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Assessing food security among fisher households in the coastal regions of central and west Lombok, Indonesia

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ABSTRACT

Background: Malnutrition and stunting remain significant public health issues in Indonesia, with national stunting prevalence at 19.8%. Coastal communities face distinct challenges, including unstable income, limited access to diverse foods, and reliance on fisheries, which may compromise child nutrition. This study investigated the relationship between food security and nutrient adequacy among households with children under five in coastal areas.

Methods: This cross-sectional study was conducted in districts and cities with high stunting prevalence, involving 344 randomly selected households with children aged 6–59 months. Children's food consumption was assessed using a 1x24-hour food recall, while other data were collected through interviews using structured questionnaires. Nutrient intake was calculated based on the Indonesian food composition table and compared with the Ministry of Health's 2019 recommended dietary allowance (RDA). Instruments included the Household Dietary Diversity Score (HDDS), Household Food Insecurity Access Scale (HFIAS), and Food Consumption Score (FCS). Data were analyzed using IBM SPSS version 26.0 with Spearman's correlation test.

Results: Nutritional status based on height-for-age indicated 75.0% normal, 16.9% stunted, and 4.1% severely stunted children. Mean protein adequacy was high (123.9±34.7%), while fat adequacy was low (67.0±19.4%), with more than half experiencing deficits. Micronutrient deficiencies, particularly in vitamin A, vitamin C, iron, and calcium, exceeded 50%. Half of households (50.3%) were food secure. HDDS, FCS, and HFIAS scores were significantly correlated with nutrient adequacy levels.

Conclusions: Household food security strongly influences nutrient adequacy among coastal children under five. Enhancing dietary diversity, food access, and nutrition education is essential to reduce stunting in vulnerable communities.

KEYWORDS

Dietary diversity, micronutrients, growth, food access, poverty.

INTRODUCTION

Numerous studies have demonstrated that economic, social, and environmental factors significantly influence the food security status of fisher households[1–3]. Low household income often results in a higher proportion of expenditure on food, thereby increasing the risk of food insecurity[4]. Moreover, limited access to natural resources and inadequate infrastructure could also contribute to food insecurity, especially in remote coastal areas where communities have fewer opportunities to obtain diverse and nutritious food compared to those living near economic centers[5]. Food security includes not only food availability but also food access, stability, and utilization[6]. Previous research showed that a fisher household's income plays an important role in determining the level of food security. The income of hook-dependent fishermen is unstable due to weather and seasonal factors. This means that fisher households often appear food insecure[7]. In addition, geographical conditions further affect the food security of fisher households, as households in remote areas face more challenges to access adequate food compared to those in urban areas[8].

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Food security in fisher households is influenced by a combination of economic conditions, market and resource accessibility, and the broader socio-economic context of coastal communities[9]. Low household income often compels families to allocate a larger share of their expenditure to food, thereby heightening the risk of food insecurity. Moreover, limited access to natural resources and inadequate infrastructure exacerbates this risk, particularly in remote coastal areas where communities have fewer opportunities to obtain diverse and nutritious food compared to those residing near economic centers[10]. The inhabitants of the coastal regions, particularly in rural communities, also face daunting challenges of poverty due to scarce resources[11]. The poverty-stricken coastal population is further reinforced by the lack of essential resources such as land and crops, which are critical for securing livelihoods and ensuring household food security[12].

Food security is essential for a country's development, as emphasized in the SDGs' goal of zero hunger. It refers to the ability of households to access sufficient quantity and quality food consistently. Geographical location also plays an important role in determining food access[13]. Currently, several single indicators are widely used to assess household food security based on the dimension of food access, including the Household Food Insecurity Access Scale (HFIAS), Household Hunger Scale (HHS), Household Food Security Scale Module (HFSSM), Latin American and Caribbean Food Security Scale (LCSA), and the Food Consumption Score (FCS)[14].

