# The relationship between food quantity and diversity with stunting incidence in Indonesia

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## Abstract

Stunting often a result of inadequate nutrition or malnutrition, can be mitigated by ensuring both sufficient food quantity and dietary diversity. This study aimed to explore the relationship between food quantity and diversity with stunting incidence in toddlers. Employed a cross-sectional design, this observational research involved 39 randomly selected toddlers from a Surabaya Public Health Center in Indonesia. Researchers assessed nutritional status, diagnosing stunting using anthropometric measurements. Food quantity and diversity in the children's diets were evaluated through a semi-Food Frequency Questionnaire (FFQ). Data analysis was conducted using the Chi-Square test in the Statistical Package for the Social Sciences (SPSS). The study revealed a significant relationship (p=0.001) between dietary diversity with stunting incidence but found no significant link (p=0.892) between food quantity with stunting. Stunting has multifactorial causes, some originating even before a child's birth. After birth, several factors beyond dietary patterns influence stunting. Thus, addressing the causes of stunting necessitates a case-by-case approach and tailored interventions for each child.

## Introduction

Growth is an important factor in a child's maturation process.[1] When a child fails to reach a common standard height for their age, they can be classified as stunted. It is crucial to fully understand the potential causes and how to address the issue of stunting in children, as stunting leads to irreversible physical and mental damage in the next generation. The prevalence of stunting in toddlers in Southeast Asia ranks first worldwide, according to World Health Organization (WHO) data from 2010 to 2020. The incidence of stunting has been decreasing compared to 2010 (41.60%) but remains high, at 30.10% in 2020. The percentage of stunting in Southeast Asian countries in 2020 is nearly the same as that in African countries, at 31.70%. In 2020, the incidence of stunting among children under five is only 5.70% in European countries and 8.90% in American countries.[2] The high prevalence of stunting is also observed in Indonesia, a Southeast Asian nation. In 2019, the incidence of stunting in Indonesia reached 27.7%, meaning that 28 out of 100 toddlers are affected.[3]

The WHO has established six Global Nutrition Targets for 2025, including a 40% reduction in stunting among children under five.[4] Stunting is a significant concern for both the WHO and the Indonesian government due to its negative short-term and long-term impacts. In the short term, stunting increases mortality and morbidity hampers cognitive and motor abilities, and leads to higher healthcare costs.[4,5] In the long term, stunted individuals may experience short stature, higher obesity rates, reproductive health issues, reduced educational performance, decreased learning abilities, and diminished work capacity and productivity.[5,6]

These impacts are particularly prevalent in lower middle-class economies, particularly in Southeast Asia and Africa.[7]

The leading cause of stunting in preschool-aged children is inadequate fulfillment of nutrition and nutritional energy[8,9]. The results of a study in four villages in Central Java, Indonesia, showed that changes in children's eating patterns were a significant factor in nutritional disorders.[10] Another study emphasized that maternal nutrition deficiency, undernutrition during pregnancy, absence of exclusive breastfeeding (up to six months of age), insufficient complementary feeding, and malabsorption or infectious diseases may lead to nutritional stunting.[11] Yet another study underlines that parents need to be informed about guidelines for healthy eating patterns and the health risks their children may face due to inadequate nutrition. This can change their priorities and perceptions regarding their children's nutrition. Providing better nutrition to children can change their eating patterns.[12] This study aims to identify eating patterns by classifying the quantity, type, and frequency of the food given to children, considering the various age ranges of children. Parental provision of children's nutrition is depicted in terms of the mother's education and the family's income rate. The high prevalence of stunting in the world, as well as in Surabaya, Indonesia, the short-term and long-term adverse effects of stunting, changes in children's eating patterns as preventive measures and for stunting management, form the basis for this research. This study aimed to analyze the relationship between the quantity and diversity of food and the incidence of stunting in toddlers.

## Materials and Methods

### Design study

This research employed a descriptive observational design and utilized a cross-sectional study design. The study was conducted in Surabaya Regency, East Java Province, over a period of approximately four months in late 2022.

