

# Food consumption patterns and child stunting in the lowland region

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## Food consumption patterns and child stunting in the lowland region

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### ABSTRACT

Stunting in children under five is a public health problem in Indonesia, especially in lowland areas related to food consumption patterns. This study aims to determine the relationship between food consumption patterns and the incidence of toddler stunting in lowland areas in the Province of South Kalimantan, Indonesia. This type of research is quantitative descriptive, and the sample study amounted to 166 toddlers 12-59 months. The instrument used was a threaded form of the expected food pattern score (DDP) and a 24-hour food recall to determine the diversity of food consumption for toddlers. To determine the relationship between food consumption patterns and stunting, Chi-Square analysis ( $\alpha = 0.05$ ) was used. The results showed that the average actual energy of under five was quite diverse, with a DDP score of 76.4. The average energy consumed by toddlers at 1296.4 kcal/cap/day. The highest food groups consumed by toddlers are grains at 740.3 kcal/cap/day, and the lowest oily seeds fruit food group at 7.8 kcal/cap/day. Based on the analysis of Chi-Square shows the results of 21.715 and  $p$ -value = 0.000 ( $\alpha = 0.05$ ), then  $\alpha > p$ -value indicates a link between food consumption patterns in toddlers with the incidence of stunting in toddlers in lowlands.

**Keywords:** food consumption pattern, toddler, stunting, lowland

### INTRODUCTION

Less diverse food consumption patterns are among the leading nutritional problems in developing countries such as Indonesia. In developing countries, the majority of food intake is dominated by food sources of calories and a lack of intake of animal-sourced foods (ASFs), fruits, and vegetables [1], [2]. The disparity in the diversity of food consumption among individuals and groups of people is genuine in Indonesia [3]. Many factors and the type and amount of food consumed can vary between communities and groups due to regional differences [4], [5].

Diversification of community food consumption must be carried out to create human resources of higher quality and competitiveness [6]. Children aged under five years old (toddlers) and school-age children need a quality nutrient intake, balanced and diverse [7]. In addition to the diversity of food consumption and the nutritional status of the people being closely related to the environment, geographical conditions influence food consumption patterns, so it is essential to separate the regions according to the highlands and lowlands [8], [9].

Nutritional problems in Indonesia arise from consuming foods that are only considered delicious and filling. Balanced nutrition must be fulfilled from various foods consumed because no food has a perfect nutritional content, so it is necessary to diversify the food consumed.

Data from the Hulu Sungai Utara Regency Food Security Service shows that the food consumption pattern of the community has an average energy consumption of 1,647.9 kcal/cap/day with a DDP score of 78.3 [10], [11]. The grain food group still dominates the people's food consumption pattern with a recommended dietary allowance (RDA) of 35.0%. On the other side, the lowest were the tubers (1.6%), oily fruit/seeds (1.0%), and others (0.5%). This shows that there still needs to be more diversity in food consumption for families living in this lowland area.

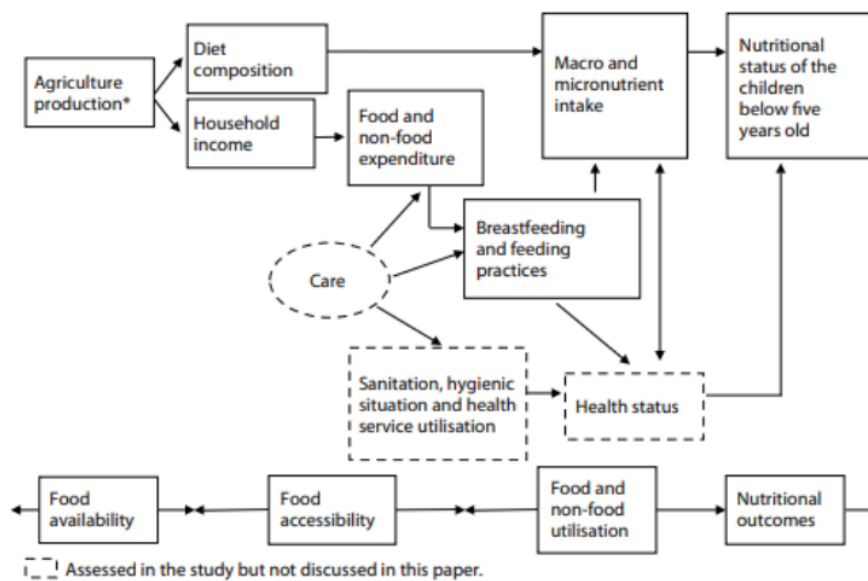
The average production of food crops in Hulu Sungai Utara Regency is lower than the average production of South Kalimantan Province, so it is necessary to increase production. Household food availability is influenced by food production and income, which determines a person's purchasing power or a family for food. Socio-cultural

status, such as attitudes, taboo eating habits, ignorance of nutrition, and food distribution in the family, affect the adequacy of food availability [10], [11].