MATERIAL AND METHOD

Design, Location, and Time

This study employed a cross-sectional study and was conducted in March 2024. The research take place in the coastal areas of Central Lombok and West Lombok Regency, West Nusa Tenggara Province. Study sites were selected based on recapitulation data identifying coastal areas vulnerable to food insecurity, covering four Community Health Center (Puskesmas) areas. In West Lombok, the study included West Sekotong and Lembar Selatan villages, which fall under the Pelangan and Jembatan Kembar Community Health Centers. In Central Lombok, the sites included Selong Belanak village, under the Mangkung Community Health Center, and Mertak village, under the Pelabuhan Awang Community Health Center. Informed consent was obtained from all participants before data collection. This study adhered to ethical guidelines for research involving human subjects. Ethical approval was granted by the Ethics Commission of the Mataram Ministry of Health Polytechnic (No. LB.01.03/6/137/2024) and research permission was issued by Kesbangpol of West Nusa Tenggara Province (No. 070/342/II/R/BKBPDN/2024).

Population and Sample

This study involved toddlers and their primary caregivers, either fathers or mothers. The inclusion criteria for child participants were aged 6 to 59 months and absence of serious illness or undergoing routine treatment. Accordingly, subject included were 344, consisting of one caregiver and one child per household. Participants were selected from each Community Health Center using a simple random sampling without substitution.

Data Types and Collection Methods

The instruments employed were internationally standardized and validated tools commonly used in global food security assessments. The Household Dietary Diversity Score (HDDS) developed by FAO, was a method to assess the quality of household food consumption. Meanwhile in the family-level, we used the Household Food Insecurity Access Scale (HFIAS) by FAO. In addition, The Food Consumption Score (FCS), developed by the World Food Programme, was employed to evaluate food security based on dietary diversity, consumption frequency, and food groups categorized by nutritional value.

Enumerator training was conducted over two days to ensure that enumerators understood how to complete the questionnaire and practiced anthropometric measurement procedures. Data quality control was considered essential to maintain data security, accuracy, and consistency throughout the study. The research team supervised the data collection process directly, assisting enumerators in the field, checking the completeness of questionnaires, and ensuring that no questions were left unanswered. Supervision by the research team was carried out every day for six days across each village. Additional quality controls include limiting the enumerator to 7-10 respondents per day, with each interview lasting 30-40 minutes per respondent.

Statistical Analysis

Data processing included coding, editing, entry, cleaning, and analysis. The process was carried out using Microsoft Excel 2019 software and IBM Statistical Program for Social Sciences (SPSS) version 26.0. Univariate analysis was performed to describe the frequency of each variable, while the Spearman correlation test was applied to measure the relationship between variables. Before bivariate analysis, a data normality test was carried out using Kolmogorov-Smirnov.

RESULTS

The toddlers included in this study were aged 1-59 months and categorized into two groups: under two years old and two years or older. Table 1 showed that the majority were aged two years or older (70.3%). The distribution of gender is nearly equal between boys (50.3%) and girls (49.7%).

The nutritional status of toddlers was assessed using anthropometric methods with weight-for-age (W/A), height-for-age (H/A), and weight-for-height (W/H) parameters, following

the indicators and classification standards defined in the Indonesian Ministry of Health Regulation (Permenkes) No. 2 of 2020. The distribution of toddlers based on their nutritional status is presented in Table 1. According to the W/A parameter, the majority of toddlers (75.0%) have normal nutritional status. However, the table shows that the prevalence of underweight is 20.9%, and severe underweight is 2.6%. The nutritional status of toddlers based on the height-for-age (H/A) parameter shows that 75.0% of toddlers have normal nutritional status. For the parameter of weight-for-height (W/H) presented in Table 1, it shows that 86.3% of individuals have normal nutritional status. The percentages of wasted and severely wasted are 9.9% and 0.9%, respectively.

In addition to nutritional status assessed through anthropometric methods, an evaluation of toddler food consumption is also conducted to determine the sufficiency of energy and nutrient intake, referring to the Indonesian Ministry of Health Regulation (Permenkes) No. 28 of 2019 on Recommended Dietary Allowances (RDA). Table 2 presents the levels of energy and macro-nutrient sufficiency in toddlers. All respondents experienced a deficit in energy intake, meaning their energy needs were not met. The majority of respondents (59.0%) had a severe energy deficit, with 38.1% having a moderate deficit and 2.9% having a mild deficit. The average energy sufficiency level is 87.6±35.0%. Regarding protein sufficiency, the majority of toddlers (55.2%) have an excess level of protein intake, with fewer than 20% experiencing a protein deficit. The average protein sufficiency level is 123.9±34.7%.

