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Household Food Security and Individual Dietary Diversity as Determinants of Stunting: Evidence from a Primary Healthcare Center

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ABSTRACT

Stunting in children remains a priority nutrition problem in Indonesia. Household food security and individual dietary diversity are presumed to play important roles in the nutritional status of children under five. This study aims to determine the association between individual dietary diversity and household food security with the nutritional status of children aged 12–59 months in the Tamalanrea Health Center area, Makassar. This quantitative, cross-sectional study involved 81 children aged 12-59 months, selected using a purposive sampling technique. Data collection included measurement of nutritional status using the height-for-age indicator, household food security using the Household Food Insecurity Access Scale (HFIAS), and individual dietary diversity using the Individual Dietary Diversity Score (IDDS). Data analysis was performed univariately and bivariately using the chi-square test. The prevalence of stunting was 28.4% among the total research subjects. Household food security was significantly associated with children's nutritional status, as indicated by H/A (p=0.019), with children from food-insecure households having a 3.4 times greater risk of stunting (OR=3.429; 95% CI: 1.242-9.464). Conversely, individual dietary diversity did not show a significant relationship with children's nutritional status (p=0.424). Consumption of legumes and nuts was very low (6.17%), and consumption of vitamin A-rich fruits and vegetables was below 50%. Household food security is a more determinative factor in children's nutritional status than individual dietary diversity. Stunting prevention interventions need to focus on improving household economic access to food through multisectoral approaches.

Key Messages:

- To effectively prevent childhood stunting, interventions must prioritize improving household food security and economic access to food, as it is a significantly stronger determinant of a child's nutritional status than individual dietary diversity alone

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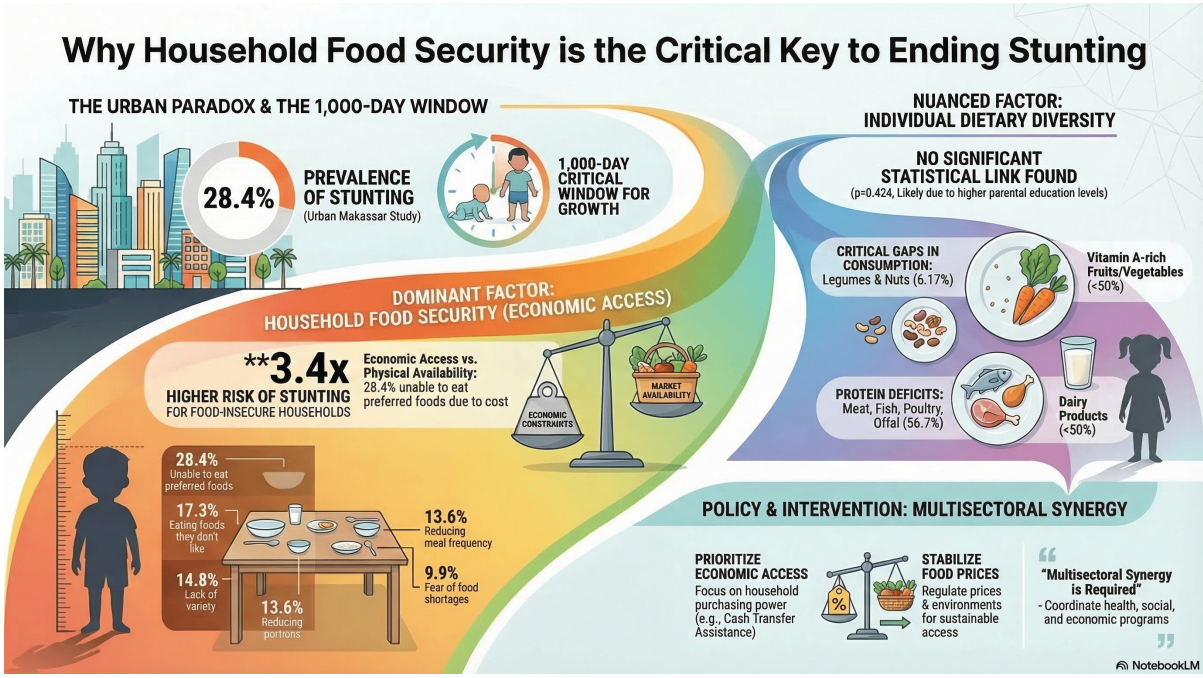
GRAPHICAL ABSTRACT