Based on the Indonesian Basic Health Research (Riskesdas) results in 2018, the prevalence of stunted under-five ages was 19.3% and severely stunted 11.5%. The problem of stunting in Indonesia's children under five is still quite severe, with around 37.2% or about 9 million children. Health Department data show that in 2018 the prevalence of stunting in the Hulu Sungai Utara regency reached 26.06% of the amount weighed as much as 16984 toddlers and in 2019 to 23.24%, with the amount weighing as much as 15895 toddlers. In 2019, the percentage of children under five ages (toddlers) with stunting in four sub-districts in Hulu Sungai Utara, namely Sungai Pandan sub-district, reached 28%, with a weighted number of 2037 children. The percentage of toddlers with stunting in the Banjarm sub-district reached 25.87%, with a weighted number of 1202 toddlers. Sub-district South Amuntai percentage toddler stunting 21.70%, with a weighed amount of 1954 toddlers. Meanwhile, the Amuntai Tengah sub-district has a percentage of toddlers with stunting at 34.59%, with a weighted number of 3631 toddlers.

### Scientific Hypothesis

There is a relationship between food consumption patterns and the incidence of stunting in toddlers in the lowlands of Hulu Sungai Utara Regency, South Kalimantan Province, Indonesia.



**Figure 1** Conceptual framework of the study (adopted from Purwestri et al. [12], [13]).

## MATERIAL AND METHODOLOGY

### Samples

Our sample consisted of respondents from children under five in Hulu Sungai Utara regency, many as 166 respondents. Then we classified the samples based on food consumption patterns and nutritional status.

### Description of the Experiment

**Questionnaire preparation:** This research was conducted in the lowland area of South Kalimantan Province, namely in the Hulu Sungai Utara Regency. The research time is from March to June 2021. The selection of the Hulu Sungai Utara Regency area considered representative takes into account the criteria for lowland geographical conditions, namely at an altitude of 0-7 m above sea level and the highest prevalence of stunting in toddlers (31.03%) in South Kalimantan Province.

**Conducting a questionnaire survey:** The instrument used was a threaded form of the expected food pattern score (DDP) and a 24-hour food recall to determine the diversity of food consumption for toddlers. To determine the relationship between food consumption patterns and stunting, Chi-Square analysis ( $\alpha = 0.05$ ) was used.

**The number of answers:** The total number of processed answers was 166.

**Creating a dataset:** We performed some processing on the raw data. Each participant's response to the questionnaire was analyzed. We checked the text responses for grammatical errors and then compiled the final data set for further processing in Microsoft Excel. To facilitate additional statistical processing, the dataset's structure was modified.

**Processing the answers:** We analyzed all the questions and used tables to present the findings about the Food Consumption Pattern and the Incidence of Stunting in Toddlers. We analyzed the responses to the questionnaire survey and consequently established the most common Toddler Food Consumption Patterns. These responses can be found in the article's discussion section.

### Statistical Analysis

We have used the SPSS 25 statistical software. The significance of our results was based on the  $p$ -values with  $\alpha 0.05$ . The food consumption patterns of toddlers were analyzed using the Desirable Dietary Pattern (DDP) approach. Various types of food have been converted to the same unit, namely grams/day. The formula used is to calculate the Total Desirable dietary pattern (DDP) Score. The total DDP score, known as the quality of food consumption, is the sum of the scores of 9 food groups, namely the number of the grains group and the scores of other groups. This figure is called the DDP score for food consumption, which shows the level of diversity in food consumption.

$$\text{DDP score} = \text{DDP score for grains} + \text{tubers} + \dots + \text{DDP score for other groups.}$$

The relationship between food consumption patterns and the incidence of stunting in children under five in lowland areas was analyzed using Chi-Square, with the formula (1):

(1)

$$\chi^2 = \sum_{i=1}^k \frac{(O_i - E_i)^2}{E_i}$$

Where:

$\chi^2$  = Chi-Square;

$O_i$  = frequency of observation;

$E_i$  = expected frequency.