The average level of fat sufficiency in toddlers is 67.0±19.4%. The majority of toddlers (>50%) experience a severe deficit in meeting daily fat requirements. Only 1.7% of toddlers have an excess level of fat intake. Additionally, 11.6% of toddlers meet the recommended daily allowance for fat. The average level of carbohydrate sufficiency in toddlers is 92.4±54.5%. The largest proportion, 41.3%, has a normal level of carbohydrate sufficiency, while 9.6% of toddlers have an excess of carbohydrate intake, and nearly half of the respondents have a carbohydrate sufficiency level categorized as deficient.

The overview of micronutrient sufficiency in toddlers is presented in Table 2. The average intake of Vitamin A in toddlers meets the requirement, with an average sufficiency level of 123.5±129.7%. Most toddlers (61.0%) have sufficient levels, while 39% are still categorized as inadequate. For Vitamin C, 79.4% of toddlers experience a deficit, and only 20.6% meet the requirement. The average sufficiency level for Vitamin C is 62.1±131.9%. Besides Vitamin A and Vitamin C, assessments of calcium and iron intake show that the majority have not met sufficiency. The average level of iron sufficiency in toddlers is 81.2±98.8%, with 70.6% still classified as deficient and 29.4% meeting the requirement. Calcium intake is very low, failing to reach half of the sufficiency level, as indicated by an average sufficiency level of only 46.5±32.7%. A

Table 1. Distribution of respondent characteristics in coastal areas

Toddlers characteristics	n	%
Gender		
Male	173	50.3
Female	171	49.7
Age		
12-24 months	102	29.7
25-59 months	242	70.3
Age Average (months)	34.3±13.8	
Toddlers nutritional status		
Weight/Age (z-score)*		
Severe underweight (<-3 SD)	9	2.6
Underweight (- 3 SD sd <- 2 SD)	72	20.9
Normal (-2 SD sd +1 SD)	258	75.0
Risk of overweight (> +1 SD)	5	1.5
Weight Average (kg)	11.7±2.6	
Height/Age (z-score)*		
Severe stunting (<-3 SD)	14	4.1
Moderate stunting (- 3 SD sd <- 2 SD)	58	16.9
Normal (-2 SD sd +3 SD)	272	79.1
Tall (> +3 SD)	0	0.0
Height Average (cm)	88.3±10.8	
Weight/Height (z-score)*		
Severly wasted (<-3 SD)	3	0.9
Wasted (- 3 SD sd <- 2 SD)	34	9.9
Normal (-2 SD sd +1 SD)	297	86.3
Risk of overweight (> + 1 SD sd + 2 SD)	8	2.3
Overweight (> + 2 SD sd + 3 SD)	2	0.6
Obese (> + 3 SD)	0	0.0

* Indonesian Ministry of Health standard for Child Nutrition Status.

Table 2. The Sufficiency of Energy and Nutrient Intake in Toddlers

Levels of sufficiency	n	%
Energy		
Severe deficit (<70%)	203	59.0
Moderate deficit (70% - 79%)	131	38.1
Mild deficit (80% - 89%)	10	2.9
Normal (90% - 119%)	0	0.0
Excess (≥120%)	0	0.0
Average	87.6±35.0	
Protein		
Severe deficit (<70%)	16	4.7
Moderate deficit (70% - 79%)	18	5.2
Mild deficit (80% - 89%)	26	7.6
Normal (90% - 119%)	94	27.3
Excess (≥120%)	190	55.2
Average	123.9±34.7	
Fat		
Severe deficit (<70%)	196	57.0
Moderate deficit (70% - 79%)	53	15.4
Mild deficit (80% - 89%)	49	14.2
Normal (90% - 119%)	40	11.6
Excess (≥120%)	6	1.7
Average	67.0±19.4	
Carbohydrate		
Severe deficit (<70%)	64	18.6
Moderate deficit (70% - 79%)	52	15.1
Mild deficit (80% - 89%)	53	15.4
Normal (90% - 119%)	142	41.3
Excess (≥120%)	33	9.6
Average	92.4±54.5	
Vitamin A		
Insufficient	134	39.0
Sufficient	210	61.0
Average	123.5±129.7	
Vitamin C		
Insufficient	273	79.4
Sufficient	71	20.6
Average	62.1±131.9	
Fe		
Insufficient	243	70.6
Sufficient	101	29.4
Average	81.2±98.8	
Ca		
Insufficient	305	88.7
Sufficient	39	11.3
Average	46.5±32.7	

significant 88.7% of toddlers experience a calcium intake deficit, with only 11.3% meeting the requirement.