INTRODUCTION

Stunting, or low height-for-age, is one of the priority nutritional problems in Indonesia affecting children under the age of five (under-fives), characterized by a height-for-age z-score (HAZ) < -2 standard deviations (SD) (1). Stunting may result from inadequate nutrient intake and repeated infections over a prolonged period during the critical window of the first 1,000 days of life (2,3). These causes are closely linked to caregiving practices, sanitation and water supply, and household food security. The national target to reduce stunting prevalence to 14% by 2024 has yet to be achieved, posing a significant threat to the quality of human resources and the country's economic development (4,5).

According to the Makassar City Health Office records (2023), stunting was identified in 30% of 87,320 under-five children who underwent anthropometric assessment. The most recent Indonesian Nutritional Status Survey (SSGI) reported a stunting prevalence of 22.9% in Makassar City. These epidemiological data collectively indicate that nutritional problems among under-five children in Makassar City constitute a public health priority requiring immediate attention (6,7). Household food security, as a key determinant of stunting, represents a critical entry point for stunting prevention at the family level (8). Food security reflects the household's ability to provide sufficient, safe, and nutritious food, directly impacting the child's nutritional status (9).

Household food security involves food availability, economic access, supply stability, and effective food utilization within the family member (10,11). A study conducted in Indonesia showed that poor household food security is associated with an increased prevalence of stunting and wasting among children (12). Food security and dietary diversity also play a critical role in a child's nutritional status. A study demonstrated a significant association between under-fives dietary diversity and nutritional status (13). These findings are consistent with previous research indicating that children with low dietary diversity have a higher risk of stunting than those with more varied diets (14–16).

Improving child nutritional status requires a comprehensive approach, encompassing household-level food security and individual dietary diversity. Interventions at the household level are particularly crucial, given that the family environment is the primary setting for a child's growth and development. Based on this background, this study examines the association between household food security and individual dietary diversity with nutritional status, as measured by height-for-age (H/A), among children aged 12 to 59 months in the Tamalanrea Primary Health Center, Makassar.

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Unlike previous studies that predominantly emphasized individual dietary diversity as a key determinant of stunting, this study highlights the greater significance of household food security in an urban Indonesian setting. Focusing on children in Makassar—a city with relatively good access to services but persistent stunting prevalence—this study offers novel insights into the contextual drivers of stunting and the need to prioritize economic food access over dietary diversity alone. The findings of this study are expected to inform the design of more effective local nutrition intervention programs.

METHODS

This study employed a quantitative, cross-sectional design to analyze the relationships among household food security, individual dietary diversity, and the nutritional status of children aged 12–59 months in the working area of Tamalanrea Primary Health Center, Makassar. The research was conducted from May to June 2025. The study subjects were children aged 12–59 months, with their mothers or primary caregivers as respondents. The minimum sample size was 81, based on the World Health Organization's recommended public health survey design approach. Sampling was conducted using purposive sampling with inclusion criteria comprising children aged 12–59 months residing in the service area of the Tamalanrea Primary Health Center. Children diagnosed with chronic illnesses or congenital abnormalities that may affect growth (e.g., congenital heart disease, chromosomal disorders, or metabolic diseases) and children experiencing acute illness or severe infection during the data collection period were excluded from the study.

This study collected data on child and maternal characteristics, child nutritional status based on height-for-age (HAZ), individual dietary diversity, and household food security. Nutritional status data were collected through direct anthropometric measurements using a stadiometer or digital height meter and analyzed using z-scores calculated with the WHO AnthroPlus software. Children were categorized as stunted if their height-for-age z-score was below −2 SD, and as normal if their z-score ranged between −2 SD and +3 SD (1). Individual dietary diversity data were obtained using a 24-hour food recall questionnaire, supported by a food photograph book (portion guide), and analyzed using the Individual Dietary Diversity Score (IDDS). Referring to the *Indicators for Assessing Infant and Young Child Feeding Practices*, the IDDS includes seven food groups: (1) grains, roots, and tubers, (2) legumes and nuts, (3) dairy products, (4) meat/fish/poultry/offal, (5) eggs, (6) vitamin A-rich fruits and vegetables, and (7) other fruits and vegetables. A dietary diversity score was classified as "adequate" if the child consumed foods from four or more food groups, and "inadequate" if fewer than four groups were consumed (17).