### Population and sample

The sample for this study consisted of 39 toddlers from a Public Health Center in Surabaya, selected randomly using a simple random sampling method. The samples were chosen from invitations extended to approximately one hundred toddlers in 15 integrated toddler service centers, both stunted and non-stunted. These toddlers attended the health service center, and a sample of 39 stunted and non-stunted children was ultimately selected. Public health center officers assisted in filtering samples that met the inclusion criteria. This included toddlers who came to the Community Health Center for health check-ups and were willing to participate as respondents by providing informed consent, which was deemed ethically appropriate. Exclusion criteria applied to toddlers who were unwell, unable to visit a health service center, or unwilling to sign an informed consent.

### Data collection

The variables measured in this study included the incidence of stunting, as well as the variety and quantity of food consumed by children under five. All research variables were considered primary. The following methods and instruments were used for research variables. Nutritional status was assessed through anthropometric measurements, including the child's height/length and weight. Measurements were conducted twice: first by public health center officers to screen potential child samples, and second by the researchers on the day of data collection. Data collected on the day of data collection was used for analysis. The diversity and quantity of children's diets were evaluated using a semi-food frequency questionnaire (FFQ) validated in the "Guidelines for Measuring Household and Individual Dietary Diversity" by the Food and Agriculture Organization (FAO) of the United Nations.[13] The original guideline served as the framework and was adapted to suit Indonesian food patterns. The FFQs were completed by parents or caregivers responsible for the children's daily nutrition.

### Data analysis

Research data, comprising anthropometric measurements (body weight, height) and questionnaires regarding diet and food diversity, were collected. The data were subsequently analyzed using SPSS for Windows version 16. The Chi-Square Test was employed to determine differences in food diversity and its relationship to the number of toddlers' diets.

## Results

Based on Table 1, the characteristics of the respondents are as follows: Data was collected from a sample of 39 children under the age of five. Of these children, 23 (58.97%) were female. The

**Table 1.** Characteristics of research respondents (N=39).

| Characteristics of respondents | Number of respondents | |
|---|---|---|
| | N | % |
| Toddler gender | | |
| Man | 16 | 41.03 |
| Women | 23 | 58.97 |
| Toddler age (months) | | |
| 1-10 | 3 | 7.69 |
| 11-20 | 6 | 15.38 |
| 21-30 | 13 | 33.33 |
| 31-40 | 9 | 23.08 |
| 41-50 | 4 | 10.26 |
| 51-60 | 4 | 10.26 |
| An Educational History of the Mother of the Toddler | | |
| Elementary school | 4 | 10 |
| Junior high school | 4 | 10 |
| Senior high school | 27 | 69 |
| Diploma | 1 | 3 |
| Bachelor degree | 3 | 8 |
| Parental income history (IDR) | | |
| <4 million | 33 | 85 |
| 4-4.5 million | 6 | 15 |
| >4.5 million | 0 | 0 |
| Food diversity | | |
| Not enough | 6 | 15.4 |
| Enough | 22 | 56.4 |
| Good | 11 | 28.2 |
| Food quantity | | |
| Hard to eat | 6 | 15.4 |
| Sometimes/normally | 25 | 64.1 |
| Really like | 8 | 20.5 |
| Stunting | | |
| Severe stunted | 8 | 20.5 |
| Stunted | 21 | 53.8 |
| Normal | 10 | 25.7 |
| Total | 39 | 100 |

largest age group among the children was 21-30 months, consisting of 13 children (33.33%). The background of the toddlers' parents was described based on maternal education and family income. Most of the mothers had completed high school (27 individuals, 69%). The majority of parents reported a monthly income of less than IDR 4 million. Height measurements (in centimeters) were compared with the standard anthropometric heights for children based on their age (in months) and sex. A total of 21 children (53.84%) were classified as short.