Table 3 shows that the majority of households (86.0%) are classified as food secure based on the modified cut-off point[15], while 14% of households have a low Food Consumption Score (FCS). The average FCS score is relatively high (≥89), at 115.5±33.1. The high FCS score is observed in almost all households due to the significant points derived from animal protein sources (meat, fish, eggs, and their products). The households participating in this study frequently consume protein-rich foods, resulting in a high FCS. Additionally, the FCS score for these food groups carries the highest weight.

The Household Dietary Diversity Score (HDDS) is used to assess the diversity of food consumption at the household level. Based on HDDS, 73.3% of households have high food diversity (≥9), while 26.7% have low food diversity (<9). The average score among households is 9.6±1.8. Differences in HDDS scores can also provide information about which food groups are prioritized by households at each level of HDDS.

Unlike the HDDS and FCS methods, the Household Food Insecurity Access Scale (HFIAS) assesses food security or insecurity in a more qualitative manner. This method is an adaptation of an approach used to estimate the prevalence of food insecurity. The distribution of households based on food security/insecurity categories is presented in Table 3. Among the households surveyed in this study, 50.3% are classified as

Table 3. Distribution of Household Food Security

Household Food Security	n	%
HFIAS (Household food insecurity access scale)		
Food Secure (0-1)	173	50.3
Mildly Food Insecure (2-7)	123	35.8
Moderately Food Insecure (8-14)	33	9.6
Severely Food Insecure (15-27)	15	4.4
Average	2.9±3.6	
FCS (Food Consumption Score)		
Low (<89)	48	14.0
High (≥89)	296	86.0
Average	115.5±33.1	
HDDS (Household Dietary Diversity Score)		
Low (<9)	92	26.7
High (≥9)	252	73.3
Average	9.6±1.8	

food secure. Additionally, 35.8% are categorized as mildly food insecure, 9.6% as moderately food insecure, and 4.4% as severely food insecure. The average HFIAS score is 2.9±3.6, with higher scores indicating greater food insecurity. This method focuses on the household's perception of food access, both physically and economically, rather than assessing food intake or nutritional status.

Table 4 illustrates the relationship between food security variables and the levels of energy and nutrient sufficiency. Table 4 illustrates the relationship between food security variables and the levels of energy and nutrient sufficiency. Correlation test results show that HDDS scores are associated with energy, protein, carbohydrate, and micronutrient sufficiency levels. Higher HDDS values indicate a higher level of sufficiency. The food diversity represented by HDDS scores affects the amount of energy and nutrients consumed. Food security and sufficient amounts of fat, vitamin A, vitamin C, iron, and calcium are significantly correlated, as shown by FCS scores. Iron, energy, and macronutrient sufficiency levels are significantly correlated with the food security status as measured by HFIAS scores. Lowered HFIAS scores indicate improved food security, which is accompanied by higher levels of energy and nutrients that are sufficient for young children. On the other hand, lower levels of energy and nutritional sufficiency are associated with higher HFIAS scores. A state of food insecurity is qualitatively indicated by elevated HFIAS scores.

DISCUSSION

Based on the height-for-age (H/A) parameter, 75.0% of toddlers had normal nutritional status. The prevalence of stunting was 16.9%, while severe stunting accounted for 4.1%. The prevalence of stunting in this study was lower than the national prevalence of 19.8%[16]. Mean protein adequacy was 123.9±34.7%. The average protein adequacy level was 123.9±34.7%. Similar results were reported in a previous study, which found that toddlers living in fishpond areas had

Table 4. Relationship between household food security and energy and nutrient sufficiency

Variable	HDDS		FCS		HFIAS	
	p-value	r	p-value	r	p-value	r
Energy	0.022	0.123*	0.050	0.050	0.000	-0.361**
Protein	0.005	0.152**	0.187	0.071	0.000	-0.320**
Fat	0.000	0.221**	0.028	0.118*	0.014	-0.133*
Carbohydrates	0.128	0.082	0.916	-0.006	0.000	-0.354**
Vitamin A	0.000	0.221**	0.009	0.141**	0.533	0.034
Vitamin C	0.000	0.221**	0.010	0.139*	0.088	-0.092
Iron	0.010	0.138*	0.030	0.117*	0.000	-0.335**
Calcium	0.021	0.124*	0.015	0.131*	0.090	0.092

protein adequacy levels above 135%[17]. The findings of this study are consistent with earlier research showing that energy and nutrient adequacy influence toddler nutritional status, with stunting associated with low energy and protein intake[18]. There is a relationship between fish consumption and the incidence of stunting in children. Fish nuggets are one alternative to increase fish consumption[19]. Other studies have also reported correlations between toddler nutritional status and factors such as exclusive breastfeeding practices and personal hygiene[20].

