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An Analysis of Food Security Indicators and Stunting in Bengkulu Province, 2021–2023

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Abstract

Stunting remains a significant public health concern in Bengkulu Province. According to the 2023 Indonesian Health Survey (IHS), the prevalence of stunting in Bengkulu reached 20.2%. This study analyzes the relationship between stunting and food security indicators using secondary data from the Bengkulu Central Statistics Agency and the National Food Agency from 2021 to 2023, comprising 30 samples. The analysis showed no statistically significant relationship between stunting and any of the independent variables at the 95% confidence level. The p-values for all variables—including the Food Security Index (FSI), Nutritional Consumption Pattern Ratio (NCPR), poverty rate, food and electricity expenditures, access to clean water, average years of schooling, health worker ratio, life expectancy (AHP), Desirable Dietary Pattern (DDP), Energy Adequacy Ratio (EAR), and Protein Adequacy Ratio (PAR)—were above 0.05. These findings suggest that none of the examined indicators had a significant effect on stunting in Bengkulu Province during the study period.
Keywords : bengkulu province, food security index, nutrition, poverty, stunting

Introduction

Stunting remains a significant public health issue in Bengkulu Province. According to the 2023 Indonesian Health Survey (IHS), the stunting prevalence in the region reached 20.2% (MOH, 2023), representing a 0.4% increase from the 2022 Indonesian Nutrition Status Survey (SSGI), which reported a prevalence of 19.8% (MOH, 2022). Contributing factors to the persistently high rate of stunting include limited access to nutritious food, poor sanitation, and a lack of awareness regarding parenting practices and adequate child nutrition (Supadmi et al., 2024).

One key indicator closely associated with stunting prevalence is the Food Security Index (FSI) (Yuliantini et al., 2022). The FSI reflects a region's capacity to provide sufficient, safe, and nutritious food for its population. In 2023, Bengkulu reported an FSI score of 72.27, classified as "Resistant" (Bapanas, 2023a). However, significant challenges remain, particularly in the equitable distribution of nutritious food and access for vulnerable rural communities (Bapanas, 2023a). Food insecurity in these areas further exacerbates nutritional problems, contributing to stunting (Masitoh et al., 2023).

The FSI comprises nine key indicators: (1) the ratio of normative consumption to net production, (2) the percentage of the population living below the poverty line, (3) the percentage of households with food expenditures exceeding 65% of total expenditures, (4) the percentage of

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households without electricity access, (5) the average years of schooling among women over 15 years old, (6) the percentage of households without access to clean water, (7) the ratio of population to health workers relative to population density, (8) the percentage of children under five who are stunted, and (9) life expectancy at birth (Bapanas, 2023a).

The FSI's success is measured by a region's ability to ensure year-round access to safe, nutritious, and adequate food for all, particularly for vulnerable groups such as the poor, pregnant women, infants, the elderly, and individuals with disabilities (Bapanas, 2023). Strengthening food systems, improving community nutrition, enhancing health services, and promoting welfare are essential strategies for reducing hunger and malnutrition in all its forms (Bapanas, 2023). These efforts serve as a foundation for building a healthy, intelligent, active, and productive society.

Based on this context, the present study aims to examine the relationship between the Food Security Index indicators and nutritional status, particularly stunting, and to analyze the strength and direction of this relationship in Bengkulu Province.

Research methods

This study utilized secondary data obtained from the Bengkulu Central Statistics Agency (BPS Bengkulu) and the National Food Agency. The data covered the period from 2021 to 2023, with a total of 30 data points analyzed. Data collection was conducted between November 1 and 24, 2024. The purpose of this study was to assess whether the independent variables—including the total Food Security Index (FSI), Nutritional Consumption Pattern Ratio (NCPR), poverty rate, food expenditure, electricity expenditure, access to clean water, average years of schooling, health worker ratio, life expectancy, Desirable Dietary Pattern (DDP) score, Energy Adequacy Ratio (EAR), and Protein Adequacy Ratio (PAR)—have a significant influence on the dependent variable, namely the prevalence of stunting. The data analysis method used was multivariate analysis through multiple linear regression, conducted using IBM SPSS Statistics version 27. Prior to the regression analysis, data were tested for normality and correlation using the Spearman rank correlation test. The formulation of the multiple linear regression model used in this study is as follows:

$$\mathbf{S = \alpha + \beta 1X1 + \beta 2\ X2 + ….. + e}$$

Information :
S: Stunting
α : Constant
β : Regression coefficient of independent variables
X1, X2, X3…..: Independent variables
e : Error

To understand the meaning of the model described above, we can see the statistical explanation of the output analysis results, namely the F observation value or F calculation with the F table (presented in the probability table) as follows:

1. If the F hit value is smaller or equal to F in the table, this indicates that the variable does not have a significant effect on stunting in Bengkulu Province.
2. If Fcount > Ftable, it means that the variable is not significant or H_1 is not obtained, which means it has the same influence on stunting in Bengkulu Province.