Household food security data were collected using the Household Food Insecurity Access Scale (HFIAS) questionnaire, originally developed by the Food and Nutrition Technical Assistance (FANTA) Project (18) and validated and adapted by Ashari et al. (19) The HFIAS consists of nine occurrence questions representing food insecurity experiences, and nine frequency-of-occurrence questions used to determine how often these events occurred during the past month. The occurrence questions were scored 0 for "no" and 1 for "yes." If the response was "yes," the frequency was scored from 0 to 3, with 0 = never, 1 = rarely (1–2 times/month), 2 = sometimes (3–10 times/month), and 3 = often (>10 times/month). Households were classified as food secure with a total score of 0–1 and as food insecure with a score of 2–27. A higher score reflects a greater degree of food insecurity (20).

Data analysis was conducted using univariate and bivariate methods. Univariate analysis was used to describe the characteristics based on the distribution of categorical data. The bivariate analysis employed the chi-square test to examine the relationship between individual dietary diversity and household food security with nutritional status based on height-for-age (H/A).

CODE OF HEALTH ETHICS

This study has met ethical eligibility on the ethical clearance certificate issued bye the Institutional ethical approval was obtained from the Health Research Ethics Committee at the Health Polytechnic of the Ministry of Health, Makassar, under protocol number 0737/M/KEPK/PTKMS/V/2025.

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RESULTS

Most children were female (59.26%), while males accounted for 40.74%. Most children had fathers with higher education (56.79%), whereas their mothers predominantly had a primary education background (51.85%). 4.94% of the children had unemployed fathers, and 30.86% had working mothers. The study population demonstrated a stunting prevalence of 28.40%, representing 23 children among the total sample of 81 participants. Nearly one-third of the children in the sample were stunted, suggesting the potential presence of chronic nutritional problems within the catchment area of the Tamalanrea Primary Health Center (Table 1).

Table 1. Characteristics and Nutritional Status of Children

Variable	Categori	n	%
Child's Sex	Boy	33	40.74
	Girl	48	59.26
Father's Education Level	Higher Education	46	56.79
	Primary Education	35	43.21
Mother's Education Level	Higher Education	39	48.15
	Primary Education	42	51.85
Father's Employment Status	Employed	77	95.06
	Unemployed	4	4.94
Mother's Employment Status	Employed	25	30.86
	Unemployed	56	69.14
Nutritional Status (H/A)	*Stunted*	23	28.40
	Normal	58	71.60

Meat/offal/fish/poultry and eggs were consumed by 56.79% of children, while 43.21% did not consume either of these food groups. Dairy and dairy products were consumed by 48.15% of children. The intake of vitamin A-rich fruits and vegetables demonstrated suboptimal levels among participants. Inadequate dietary diversity among children may be a critical factor influencing the adequacy of daily nutrient intake. A lack of essential nutrients derived from a variety of food groups can hinder optimal growth and increase the risk of stunting (21,22).