The average fat adequacy level among toddlers was 67.0±19.4%. More than half of the toddlers had a severe deficit in meeting daily fat requirements, while 1.7% had excessive fat intake. A total of 11.6% of toddlers met the recommended daily fat adequacy level. These findings differ from previous studies reporting that most toddlers had normal fat adequacy level[21]. However, other studies have indicated that toddler fat adequacy levels were generally deficient, ranging from 17.3% to 80.2%[22]. Regarding household food security, 43.34% of fishermen's households were classified at the food shortage level, 10% were categorized as food insecure, and only 23.33% were food secure. This fishing community lives under difficult conditions on La Borracha Island, maintaining a distinctive dietary structure and cultural patterns that present challenges in promoting food sufficiency and healthier lifestyles through nutrition education programs[23].

Previous studies reported that only vitamin C adequacy had reached 90.5%, while vitamin A, iron, and calcium adequacy levels were 42.2%, 61.9%, and 74.4%, respectively[24]. Micronutrient deficiencies such as iron, zinc, and calcium are common nutritional problems in Indonesia, particularly among infants and toddlers after the introduction of complementary foods[25]. In the present study, the prevalence of micronutrient deficiencies, especially vitamin C, iron, and calcium, exceeded 50%. Inadequate intake of both macro- and micronutrients among toddlers from food-insecure households is indirectly associated with poor health outcomes and suboptimal nutritional status[26].

Food security measured by the FCS showed a significant association with fat, vitamin A, vitamin C, iron, and calcium adequacy levels. Adequate intake of all nutrients, particularly energy, protein, zinc, calcium, and iron, is essential for children under five years of age to support growth, activity, and basal metabolic needs[27].

Food security assessed using the Household Food Insecurity Access Scale (HFIAS) also demonstrated a significant association with energy and macronutrient adequacy as well as iron intake. Lower HFIAS scores, indicating greater food security, were associated with higher energy and nutrient adequacy among toddlers. Conversely, higher HFIAS scores reflected poorer food security and were linked to lower energy and nutrient intake. A high HFIAS score also indicates qualitative food insecurity, where households tend to provide energy-dense foods lacking in micronutrients, leading to nutritional deficiencies in children[28].

The distribution of households based on food security status is presented in Table 3. Among the surveyed households, 50.3% were classified as food secure. Fishing households in coastal areas have higher food security than agricultural areas, although they continued to face challenges in accessing adequate food due to geographical constraints and limited infrastructure[6].

Correlation analysis showed that the HDDS was positively associated with energy, protein, carbohydrate, and micronutrient adequacy. These findings are consistent with previous studies showing that areas with a high prevalence of stunting are often characterized by low consumption of dietary diversity[29]. Higher HDDS values reflected greater nutrient adequacy. Dietary diversity, as measured by HDDS, directly influenced energy and nutrient intake. The food consumption diversity score has been validated and found to correlate positively with both macronutrient and micronutrient adequacy among toddlers. Food security is related to demographic conditions, and income plays an important role in overcoming food insecurity[30].

CONCLUSION

Based on the Household Dietary Diversity Score (HDDS), most coastal households demonstrated high food diversity. According to the Food Consumption Score (FCS), the majority of households were food secure, while the Household Food Insecurity Access Scale (HFIAS) classified 50.3% of households as food secure. HDDS was positively associated with energy, protein, carbohydrate, and micronutrient adequacy, with higher scores reflecting better nutritional intake. Food security measured by FCS was significantly related to fat, vitamin A, vitamin C, iron, and calcium adequacy. Similarly, food security assessed through HFIAS was significantly associated with energy adequacy, macronutrients, and iron intake.

Future nutrition education programs should emphasize appropriate preparation of diverse foods to support optimal child growth and development. Additionally, further studies that integrating factors that affect the child nutritional status, such as birth weight, breastfeeding history, and exclusive breastfeeding status, are recommended to provide a more comprehensive understanding.

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