To simplify the Chi-Square analysis, because each variable only has two categories, the data values of the two variables are presented as a cross table as in Table 1 below.

**Table 1** Chi-Square Analysis Contingency Table

Food Consumption Pattern	Nutritional status		Amount
	Stunted	Not Stunted	
Undiversified	A	B	a + b
Diverse	C	D	c + d
<b>Amount</b>	a + c	b + d	N

The  $\alpha$  value used is 0.05 (5%). Using the SPSS 25 program, what is looking for is the  $p$ -value as the value of the opportunity for the research results to determine the statistical test decisions by comparing the  $p$ -value with  $\alpha$ .

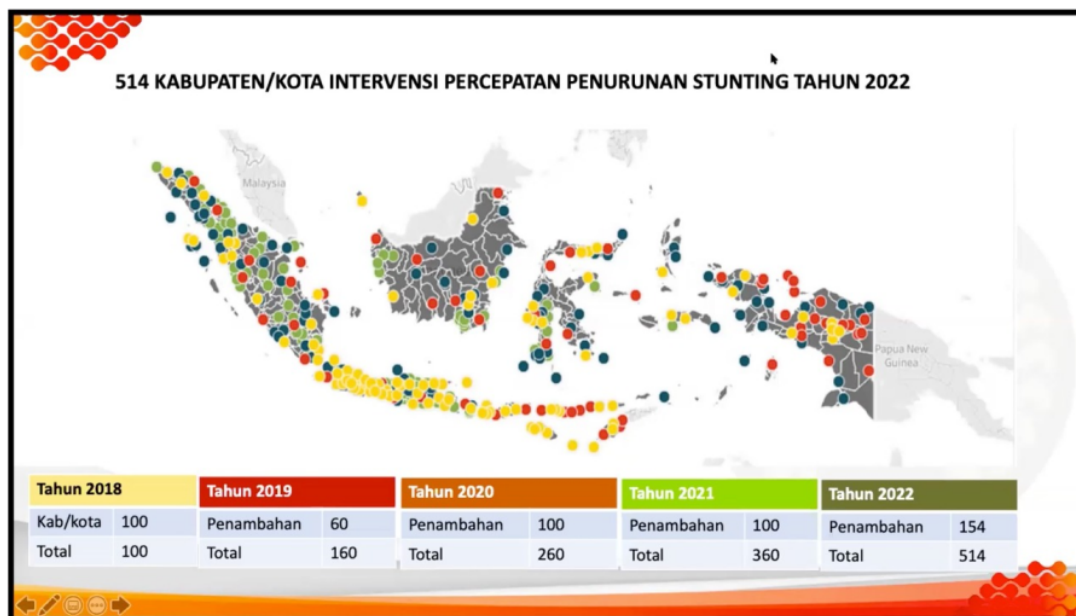
The following conditions apply:

If the  $p$ -value  $\geq \alpha$ , there is no relationship between the two variables.

If the  $p$ -value  $\leq \alpha$ , there is a relationship between the two variables.

## RESULTS AND DISCUSSION

According to estimation, stunting will affect 21.3 % or 114 million children under the age of 5 in 2019. This revealed that stunting and malnutrition were indications of undernutrition concerns in Indonesia. Children with malnutrition typically have a decreased appetite. It can be seen by the time they wanted to eat, but for a short while. Therefore, he needs specialized food with a high enough concentration of nutrients and can be easily ingested, even though there is a limited supply of such foods. In general, the calorie content of foods exceeding 1.2 kcal per millilitre is considered excessive. While the standard composition ranges from 0.9 to 1.2 kcal per millilitre of liquid or powder, this formula contains fewer calories. The acceleration of stunting reduction in 514 districts/cities of Indonesia is present in Figure 2.