Food diversity is determined by categorizing the foods in the questionnaire based on their functions, which include carbohydrates (as an energy source), proteins, lipid sources, vitamins, and minerals. Examples of food sources in each category are provided for selection by caregivers. For instance, carbohydrate sources include rice, potatoes, corn, bread, and cereals. Protein and lipid sources encompass fish, meat, legumes, nuts, eggs, milk, and butter. Vitamins and minerals sources include foods like spinach, cabbage, broccoli, carrots, tomatoes, apples, oranges, mangoes, bananas, and water, among others. Food quantity is assessed by inquiring about eating frequency, snack frequency, and the amount of each meal provided. For example, caregivers are asked how much water (in liters) the child consumes in a day.

Based on the data from Table 2, the results indicate a significant relationship between food diversity and the incidence of stunting at the Public Health Center in Surabaya, Indonesia. This relationship is supported by statistical analysis using SPSS for Windows 16, with a p-value of 0.001. However, for the relationship between food quantity and the incidence of stunting at the Public Health Center, there is no evidence of a significant relationship, as the p-value is 0.892, which is greater than 0.05.

## Discussion

A similar study conducted in Bangka Belitung yielded results indicating a significant correlation between eating patterns with the incidence of stunting in children under five years old. Negative eating behavior was associated with a 4.89 times higher likelihood of stunting compared to positive eating behavior. The data collection instruments used in that research, including height measurement, height-for-age standard graphics, the Child Feeding Questionnaire (CFQ), and the Child Eating Behavior Questionnaire (CEBQ), were quite similar to those used in this study. The findings from the Bangka Belitung research align with the results of our study.[14,15]

The fulfillment of proper nutrition for children differs for each age group. Babies aged 0-6 months receive balanced nutrition exclusively through breastfeeding, as breast milk is considered the gold standard for baby nutrition, containing all the necessary nutrients.[16,17] Infants and children aged 6-24 months are in a period of rapid growth and development, with increasing physical activity and a higher risk of exposure to infection. Complementary foods are introduced alongside continued breastfeeding, which is recommended until the age of 2 years.[16] This stage also involves teaching clean living habits to prevent infectious diseases. Children aged 2-5 years experience rapid growth and high physical activity levels, often making their own food choices. Therefore, the quantity and variety of their food must receive special attention. A balanced diet in sufficient quantities, consumed regularly, is essential for achieving balanced nutrition. Clean living habits are equally important and must be emphasized.[18,19]

Food diversity involves various food groups, including staple foods, side dishes, vegetables, fruits, and water, with diversity within each group. This diversity is vital for maintaining a balanced nutritional diet. Dietary Diversity Score is a measure of diversity in food consumption that is built through assessing the quality and quantity of nutrition for children under five. A diverse range of food types, consumed in sufficient quantities, leads to higher dietary diversity scores, resulting in excellent nutritional status for children under five.[20]

While prenatal and postnatal nutritional deficiencies and enteric and systemic infections contribute to stunting, several studies emphasize the primary role of Environmental Enteric Dysfunction (EED). EED is a common disorder affecting the structure and function of the small intestine and is prevalent in children living in areas with poor sanitation. Mechanisms leading to growth failure in EED include intestinal "leakage," high intestinal permeability, intestinal inflammation, bacterial translocation, systemic inflammation, and nutrient malabsorption.[21,22]

Preventing stunting offers more diverse short- and long-term benefits compared to managing its consequences. Prioritizing stunting prevention requires the involvement of decision-makers, program designers, and implementers. Stunting prevention programs should address conditions specific to each age group, such as promoting exclusive breastfeeding for babies aged 0-6 months, ensuring adequate complementary food for babies over 6 months up to 2 years old, and establishing physical activity programs to stimulate growth in children aged 2-5 years. These prevention programs should conclude with the evaluation of program results, especially through height measurements.[23,24] This study has several limitations, and more trustworthy results could be achieved by increasing the sample size or conducting research on a larger scale. Additionally, conducting research for specific age ranges and considering the gender of the children could provide more specific results, as there are indications that gender influences children's eating habits.