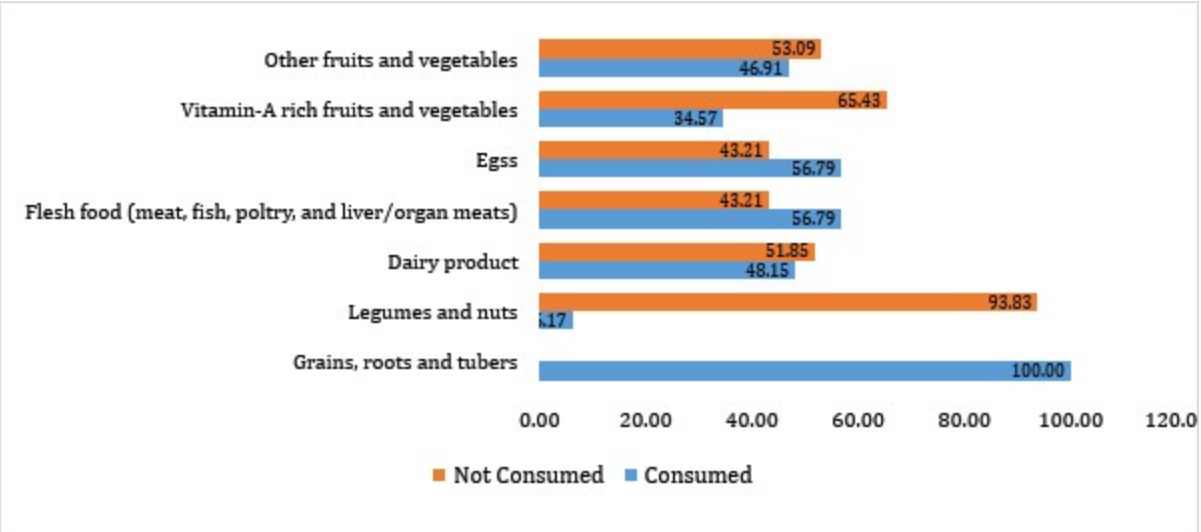

Figure 1. Description of Individual Dietary Diversity

According to Table 2, the HFIAS shows that only a small proportion of households (9.88%) reported concerns about food shortages at the household level. However, nearly one-third of households stated they could not consume their preferred foods. imilar percentages of participants reported moderate food insecurity behaviors, encompassing limited food diversity, consumption of non-preferred foods,

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portion size reduction, and decreased eating frequency. Few households experienced severe food insecurity manifestations, including complete food unavailability, hunger at bedtime, or prolonged fasting episodes exceeding 24 hours within the previous month.

Studies in Indonesia have found that 26.5% of households experience mild food insecurity, which is significantly associated with an increased risk of infectious diseases among children under five, ultimately contributing to a higher risk of stunting in this age group (23,24). The findings presented in Table 3 reveal that within the low dietary diversity group, 9 children (11.1%) were classified as stunted, while 16 children (19.8%) had normal nutritional status. In contrast, among those with adequate individual dietary diversity, 14 children (28.4%) were stunted and 58 children (71.6%) exhibited normal nutritional status. No statistically significant relationship was observed between dietary diversity measures and stunting occurrence ($p > 0.05$), representing a departure from the accumulated evidence in the literature where suboptimal dietary diversity has been consistently associated with heightened stunting risk in pediatric populations (25–27).

Table 2. Frequency Distribution of Food Security Indicators Assessed Using HFIAS

HFIAS Indicator	Yes n (%)	No n (%)
Fear of food shortages	8(9.88)	73 (90.12)
Not being able to eat the food you want	23 (28.40)	58 (71.60)
Lack of variety of foods you eat	12(14.81)	69 (85.19)
Eating foods you don't like	14 (17.28)	67(82.72)
Eating smaller portions	11 (13.58)	70 (86.42)
Reduce the frequency of eating in a day	11(13.58)	70 (86.42)
Having no food at all in the house	1(1.23)	80(98.77)
Going to bed hungry	2(2.47)	79(97.53)
Not eating at all in a day	3 (3.70)	78 (96.30)

The findings presented in Table 3 indicate a statistically significant correlation ($p < 0.05$) between food insecurity and higher prevalence of height-for-age deficits, with important ramifications for public health policy development and programmatic interventions. The most striking finding emerges from the food security categorical analysis, where children residing in food-insecure households exhibit an odds ratio of 3.429 (95% CI: 1.242-9.464, $p = 0.019$) for developing stunting compared to their counterparts in food-secure environments. This represents a more than three-fold increased risk, indicating that food insecurity is a powerful predictor of linear growth failure. The results indicate that food-insecure household children exhibit more than triple the likelihood of experiencing stunting compared to children from food-secure households.

