RESEARCH ARTICLE OPEN ACCESS
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Analysis of Changes in Desirable Dietary Pattern (DDP) Scores on the Nutritional Status of Toddlers in Island of Borneo

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ABSTRACT

The *Dietary Diversity Score (DDS)* is an important indicator for assessing the quality of food consumption within a population, directly linked to the nutritional status of individuals, particularly toddlers, who are highly vulnerable to nutritional issues. This study aims to analyze changes in DDS scores and their influence on toddler nutritional status, life expectancy, poverty levels, and the Food Security Index (IKP) in Island of Borneo. This research is an observational analytic study with a cross-sectional design. The population in this study consists of 55 cities/districts on the island of Borneo. The data used are secondary data from 2022 and 2023, analyzed using a simple linear regression test.The results indicate that DDS scores and toddler nutritional status (*stunting*, *wasting*, *underweight*, and *overweight*) in Island of Borneo show no statistically significant relationships, with p-values of 0.948, 0.288, 0.326, and 0.850 ($p > 0.05$), respectively. However, there is a significant influence of DDS scores on poverty levels ($p = 0.011$).

ARTICLE INFORMATION

Submitted: 03/12/2024
Revised: 07/03/2025
Accepted: 01/05/2025
Publised Online: 01/05/2025

Keywords:
borneo
desirable dietary pattern
nutritional status
poverty
toddlers

How to cite this article: Permata, G. C. I., Rudiansyah, Sitanggang, T. R., & Tanziha, I. (2025). Analysis of Changes in Desirable Dietary Pattern (DDP) Scores on the Nutritional Status of Toddlers in Island of Borneo. *Journal of Nutrition Science*, *6*(1), 1–5. https://doi.org/10.35308/jns.v6i1.10961

Introduction

The success of a nation's development is determined by the availability of quality human resources (HR), characterized by individuals with robust physical health, strong mental resilience, excellent health, and intelligence. Empirical evidence shows that this is significantly influenced by good nutritional status, which in turn is determined by the quantity and quality of food intake. The issues of undernutrition and malnutrition are directly influenced by food consumption factors. Indirectly, they are affected by parenting practices, food availability, socioeconomic factors, as well as cultural and political conditions. If undernutrition and malnutrition persist, they can become significant obstacles to national development.

One of the unresolved health issues in Indonesia is malnutrition among children under five (Ngoma *et al*., 2019). Children with malnutrition are nearly 12 times more likely to die compared to well-nourished children (UNICEF, 2020). Based on the 2023 Indonesian Health Survey, Island of Borneo has a relatively high prevalence of malnutrition among children under five, with stunting at 22.9%, wasting at 10.1%, underweight at 18.0%, and overweight at 4.7% (Mulyani et al., 2020; Kemenkes, 2023; Maulizar, et al., 2023).

Poor nutritional status in children not only affects their short-term health but also influences life expectancy and future productivity. Stunted children are at higher risk of experiencing various health problems later in life, which may reduce their life expectancy (Widodo, 2017). Nutritional problems essentially reflect insufficient nutrient intake to meet the body's needs. Those who consume nutrients in accordance with their body's requirements will have good nutritional status, and vice versa (Harjatmo *et al*. 2017).

The Food Consumption Score serves as a crucial indicator for assessing the quality of food consumption in a population, which is directly linked to individual nutritional status, especially for children under five who are highly vulnerable to nutritional issues. A high PPH score indicates that the population's food consumption meets ideal standards of variety, nutrition, balance, and safety (B2SA) (BPN, 2024).

The PPH score also reflects food security, defined as the ability of a population to obtain adequate, safe, nutritious, and sustainable food. Analyzing the PPH score can indicate how well a community achieves food security and how it relates to socio-economic factors, poverty levels, and health. It also serves as a key point for evaluating the success of food and nutrition policies (Kementan, 2017).

Therefore, analyzing changes in the PPH score and its impact on the nutritional status of children under five, life expectancy, poverty levels, and food security index in Island of Borneo essential. This study will not only provide insights into the relationship between food consumption patterns and community health but also serve as a basis for

intervention policies to improve the quality of life in the region.