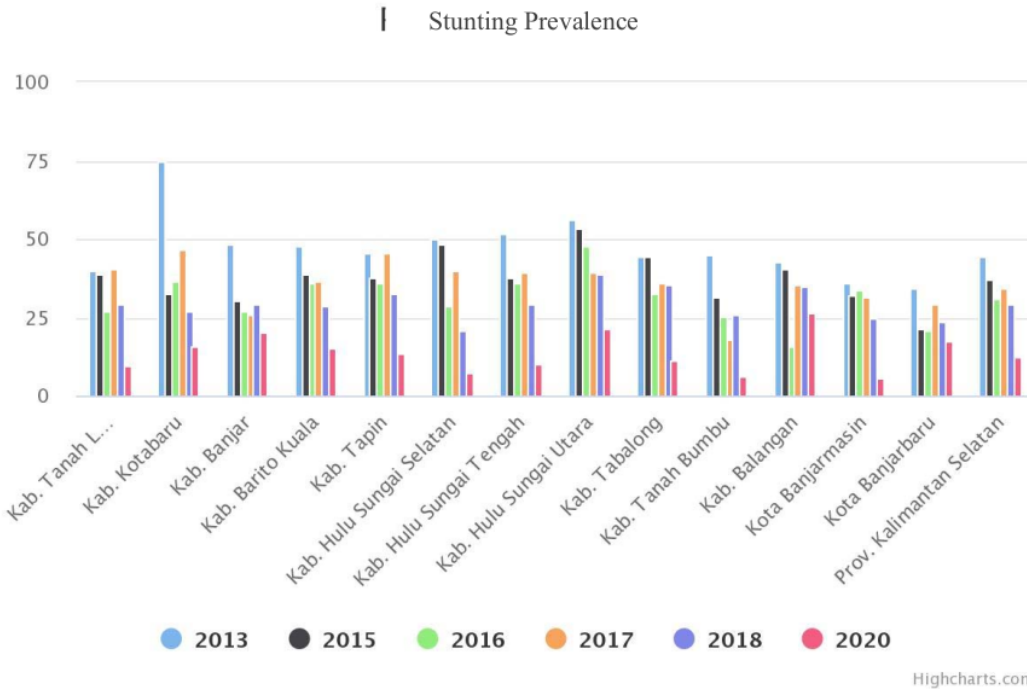


**Figure 2** Acceleration of stunting reduction in 514 districts/cities. Note: Source: <https://prohealth.id/demi-indonesia-emas-stunting-harus-tuntas/>.

In most cases, it contains a protein level that ranges from 15 to 20 %. WHO regulations must be followed while nourishing children with stunted growth. For instance, a P/E ratio (PER) of 8.9 % should be adopted if we aim for a weight gain of 10 g/kg/day. Or, to reach 20 g/kg/day, a R/E ratio of 11.5 % is required.

According to information from the Indonesian Nutritional Status Study in 2021, the incidence of stunting in South Kalimantan was 33.08%, placing it as the 6th highest state in the nation. Tanah Laut, Balangan, Barito Kuala, Tapin, and Banjar regions Tanah Laut, Balangan, Barito Kuala, Tapin, and Banjar regions with stunting rates higher than the provincial average comprise the five regions in the red zone for stunting. Meanwhile, the stunting rate in South Kalimantan has reached 10.5% using the electronic application method-Community-Based Nutrition Recording and Reporting (e-PPGBM) in 2022, which is carried out directly on the field, and survey data from January to the present has reached 80%. Although the prevalence of stunting has decreased every year, handling stunting must remain our priority, this is to achieve the national target of 14 percent by 2024.

Stunting Prevalence by City/Regency in South Kalimantan Province of Indonesia is present in Figure 3.



**Figure 3** Stunting Prevalence by City/Regency in South Kalimantan Province. Note: Source: <https://kalseprov.go.id/>.

**Toddler Food Consumption Patterns**

The results of the study of the food consumption patterns of toddlers in Hulu Sungai Utara District using the desirable dietary pattern (DDP) approach. Scores of DDP toddlers in the study area can be seen in Table 2.

**Table 2** A score of Expected Food Patterns for Toddlers in Hulu Sungai Utara District, South Kalimantan Province, Indonesia.

Food Group	Calories	%	% RDA	Weight	Actual Score	RDA score	Score Max	Gap Score RDA and Max Score	DDP Score
Grains	740.3	57.1	52.9	0.5	28.6	26.4	25.0	3.55	25
Tubers	17.8	1.4	1.3	0.5	0.7	0.6	2.5	-1.8	0.6
Animal-Sourced Foods (ASFs)	384.9	29.7	27.5	2.0	59.4	55	24.0	35.4	24
Oil and fat	25.4	1.9	1.8	0.5	0.9	0.9	5.0	-4.05	0.9
Oily Seed	7,8	0.6	0.6	0.5	0.3	0.3	1.0	-0.7	0.3
Fruits	29.5	2,3	2.1	2.0	4,6	4,2	10.0	-5.4	4,2
Nuts	21.6	1.7	1.5	0.5	0.9	0.8	2.5	-1.7	0.8
Sugar	57.7	4,4	4,1	5.0	22	20.6	30.0	-8	20.6
Vegetables and fruit	11.4	0.9	0.8	0.0	0	0.0	0.0	0	0
Others	11.4	0.9	0.8	0.0	0	0.0	0.0	0	0
<b>Total</b>	<b>1296.4</b>	<b>100</b>	<b>92.6</b>	<b>11.5</b>	<b>117.4</b>	<b>108.8</b>	<b>100.0</b>		<b>76.4</b>

Based on Table 2 above, the average energy consumed by toddlers is 1296.4 kcal/cap/day. This value is sufficient in energy consumption standards toddlers are 1000-1400 kcal/cap/day. The DDP score of 76.4 is still below the DDP ideal score of 100.

