of the RDA and Adequate if the toddler's intake reached 80 percent of the RDA or more. The dependent variable was the incidence of stunting among toddlers aged 24 – 59 months. Toddlers were said to be stunted if the height-for-age (H/A) index z-score was less than -2SD.

Those data were analyzed using SPSS. Univariate analysis resulted in percentages of each categories for sample characteristics as well as independent and dependent variables. Bivariate analysis was performed with chi-square test to see if there was a significant relationship between the independent and dependent variables. The relationship was said to be significant if the *p*-value was less than 0.05. This study was approved by the Health Research Ethics Commission of the Jakarta Health Polytechnic II No. LB.02.01/KE/31/503/2023.

TABLE 1. Demographic Characteristics of Samples

Characteristics	n	%
Gender of Toddlers		
Male	87	57.6
Female	64	42.4
Father's Age		
21 – 35 years	63	41.7
>35 years	88	58.3
Father's Education Level		
No Education	1	0.7
Elementary School	42	27.8
Junior High School	43	28.5
Senior High School	58	38.4
University	7	4.6
Mother's Age		
<21 years	2	1.3
21 – 35 years	106	70.2
>35 years	43	28.5
Mother's Education Level		
No Education	1	0.7
Elementary School	48	31.8
Junior High School	45	29.8
Senior High School	52	34.4
University	5	3.3
Incidence of Stunting		
Stunting	63	41.7
Normal	88	58.3

III.RESULTS AND DISCUSSION

Table 1 shows the characteristics of toddlers in this study. More than half of the toddlers were male (57.6%) and the rest were female (42.4%). Most fathers of toddlers were over 35 years old (58.3) and the highest proportion (38.4%) had completed high school or its equivalent. Regarding the mother's characteristics, the majority (70.2%) were between 21 and 35 years old and 34.4 percent of them had completed high school or its equivalent. Of the total sample, 63 toddlers (41.7%) had stunting based on the height-for-age index.

The prevalence of stunting in this study was far above the national and Bogor Regency's prevalence based on the results of SSGI in 2022 of 21.6 and 24.9 percent [15]. Most of the stunted toddlers in this study were male (60.3%) and similar to the results of the National and West Java Riskesdas in 2018 with 52.5 and 54 percent of stunted toddlers who were male [13]. The higher prevalence among boys can be attributed to their characteristics of being more active, especially outside, and spending more energy and being exposed to pathogens in the environment outside. In addition, faster growth and larger body size in boys also increase the risk of malnutrition,

considering that the growth process requires considerable energy and nutrients [16].

Most of the stunted toddles had fathers aged over 35 years (61.9%) and mothers in the 21 – 35 years age group (66.7%). It was quite similar to a study by Marlani, 2021 [17] where 55.4 percent of stunted toddlers aged 24 – 59 months had mothers aged 26 – 35 years. The mother's age did not guarantee that toddlers would not suffer from stunting since there were other factors that were more directly related to the incidence of stunting in toddlers.

Parents of stunted toddlers were dominated by fathers with senior high school education (39.7%) and mothers with elementary and senior high school educations (36.5% each). Similar characteristics were shown when compared with a study by Putri, 2021 [18] on toddlers aged 24 – 59 months in Jambi where 42.9 percent of fathers and 40.5 percent of mother of stunted toddlers were senior high school graduates. Parents with higher level of education tend to have better jobs and higher incomes, so they can buy more food to fulfill the energy and nutrient needs and have better food availability as well. Besides, parents with higher education levels also have better knowledge and the ability to implement knowledge, especially related to parenting and nutrition. However, the results in this study indicate that parents' education is not the only factor related to stunting in toddlers.

Table 2 shows the result of analysis of relationship between the independent and dependent variables. The table shows significant relationships between family income (p=0.022), birth length (p=0.040), and energy intake (p=0.040) with the incidence of stunting among toddlers aged 24 – 59 months in Cibungbulang District.

TABLE 2. Distribution of Family Income, Birth Length, and Energy Intake by Incidence of Stunting in Toddlers in Cibungbulang

Independent Variable	Incidence of Stunting				Total		p-value
	Stunting		Normal				
	n	%	n	%	n	%	
Family Income							
Under Minimum Wage	60	45.1	73	54.9	133	100	0,022*
Equal to Minimum Wage	3	16.7	15	83.3	18	100	
Birth Length							
Short (<48 cm)	17	58.6	12	41.4	29	100	0,040*
Normal (≥48 cm)	46	37.7	76	62.3	122	100	
Energy Intake							
Deficient	23	32.9	47	67.1	70	100	0,040*
Adequate	40	49.4	41	50.6	81	100	

*The relationship is significant if p<0.05. Analyzed with chi-square test

Besides the significant relationship, the prevalence of stunting tended to be greater in toddler with lower family income or under the minimum wage. Similar result was shown in a study by Sutarto, 2021 [19] on toddlers aged 24 – 59 months, where family income level was associated with the incidence of stunting in toddlers. However, a study by Hasbiah, 2021 [20] on toddlers in Banjarmasin, South Kalimantan showed

different result. In that study, there was no significant relationship between family income and stunting in toddlers. The difference might be caused by the difference in sample characteristics between studies. The sample in Hasbiah eta al.'s study was dominated by toddlers aged 6 – 35 months compared with samples in this study who were 24 – 59 months. Hasbiah's study was also dominated by female toddlers, while this study was dominated by male toddlers.