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Results

a. Normality test results

Table 1. Normality Test

Variables	Shapiro Wilk		
	Statistics	Df	Sig
FSI	0.114	30	0.125
NCPR	0.141	30	0.011
Poverty	0.200	30	0.003
Food	0.127	30	0.153
Electricity	0.178	30	0.001
Water	0.158	30	0.015
School Years	0.172	30	0.001
Health Worker Ratio	0.167	30	0.016
AHP	0.220	30	0.001
DDP	0.138	30	0.010
EAR	0.129	30	0.001
PAR	0.190	30	0.001
%EAR	0.130	30	0.001
%PAR	0.305	30	0.001
Stunting	0.361	30	0.001

Normality test is conducted to see whether the data has a normal distribution. In table 1, it shows that the variables that are normally distributed are only FSI 0.125 and food expenditure 0.153 while other data are not normally distributed. So through these results, the next test uses the Spearman test because the data is not normally distributed.

b. Correlation Test Results

Table 2. Spearman Correlation Test

Variables	Correlation Coefficient	Df	Sig
FSI	-0.474	30	0.125
NCPR	0.426	30	0.011
Poverty	-0.229	30	0.003
Food	-0.055	30	0.153
Electricity	0.3	30	0.001
Water	0.34	30	0.015
School Years	-0.291	30	0.001
Health Worker Ratio	0.109	30	0.016
AHP	0.125	30	0.001
DDP	-0.239	30	0.010
EAR	-0.148	30	0.001
PAR	0.067	30	0.001
%EAR	-0.147	30	0.001
%PAR	-0.022	30	0.001

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After the Spearman test was conducted, there were several independent variables that had a p value <0.05 with a significance of NCPR 0.011, poverty 0.003, electricity 0.001, water 0.015, length of school 0.001, health worker ratio 0.016, AHP 0.001, DDP score 0.010, EAR 0.001, PAR 0.001, %EAR 0.001, %PAR 0.001.

c. Multiple Linear Regression Test Results

Table 4. Multiple Linear Regression Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
FSI	-0.820	0.867	-0.388	-0.945	0.359
NCPR	5,573	7,081	0.510	0.787	0.443
Poor	-0.180	1,414	-0.060	-0.127	0.900
Food	0.186	0.515	0.185	0.362	0.722
Electricity	-0.459	3,568	-0.031	-0.129	0.899
Water	0.095	0.210	0.150	0.454	0.656
School Years	5,179	3,463	0.533	1,495	0.154
Health Worker Ratio	1,087	1,891	0.154	0.575	0.573
AHP	-1,096	2,700	-0.195	-0.406	0.690
DDP	-0.053	0.721	-0.019	-0.073	0.942
PAR	0.201	0.882	0.116	0.228	0.823
%EAR	-0.115	0.535	-0.124	-0.216	0.832
%PAR	-0.018	0.074	-0.073	-0.238	0.815

The results of the analysis showed that there were no significant variables at the 95% confidence level. The p-value for each variable is as follows: FSI of 0.359, NCPR of 0.443, Poor of 0.900, Food of 0.722, Electricity of 0.899, Water of 0.656, Length of Schooling of 0.145, Ratio of Health Workers of 0.573, AHP of 0.690, DDP of 0.942, PAR of 0.823, %EAR of 0.832, and %PAR of 0.815.

Discussion

The Influence of the Food Security Index (FSI) Against Stunting

The Effect of Food Security Index (FSI) on Stunting The FSI coefficient calculated using multiple linear regression test is 0.359. This value shows an insignificant relationship between FSI and stunting or > 0.05 (alpha). That the Food Security Index and stunting are positively correlated and not significant. Therefore, FSI does not have a very large influence on changes in stunting. This is in line with researchSihotang and Rumida (2020)who said that FSI has no relationship to stuntingFrom the results of statistical tests, it was found that there was no relationship between food security and nutritional status based on the weight for age index (p<0.488). This result explains that food security based on the proportion of household food expenditure and energy consumption is not a factor causing the risk of wasting or nutritional status based on the weight for age index. Factors causing poor nutritional status are influenced by gender, diarrhea, early feeding or not exclusive breastfeeding were found as risk factors for wasting. However, the results of the studyMumtaza (2024)not in accordance with this study because the statistical test shows that there is a significant relationship between food security and stunting (p = 0.001). On the other hand, families with food insecurity will increase the likelihood of experiencing stunting in toddlers. Fitriyani and Sunarto (2021) showed that there was no significant relationship between household

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food security and stunting, where the p value was 5.58 and the OR value was 1.21. The factors causing stunting in rural China are economic and genetic, not household food security. Stunting conditions in children tend to be high and increase due to low birth weight (54.6%) and infectious diseases. Low birth weight causes the intEAR of nutrients that are absorbed imperfectly, causing infectious diseases.