The table above also shows that the grain type food group has the most significant contribution (57.1%) and also has the highest % RDA value, reaching 52.9%. The second-largest energy contributor is the Animal-Sourced Foods (ASFs) group (29.7%), with an RDA value of 27.5%. Meanwhile, the food group with the lowest % RDA value was oily seeds (0.6%) and others (0.9%). This shows that a few food groups only dominate energy consumption for toddlers in these four sub-districts.

### The Relationship between Food Consumption Patterns and the Incidence of Stunting in Toddlers

The results of the research on the relationship between food consumption patterns and the incidence of stunting in children under five in Hulu Sungai Utara regency using Chi-Square analysis can be seen in Table 3 below.

**Table 3** The Relationship between Food Consumption Patterns and Stunting Incidence in Toddlers in Hulu Sungai Utara Regency, South Kalimantan Province, Indonesia.

Food Consumption Pattern	Nutritional status		Amount	X <sup>2</sup>	p-value
	Stunted	Not Stunted			
Undiversified	58	28	86	21.715	0.000
Diverse	25	55	80		
<b>Total</b>	83	83	166		

Note: Source: Primary Data Processing, 2021.

Table 3 above shows that as many as 80 respondents with various consumption categories and their nutritional status were not stunting totaling 55 samples, and only 25 were categorized as stunting. Meanwhile, 86 respondents in the consumption category were not diverse, and the nutritional status of stunting was 58 samples, and only 28 were in the non-stunting category. Meanwhile, the chi-square obtain a value of 21.715 and  $p$ -value = 0.000 ( $\alpha = 0.05$ ). Hence,  $\alpha > p$ -value indicates a relationship between the food consumption patterns of toddlers and the incidence of stunting in these four sub-districts.

### Toddler Food Consumption Patterns

Based on the study results, the average food consumption of children under five in the lowland areas is derived from the grains and Animal-Sourced Foods (ASFs) groups. The least consumed food group came from the oil and fat food group. The highest level of participation in food consumption is the grain food group (56.5%). The results of research conducted by Prasetyo, Hardinsyah & Sinaga [14] also show that the food consumption pattern is dominated by grains; of the nine food groups, it is known that the food group that has the most participation is grains, namely 99.4%. The grain food group consists of rice and its preparations, corn and its preparations, and wheat and its preparations. Rice has the highest participation rate for consumption compared to corn and wheat. As highlighted by Suhaimi [15], the pattern of food consumption in Indonesia shows that most of the population consumes rice as a staple food ingredient and some others consume rice along with other cereals and tubers that play a significant role in contributing to energy sufficiency [16], [17]. Therefore, rice is a necessary food for every main course at the research site. This pattern of behavior is hard to break, as demonstrated by the theory developed based on earlier studies' findings [18-20]. that customs strongly influence food consumption patterns. According to Sezgin & Şanlıer and Enoch, & Sumartono [21], [22] that the habit of food consumption patterns is difficult to change, and if it is forced to be replaced, it can cause reactions that are not readily accepted [23], [24].

There needs to be a new policy from the government related to food consumption patterns for toddlers to reduce the prevalence of stunting. According to Nyamasege et al. and Permatasari et al. [25], [26], the policy of providing nutrition counseling training to health workers can effectively motivate mothers to ensure proper feeding practices for their children. Previous studies also show that stunting in children in North Maluku can be reduced by improving maternal education, maternal nutrition information, and poverty reduction [27-29]. Furthermore, other results on children in Tehran-Iran reveal that adherence to a diet high in protein and carbohydrates is associated with a reduced chance of stunting [30], [31].