**Table 2.** Relationship between diversity and food quantity with stunting.

| Variables | Nutritional status | | | | |
|---|---|---|---|---|---|
| | Severe stunted | Stunted | Normal | Total | p |
| Food diversity | | | | | |
| Not enough | 4 | 7 | 0 | 11 | |
| Enough | 3 | 13 | 3 | 19 | 0.001 |
| Good | 1 | 1 | 7 | 9 | |
| Food quantity | | | | | |
| Hard to eat | 2 | 3 | 1 | 6 | |
| Sometimes/normally | 4 | 14 | 7 | 25 | 0.892 |
| Really like | 2 | 4 | 2 | 8 | |

## Conclusions

The study revealed a significant relationship between food diversity with the incidence of stunting. However, it did not find a significant relationship between food quantity with stunting. This implies that stunting is influenced by a multitude of complex factors, including maternal eating patterns, sanitation, parenting, and more. Therefore, focusing solely on dietary factors, such as quantity and diversity, may not be sufficient to address stunting comprehensively. Based on these findings, it is advisable to conduct further research by segmenting the sample into gender-specific groups and considering different stages of dietary needs for infants, babies, and children. Furthermore, targeted interventions, such as economic stimulation and health education, are needed to enhance family income and maternal knowledge. These interventions require active involvement from healthcare providers, the government, and the community to effectively combat stunting.

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# The effect of *Dayak* onion brewed water in reducing blood pressure and mean arterial pressure (MAP) in hypertensive patients

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## Abstract

The World Health Organization (WHO) estimated that 1.28 billion adults aged 30-79 years worldwide suffered from hypertension. *Dayak* onion is an herbal plant found in Indonesia, particularly in Kalimantan and traditionally used to treat hypertension. The purpose of this study was to determine the effect of *Dayak* onion steeping water on the reduction of systolic-diastolic blood pressure and mean arterial pressure (MAP) in hypertensive patients. This study employed a quasi-experimental research design with a time series approach, utilizing a pre-post-test design with a control group. The sample included two groups (intervention and control), totaling 30 participants. The independent variable was the steeping of *Dayak* onion bulbs, while the dependent variables were blood pressure values and MAP. The instruments used were Standard Operating Procedures (SPO) *Dayak* onion herb, SPO blood pressure measurement, SPO calculation of MAP, and a digital sphygmomanometer. Data analysis was performed using paired t-tests. The results of the paired t-test statistical analysis of systolic-diastolic values and MAP in each group revealed significant findings. In the intervention group, a significant result was obtained in the pre-post test difference test, with a $p<0.05$ from day 1 to day 3 assessments. This suggests that *Dayak* onion steeping water had an effect on systolic-diastolic and MAP values in the intervention group. In contrast, the pre-post test in the control group yielded a $p<0.05$ for systolic values on days 2 and 3, diastolic values on days 1 and 3, and MAP values on days 1, 2, and 3. This indicates differences in systolic-diastolic and MAP values in the pre-post assessments, although these differences were not evenly distributed across every day. The study found that *Dayak* onion steeping water had an effect on systolic-diastolic and MAP values in the intervention group. Thus, the use of *Dayak* onion steeping water, containing allicin, can be considered an approach for controlling hypertension in the realm of complementary and alternative medicine, utilizing natural ingredients for herbal therapy.

## Introduction

An estimated 1.28 billion adults aged 30-79 years worldwide suffer from hypertension, with the majority (two-thirds) residing in low- and middle-income countries. Approximately 46% of adults with hypertension are unaware of their condition, and less than half (42%) receive a diagnosis and treatment. Only about 1 in 5 adults (21%) with hypertension have their blood pressure under control. Hypertension, often referred to as the silent killer, can wreak havoc if left uncontrolled, targeting vital organs and leading to heart attacks, strokes, kidney disorders, and even blindness.[1] Hypertension induces endothelial dysfunction, exacerbates the atherosclerotic process, and contributes to the instability of