The Impact of NCPR on Stunting

Normative consumption ratio per capita (NCPR) against stunting The NCPR coefficient calculated by multiple linear regression test is 0.443. This value shows an insignificant relationship to stunting or > 0.05 (alpha). That the normative consumption ratio per capita and stunting are positively correlated and insignificant. Therefore, NCPR does not have a very large influence on changes in stunting.

The Impact of Poverty on Stunting

Poverty Against Stunting The Poverty Coefficient calculated by multiple linear regression test is 0.900 This value shows an insignificant relationship to stunting or > 0.05 (alpha). That poverty and stunting are positively correlated and not significant. Therefore, poverty does not have a very large influence on changes in stunting.Erdi Fadhilah et al (2022) said in the stunting variable (X1) the t-value is known to be -0.71 with a probability value of 0.47. This shows that the stunting variable has a negative and insignificant effect on poverty because the probability value is more than the alpha value of 0.05. non-economic factors have a greater influence on stunting.

The Impact of Food Expenditure on Stunting

Food Expenditure on Stunting The coefficient of food expenditure calculated by multiple linear regression test is 0.722. This value shows an insignificant relationship with stunting or > 0.05 (alpha). That food expenditure and stunting are positively and insignificantly correlated. Therefore, food expenditure does not have a very large influence on changes in stunting. Research conductedRahmawati et al (2020) food expenditure (p=0.390) this study showed no significant relationship between economic factors (food expenditure) and the incidence of stunting. Families with more than one toddler have a higher prevalence of stunting compared to families with one toddler because families with more toddlers require more costs and mothers have difficulty taking care of children and cannot work to increase family income.

The Effect of Electricity on Stunting

Electricity to stunting The electricity coefficient calculated by multiple linear regression test is 0.899. This value shows an insignificant relationship to stunting or > 0.05 (alpha). That electricity and stunting are positively correlated and not significant. Therefore, electricity does not have a very large influence on changes in stunting. This study is not in line withKhoirudin (2022)Because the results of the study are that electricity ownership has a significant effect on household food consumption with a value of 0.004 <0.05. The variable of electricity ownership has a positive effect on household consumption. The coefficient value shows that when a household has electricity, food consumption will increase by 0.067 percent. Households that cook using modern fuel (electricity) will increase household food consumption more than households that cook using traditional methods (stoves). This means that then processing food ingredients into

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finished food can be done using electronic equipment, where this effort can minimize cooking time so that it is more effective and efficient. In addition, the use of electronic equipment can help process various types of food more easily.

The Effect of Water on Stunting

Water on stunting The water coefficient calculated by multiple linear regression test is 0.656. This value shows an insignificant relationship to stunting or > 0.05 (alpha). That water and stunting are positively and insignificantly correlated. Therefore, water does not have a very large influence on changes in stunting. This is in line with research conducted byBasri et al (2021)that bBased on the relationship between drinking water sources and stunting incidents, calculations using the chi-square test obtained a p value = 0.749 > α 0.05, so there is no relationship between drinking water sources and stunting incidents in toddlers. Almost all households in the Pambusuang Health Center work area, Balanipa District, Polewali Mandar Regency in this study have good drinking water sources (not cloudy, tasteless, odorless, and colorless). But most of the people there do not boil their water because the source of the water they drink is suitable for consumption (not cloudy, tasteless, odorless, colorless), even though the source of the drinking water is good, it is necessary to boil the water consumed to be free from bacteria.

The Influence of Schools on Stunting

Education on stunting The coefficient of education calculated by multiple linear regression test is 0.154. This value shows an insignificant relationship to stunting or > 0.05 (alpha). That education and stunting are positively and insignificantly correlated. Therefore, education does not have a very large influence on changes in stunting. Research conducted byBasri et al (2021)said analysisusing the chi-square test obtained a p value = 0.279 > α 0.05 then there is no relationship between education and the incidence of stunting in toddlers because the community in the Pambusuang Health Center work area has received IEC (Communication, Information and Education) from health workers regarding the importance of adequate nutrition for child growth and development. The level of maternal education is the basic cause of malnutrition problems, and there are still many other factors that can influence the occurrence of malnutrition problems, especially stunting in poor families