Table 3. Association Between Household Food Security, Individual Dietary Diversity, and Stunting Among Children Aged 12-59 Months

Variable	Height-for-age (H/A)				OR	p	95%CI
	Stunted		Normal				
	n	%	n	%			
Individual Dietary Diversity Category							
Poor	9	11.1	16	19.8	1.688	0.424	0.611–4.662
Good	14	28.4	58	71.6			
Food Security Category							
Food insecurity	12	14.8	14	17.3	3.429	0.019*	1.242-9.464
Food Security	11	13.6	44	54.3			

The 95% confidence interval (1.242–9.464), with its entire range above 1, suggests a precise and consistent result. Specifically, even in the lowest-risk scenario (lower CI = 1.242), the risk of stunting is 24% higher, while in the highest-risk scenario (upper CI = 9.464), the risk approaches nearly tenfold. These findings are consistent with recent studies that have similarly reported a high prevalence of stunting

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among children under five in the context of food insecurity (23,24). This underscores the urgent need for multisectoral interventions to improve food access and dietary diversity as strategies to reduce the risk of stunting.

DISCUSSION

The main novelty of this study lies in its finding that household food security significantly outweighs individual dietary diversity in predicting stunting, even in an urban environment with relatively adequate public health infrastructure. This challenges the conventional focus on individual food group consumption and shifts the emphasis toward the broader economic and structural determinants of nutritional outcomes in children.

Analysis of individual dietary diversity revealed that although all children (100%) consumed grains, roots, and tubers, consumption patterns for vitamin A-rich fruits and vegetables and other fruit and vegetable categories were limited to approximately one-third of participants, with legumes and seeds showing the lowest consumption rate (6.17%). Yet, dietary diversity—including the consumption of vegetables, fruits, and seeds—enriches fiber and prebiotics, which support gut health, strengthen the immune system, and prevent diseases that may hinder linear growth (28) This aligns with existing literature emphasizing the importance of varied food intake to ensure adequate micronutrient and macronutrient consumption during growth periods (21,22).

This study also found that the consumption of dairy and dairy products was below 50%, and the intake of meat/offal/fish/poultry was only 56.79%. Research evidence has consistently shown that animal-derived proteins from dairy and non-dairy sources, particularly meat and eggs, are significantly linked to improved anthropometric outcomes, specifically higher weight-for-age z-scores (WAZ), weight-for-length z-scores (WLZ), and body mass index z-scores (BMIZ) (29).

The study yielded no significant association between dietary diversity and height-for-age nutritional status (HAZ) ($p = 0.424$). The present findings contradict earlier studies that have shown significant associations between reduced dietary diversity and elevated stunting risk (13,25). These contradictory results may stem from the specific characteristics inherent to this study population. First, the proportion of parents with higher education in this sample is atypical for populations vulnerable to stunting, with 56.79% of fathers and 48.15% of mothers having attained higher education. Higher parental education is generally associated with better childcare practices, sanitation, and access to healthcare services, which may mitigate the negative effects of limited dietary diversity (30).

Second, the predominance of food-secure households (54.3% among the normal nutrition group) and the low proportion of extreme conditions suggest that this sample represents a middle socioeconomic group rather than the most vulnerable populations, in which the link between dietary diversity and stunting is typically more pronounced. Third, several potential confounding variables, including recurrent infectious diseases and environmental sanitation conditions, (30) which are known to independently affect stunting outcomes, were not adequately controlled in the present analysis. Additionally, the study population within the Tamalanrea Health Center catchment area represents an urban district of Makassar, characterized by superior access to potable water and enhanced sanitation infrastructure compared to rural settings, which may have attenuated the detrimental effects of suboptimal dietary diversity.

Thus, dietary diversity may not be the primary factor influencing child nutritional status within the study population. Other factors, such as environmental sanitation, the incidence of infections, and feeding practices—including meal frequency—are also associated with stunting. This suggests that dietary diversity alone may not serve as a sufficient explanatory variable in populations where other protective determinants—such as higher maternal education levels and relatively stable household access to food—moderate nutritional risk. Therefore, the lack of a strong association in this context should be interpreted with consideration of these modifying variables rather than viewed as evidence of the insignificance of dietary diversity itself.