Based on the DDP calculation, shows that the average score for toddlers is 76.4. This value is still below the ideal score of 100, so the food consumption of toddlers is categorized as quite diverse. Previous research also shows that the overall food consumption pattern score of children aged 0.5-12.9 years is only 49.9, which is still far below the ideal score of 100 [32]. The score of food consumption patterns tends to be higher for children who live in urban areas. Mother's education level is higher, and socioeconomic status is more increased. The current study is also similar to Widyaningsih et al. [33] showing that food intake in toddlers is not in the diverse category.

Ahmad, Khalique & Khalil concluded that about half of the children were stunted, and inadequate dietary diversity was significant [34]. This shows that good food diversity can help overcome the burden of stunting in children.

Current research in lowland areas shows that food consumption for children under five is quite diverse but still dominated by only a few food groups. The best solution is for the Indonesian government to evenly implement Presidential Regulation No. 22 of 2009 concerning the Policy for Accelerating Diversification of Food Consumption Based on Local Resources. The policy has been made to implement a diverse, nutritious, balanced, and safe diet (named B2SA). This movement aims to raise awareness and cultivate a diverse, nutritious, balanced, and safe pattern of food consumption for a healthy, active, and productive life for the community, especially families with toddlers.

#### The Relationship between Toddler Food Consumption Patterns and Stunting Incidence

Based on the results of the Chi-Square analysis, the relationship between the level of diversity in food consumption and the incidence of stunting among toddlers in lowland areas shows a  $p$ -value = 0.000. This shows a link between food consumption patterns and the incidence of stunting in children under five. This finding is in line with Ngaisyah [35], from the analysis of Chi-Square obtained a degree of diversity of food consumption with the incidence of stunting in toddlers in district Ngeemplak has a  $p$ -value = 0.000. This shows that toddlers who have consumed a variety of foods will have a better nutritional status. Previous research found that food consumed in a variety of sufficient and balanced quantities will meet dietary needs [36]. Eating a variety of foods is very good for complementing the substances needed by the body [34].

A similar study also performed by Widyarningsih et al. showed 41% of toddlers aged 24-59 months of stunting [33]. Chi-Square analysis indicates a relationship between body length of birth, upbringing, and diversity of food eaten with the incidence of stunting ( $p < 0.05$ ). The most dominant risk factor for stunting is food diversity. According to Ahmad et al. [34] in Aligarh, India, that about half of the children have been stunted by the resulting variety of inadequate food, a significant predictor [34]. This shows that adequate food diversity can help overcome the burden of stunting in children. As discovered by previous findings [37], [38] that directly the food intake consumed by children can affect their nutritional status of children. Esfarjani et al. and Mahmudiono's findings [30], [31] found a protective relationship between dietary diversity and child stunting. Therefore, community interventions should focus on promoting food groups currently lacking in mothers' and children's diets, including those rich in growth-promoting nutrients such as milk, livestock, and meat. According to the WHO [39], toddlers not consuming a wide variety of foods will have impaired growth and development.

Current research in lowland areas reveals the availability of the amount and diversity of food in the household determines food intake and consumption patterns for growth in the family. Toddlers who experience stunts in growth are due to a lack of consumption of various foods, so increased nutritional deficiencies may eventually lead to stunting [40], [41]. There must be government intervention in the form of a nutrition improvement program for children under five to anticipate the increasing prevalence of stunting in these lowland areas. According to Angdembe et al. [41], nutrition programs should focus on the most disadvantaged and prone to stunting subgroups. Multi-sectoral efforts are needed to target nutritionally sensitive programs, including social protection for the poor.

#### CONCLUSION

The average energy consumed by toddlers in research areas in the lowlands amounted to 1296.4 kcal/cap/day. This value is sufficient on energy consumption standards toddlers are 1000-1400 kcal/cap/day. The score of the expected food pattern reaches 76.4 out of the ideal score of 100, indicating that the food consumption diversity of children under five ages is quite diverse but still dominated by carbohydrates. Further, the Chi-Square analysis results showed a value of 21.715 and  $p$ -value = 0.000. This indicates a relationship between food consumption patterns and the incidence of stunting among children under five years of age in lowland areas in South Kalimantan Province. Government policy to reduce stunting prevalence, especially in lowland areas through real programs, namely increasing awareness and changing people's behavior to meet family food and nutritional needs, starting with a program to increase food consumption diversification based on local food resources. In addition to increasing advocacy, campaigns, and dissemination related to stunting and various prevention efforts. This finding will provide further insight related to stunting prevalence, especially in lowland areas by addressing several elements, such as the development of food security and the improvement of dietary habits of the general public.



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The authors declare no conflict of interest.

**Ethical Statement:**

This article does not contain any studies that would require an ethical statement.

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