Method

This study is an observational analytic research with a cross-sectional design. The population in this study consists of 55 cities/districts on the Island of Borneo. The data used are secondary data from 2022 and 2023, which include data on toddler nutritional status (stunting, wasting, underweight, and overweight), the *Dietary Diversity Score* (DDS) for Borneo, as well as poverty levels and the *Food Security Index* (IKP) for Borneo, obtained from the Food Security and Vulnerability Atlas (FSVA).

Statistical analysis was performed to determine the effect of DDS scores on toddler nutritional status (stunting, wasting, underweight, overweight), as well as on poverty levels and IKP. The statistical analysis method used was the simple linear regression test. Statistical tests in this study were conducted using SPSS 27 software.

Results

The results of the study indicate that the Dietary Diversity Score (DDS) and nutritional status of toddlers (stunting, wasting, underweight, and overweight) in Island of Borneo show no statistically significant relationships, as evidenced by the p-values of 0.948, 0.288, 0.326, and 0.850 ($p > 0.05$) (Table 1).

Table 1. Correlation Food Security Index, Desirable Dietary Pattern, and Poverty with Nutritional Status

Variable	P-*Value*			
	Stunting	**Wasting**	**Under weight**	**Over weight**
Food Security Index	0.851	0.074	0.270	0.014
Desirable Dietary Pattern Score	0.948	0.288	0.326	0.850
Poverty	0.105	0.964	0.208	0.844

Based on the Pearson correlation test, the results indicate a significant relationship between the food security index and overweight, with a p-value of 0.014 and an R-value of -0.235. Meanwhile, the results for other variables show no significant relationship between the Desirable Dietary Pattern Score and poverty levels with nutritional status (p-value>0.05). This implies that variations in the DDS score do not correspond to changes in the nutritional status of toddlers within the studied population. Further investigations may be needed to identify other factors influencing toddler nutrition beyond dietary diversity.

Discussion

Food consumption patterns are an essential aspect of assessing the quality of life and public health. The *Dietary Diversity Score (DDS)* reflects ideal food consumption aimed at achieving optimal health standards and serves as a key indicator in evaluating the success of food and nutrition policies (Ministry of Agriculture, 2017). Emphasizing the intake of nutritious and diverse foods consumed by toddlers is one strategy to address nutritional problems in children. Food diversity can improve nutrient intake, as no single food contains all essential nutrients (Ministry of Health, 2018).

The nutritional intake of toddlers is critical because they are in a rapid growth phase, requiring high levels of nutrients per kilogram of body weight. Toddler meals must meet both quality and quantity standards. If nutritional needs are unmet, it can lead to impaired physical growth, lower intelligence compared to peers, and reduced disease resistance due to suboptimal nutrient intake (Sudargo *et al*., 2018).

Research by Suryana *et al*. (2018) hypothesized that low DDS scores are caused by insufficient and inadequately diverse consumption from the nine food groups included in the DDS indicator. Balanced food consumption in terms of quantity and variety is essential, as no single food can meet complete nutrient requirements (Suryana *et al*., 2018). The study found no significant impact of DDS on nutritional status indicators such as wasting (p=0.288), stunting (p=0.948), or underweight (p=0.326), based on statistical tests. This aligns with Nini's (2020) findings, which showed no significant relationship between DDS scores and nutritional status (p=1.000, >0.05).

Although this research did not establish a link between DDS scores and toddlers' nutritional status, previous studies emphasize that diverse food consumption is still crucial for achieving balanced nutrition, meeting dietary needs, and supporting a healthy and quality life.

Ngaisyah (2017) found a significant relationship between food diversity and stunting in toddlers. Toddlers with normal nutritional status tend to consume more diverse foods than those experiencing stunting. If untreated, stunting can affect life expectancy and productivity in the future, as supported by Febiola *et al*. (2022), who reported that stunting significantly correlates with life expectancy.

The study also identified a significant impact of changes in DDS scores on poverty reduction (p=0.011). Poverty is a major cause of nutritional problems. It refers to the economic inability to meet basic food and non-food needs, measured by expenditure. Poor households were found to have lower DDS scores compared to non-poor households. Poor families tend to allocate a large proportion of their income to food needs, limiting their ability to purchase nutritious food (Rindiani & Hartatik, 2020). The *Dietary Diversity Score* reflects the diversity of food consumption directly linked to nutrient intake.