The Influence of the Ratio of Health Workers on Stunting

Ratio of health workers to stunting The coefficient of the health worker ratio calculated by multiple linear regression test is 0.573. This value shows an insignificant relationship to stunting or > 0.05 (alpha). That the ratio of health workers and stunting is positively correlated and not significant. Therefore, the health worker ratio does not have a very large influence on changes in stunting. This study is not in line withRahmawati et al (2020) The results of the study found a significant relationship between health workers and cadre support, utilization of integrated health posts (p = 0.041; OR = 3.524; 95% CI: 1.055-11.768 and p = 0.019; OR = 5.282; 95% CI: 1.313-21.239). Toddlers who are not routine and never utilize integrated health posts will have a tendency of 3.5 and 5.2 times to experience stunting when compared to toddlers who utilize integrated health posts. A relevant program to be emphasized or required for poor families receiving PKH is accessing integrated health posts, especially for toddlers on the third and subsequent years.

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Another program that is very relevant for stunting risk factors in the form of a large number of family members (more than 4 people) and a birth order of more than two is Family Planning (KB) for poor people receiving PKH.

The Influence of Life Expectancy on Stunting

Life expectancy against stunting The coefficient of life expectancy calculated by multiple linear regression test is 0.690. This value shows an insignificant relationship to stunting or > 0.05 (alpha). That life expectancy and stunting are positively and insignificantly correlated. Therefore, life expectancy does not have a very large influence on changes in stunting.

The Influence of DDP Scores on Stunting

Expected food pattern towards stunting The DDP coefficient calculated by multiple linear regression test is 0.942. This value shows an insignificant relationship with stunting or > 0.05 (alpha). That DDP and stunting are positively correlated and not significant. Therefore, DDP does not have a very large influence on changes in stunting.Research conductedAmarita (2022) also showed no relationship between the Expected Food Pattern (DDP) score and the prevalence of Stunting or a weak relationship (p = 0.259; r = 0.245). food consumption obtained cannot represent nutritional status because nutritional status is a representation of long-term consumption patterns. Food consumption data in this study were obtained through a 2x24-hour food record which only reflects consumption for 2 days so that it cannot reflect the subject's eating habits so that the food consumption obtained cannot represent the subject's nutritional status. Food intEAR plays a very important role in determining a person's nutritional status, directly the food intEAR consumed by children can affect the child's nutritional status and the consequences of not consuming a variety of foods will result in growth and development disorders in toddlers.

The Influence of EAR on Stunting

The Energy Adequacy Ratio (EAR) coefficient calculated through multiple linear regression analysis was 0.832. This value indicates a statistically insignificant relationship with stunting (p > 0.05), suggesting that although EAR and stunting are positively correlated, the association is not significant. Thus, EAR does not appear to have a strong influence on changes in stunting rates. However, these findings are not consistent with previous research by Fitriyani and Sunarto (2021), who reported a significant relationship between energy adequacy and stunting (p < 0.001). Their study also indicated an insignificant relationship (p = 0.323) between energy adequacy and stunting after controlling for the history of Early Initiation of Breastfeeding (EIBF)**.** Children without a history of EIBF were found to have a 1.3 times greater risk of stunting compared to those who were breastfed immediately after birth (OR: 1.3; 95% CI: 0.8–2.0). Inadequate energy intake remains one of the contributing factors to stunting. In Indonesia, the provision of supplementary food is urgently needed, especially for vulnerable groups, as part of a strategic approach to address nutritional deficiencies.

The Influence of PAR on Stunting

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Protein adequacy rate against stunting The PAR coefficient calculated by multiple linear regression test is 0.823. This value shows an insignificant relationship with stunting or > 0.05 (alpha). That PAR and stunting are positively and insignificantly correlated. Therefore, PAR does not have a very large influence on changes in stunting. This study is in line with the results of *Swarinastiti et al* (2018)that there is no significant relationship (p>0.05) with a p value = 1,000 between the dominance of vegetable protein intEAR on the incidence of stunting. The case and control toddler groups, both found that vegetable protein intEAR was not dominant against daily total protein in EAR. Foods that do not contain essential amino acids will cause the protein synthesis process to be less than optimal, thus affecting the growth process. Soybeans also contain phytates which can inhibit the absorption of zinc and iron. The composition of the menu for stunted toddlers consists of staple foods plus side dishes and vegetables, with the type of side dish that is often consumed being vegetable side dishes.

Conclusion

From the results of research onthe main secondary data sources come from the Bengkulu Central Statistics Agency (BPS Bengkulu) and the National Food Agency. Secondary data used from 2023-2021 with a total of 30 samples based on the results of data analysis.Multiple linear regression analysis can conclude that there is no statistically significant relationship between the independent variables.FSI, NCPR, Poverty, Food Expenditure, Electricity, Water, School, Health Worker Ratio, Life Expectancy, DDP Score, EAR and PAR against stuntingin the Bengkulu area.

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