Family income determine their ability to purchase nutritious foods to meet their needs. Families with higher incomes will be able to purchase food that can meet their needs better, both in quantity and quality. The availability of food in the household directly affects the intake of toddlers. Families with low incomes tend to find it difficult to make sure they have enough food intake, which increases the risk of insufficient energy and nutrient intake in toddlers [21]. The quality of food served can also be affected by low income and results in poor intake quality and increased risk of nutritional problems in toddlers.

Regarding birth length, there was a tendency for a greater prevalence of stunting in toddlers who had short birth length (<48 cm). Research by Lukman, 2021 [11] showed similar result that there was a significant relationship between birth length and stunting in toddlers. Different result was shown in a study by Dasantos, 2020 [22] that no significant relationship was observed between birth length and the incidence of stunting among toddlers in Pidie, Aceh. The difference was related to the education level of parents in both studies. Most parents in Dasantos' study had higher education level, senior high school and university, while most parents in this study had elementary and junior high school-level educations.

Stunting is a condition caused by chronic malnutrition, especially during the first 1000 days of life that entails conception until the children reach 2 years of age. Birth length represents the baby's growth while in the womb and is influenced by maternal intake during pregnancy. Lack of energy and nutrient intake and poor nutritional status of pregnant women cause intra uterine growth retardation (IUGR), so that the child's body length tends to be low at birth and impact the future growth. Not only linear growth, IUGR also increases the risk of cardiovascular disease, obesity, hypertension, atherosclerosis, and decreased kidney function when the child grows up [23]. Lower IQ, lower social response, and poor motor skills also happened due to inhibition of the brain and nerve development in children who experience IUGR [24].

In this study, energy intake was associated with the incidence of stunting in toddlers aged 24 – 59 months. A similar result was shown in research by Aisyah, 2021 [25] that there was a significant relationship between energy intake and stunting in toddlers aged 24 – 59 months in Tasikmalaya. However, different result was shown in a study by Enardi, 2022 [26] where energy intake did not have significant relationship with the incidence of stunting in toddlers. The difference might be caused by different toddlers' age profile. The study by Enardi et al. focused on samples aged 6 – 23 months compared with this study that focused on toddlers aged 24 – 59 months.

Energy intake directly affects nutritional status of children under five. Energy acts as fuel that ensures all physiological processes in the body run properly, including the linear growth. Insufficient energy intake also indicates inadequate intake of at least one macronutrient. Protein deficiency inhibit linear growth, as well as brain and cognitive development in toddlers. Inadequate intake of fats, especially essential fatty acids, and carbohydrates can affect the development of central nervous system and growth in toddlers [27]. Lack of energy intake may trigger catabolic mechanisms to obtain energy from adipose

tissue and muscles that will affect toddler's body mass and cause metabolic disorders, marasmus, and impaired daily activities [28].

This study had several weaknesses, including the presence of temporary factors associated with stunting and invalid intake data. Those temporary factors could be misidentified in this study considering that this study used the cross-sectional approach with all data collected at one time. Invalid intake data could be caused by dishonesty of mothers during the food recall process which was one of the obstacles in this study.

IV. CONCLUSION

Based on the results of research that has been carried out, it could be concluded that there were significant relationships between family income, birth length, and energy intake with the incidence of stunting in toddlers aged 24 – 59 months in Cibungbulang District. Most toddlers had families with income lower than the minimum wage of Bogor Regency and had normal birth length and adequate energy intake.

It is necessary to closely monitor maternal intake and nutrition status during pregnancy to prevent complication that interfere with fetus growth and ensure the optimal development. In addition, it is necessary to promote home gardening programs to increase access to nutritious food in the households and increase family income.

V. ACKNOWLEDGEMENT

We would like to thank the Director of the Health Polytechnic of the Ministry of Health Jakarta II and the enumerators involved in this study.

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Cite this article as :

Rina Efiyanna, Meilinasari, Fairuz Dhia Rabbani, "The Association of Family Income, Birth Length, and Energy Intake with The Incidence of Stunting in Cibungbulang Sub-District", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 11 Issue 1, pp. 389-397, January-February 2024. Available at doi : https://doi.org/10.32628/IJSRST52411143
Journal URL : https://ijsrst.com/IJSRST52411143