Adequate nutrient intake improves life expectancy, which can ultimately drive economic changes and poverty reduction in society.

Food security refers to the availability of sufficient, safe, nutritious, diverse, equitable, and affordable food to support a healthy, active, and productive life sustainably (BAPANAS, 2021). Data analysis indicated no significant impact of DDS on the Food Security Index (FSI), as shown by a p-value of 0.123 (>0.05). However, a study by Hanum & Pangaribowo (2018) in Yogyakarta highlighted that DDS significantly influences household food security.

Research by Admaja *et al*. (2022) identified three key factors in determining food security: food availability from regional to local levels, household access to available food, and the household or individual capacity to utilize accessed food. Food diversity is closely linked to food security, particularly in terms of consumption quality, nutrient availability, and the ability of communities to sustainably meet their food needs. Therefore, maintaining balanced dietary compositions is essential for achieving food security in Indonesia (Argandi *et al*., 2019).

Household food security is a cornerstone of successful development in any region. It is influenced by household income and expenditure. Income reflects a family's purchasing power, and insufficient income can reduce access to food, leading to inadequate nutrition for toddlers and ultimately nutritional problems (Adhyanti *et al*., 2022). Household expenditures are also an indicator of food security, where higher monthly expenditures improve household food security, while lower expenditures negatively impact it (Sihite & Tanziha, 2021).

The results of this study indicate no significant relationship between poverty levels and nutritional status. This finding contrasts with the study by Katoch (2022), which suggests that children's nutritional status is influenced by multifactorial elements, including maternal education, household income, maternal nutritional status, child age, availability of sanitation facilities at home, family size, birth order, and birth weight. These findings highlight that nutritional status is not solely determined by poverty but by other stronger influencing factors.

A study by Nadhiroh *et al*. (2023) also found no significant association between parental income levels and children's nutritional status. This may be attributed to advances in information technology that provide easier access to nutritional knowledge and better household financial management, prioritizing family consumption needs. Furthermore, Li *et al*. (2020) demonstrated that maternal education has a stronger influence on children's nutritional status than the family's economic level, particularly in cases of stunting, wasting, and underweight.

Shifts in dietary consumption patterns among low-income households have also influenced the relationship between poverty levels and nutritional status. Households across all income levels—low, medium, and high—are increasingly consuming unhealthy food, such as simple carbohydrates, fried foods, or ultra-processed foods. These changes have resulted in lower diet quality and a higher likelihood of obesity (French *et al.*, 2019; Popkin *et al*., 2020). Moreover, studies indicate that sanitation and drinking water sources have a stronger correlation with nutritional status than economic status (Sahara *et al*., 2024). Government intervention programs such as food assistance, direct cash transfers, fortification initiatives, and nutritional education have also been effective in mitigating the direct impact of poverty on nutritional outcomes. For example, Cahyadi *et al.* (2018) found that the *Program Keluarga Harapan* (PKH), introduced in early 2008, significantly reduced the probability of stunting by 23–27% in children aged 0–60 months, even though it did not substantially improve household economic status.

This evidence suggests that improving nutritional outcomes requires a holistic approach that integrates socioeconomic, educational, and environmental factors alongside targeted governmental interventions.

Conclusion

This study could not demonstrate the influence of changes in the *Dietary Diversity Score* (DDS) on the nutritional status and nutritional problems of toddlers, particularly stunting, wasting, underweight, and overweight. Nevertheless, diverse food consumption remains essential for achieving nutritional balance, meeting dietary needs, and fostering a healthy and high-quality life.

The significant correlation found between DDS and poverty rates provides a valuable basis for further research and policymaking. This study can serve as a reference for the Island of Borneo Government in designing intervention policies aimed at improving the quality of life for the local population, particularly by addressing poverty as a determinant of food security and nutritional outcomes. Such policies may include initiatives to promote diversified diets, improve household income, and ensure equitable access to nutritious food, contributing to long-term social and economic development.

Strengthening strategies that link dietary diversification with poverty reduction is crucial. Policies such as vocational training programs or the enhancement of local economic activities can help increase households' purchasing power for nutritious food

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