Although dietary diversity indicates the range of food groups consumed, it does not account for the quantity of food, the nutritional quality, or the adequacy of micronutrient intake necessary for proper growth. Furthermore, limitations in the observational time frame may hinder the identification of the

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cumulative effects of chronic nutrient deficiencies. Conditions like stunting are likely to remain undetected if dietary diversity is evaluated at a single point in time, especially without the backing of longitudinal data. In summary, while dietary diversity captures the variety of food groups consumed, it falls short of considering the necessary food quantity, nutritional quality, or adequacy of micronutrient intake critical for growth.

In contrast, our analysis revealed a significant association between household food security and child nutritional status indicators ($p = 0.019$). Children from households experiencing food insecurity demonstrated a 3.4-fold increased probability of stunting when compared to children from food-secure families. These observations are concordant with emerging research that has consistently shown food insecurity to be significantly associated with heightened risks of malnutrition and infectious morbidity in children (24).

The HFIAS used in this study indicated that some households experienced limitations in accessing preferred foods, with 28.4% of respondents reporting that they could not eat the foods they desired. A study found that the inability to meet food preferences adversely affects dietary quality and child nutritional status. Households with limited access to desired or needed foods are more likely to experience food-related stress, which exacerbates food insecurity and negatively impacts both dietary quality and the psychosocial well-being of the household—particularly for mothers, who are typically responsible for managing household food resources (31).

Although only a small proportion of households experienced extreme conditions such as going to bed hungry or not eating at all, the high proportion of households that reduced portion sizes and meal frequency indicates that economic access to food remains a major constraint. The most severe impact of the pandemic was felt by households reliant on the informal sector, whose incomes are typically daily and savings minimal, rendering them highly vulnerable to income loss (32). Similarly, other studies have reported that low-income families facing food insecurity during the pandemic experienced reduced access to food, marked by declines in both the quantity and quality of food consumed (33).

In Indonesia, the government's Cash Transfer Assistance program called Bantuan Langsung Tunai (BLT) has positively impacted food security among recipient households. However, a study found that the BLT program primarily met only basic consumption needs—mainly rice (34). A recent study also highlighted that economic access constraints led food-insecure households to rely on processed foods and become increasingly dependent on food price stability (35). Food price stability plays a crucial role in maintaining household food security. Inflation has been shown to significantly reduce food security indices, indicating that food price fluctuations are a major barrier to meeting nutritional needs, particularly in vulnerable populations (36). The observed association indicating that household food insecurity serves as a strong predictor of stunting (OR = 3.429) underscores the critical role of social protection initiatives that enhance household purchasing power—such as the BLT program—not merely as mechanisms for poverty reduction, but as essential public health interventions that directly contribute to improved nutritional outcomes.

Interventions focusing solely on food provision without strengthening household purchasing power are unlikely to improve food security sustainably. Therefore, social protection measures, purchasing power enhancement, and food price and environment regulation are key strategies for improving access to nutritious foods and reducing the risk of stunting. This aligns with the findings of our study, which showed that food-insecure households had a significantly higher risk of having stunted children compared to food-secure households.

This study has several limitations that should be acknowledged. The cross-sectional design does not allow for causal inference or the assessment of long-term cumulative effects of food security on a child's nutritional status, given that stunting is a chronic condition that develops over time. Moreover, individual dietary diversity measures only the variety of food groups consumed, not the quantity, quality, or adequacy of nutrients needed to support growth. A single 24-hour food recall may not accurately represent long-term dietary patterns. Future research should consider longitudinal study designs to assess the long-term effects of food security on child growth, extend the dietary observation period, and integrate additional confounding variables in multivariate analyses.

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CONCLUSION

Household food security has proven to be a more determining factor for child nutritional status than individual dietary diversity. This underscores the importance of a holistic approach to stunting prevention, focusing on food consumption patterns and considering the household's economic capacity to sustainably access sufficient, safe, and nutritious food. Effective interventions require synergy between health, social, and economic programs to create an enabling environment that supports optimal child growth.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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