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Determinants of children's nutritional status in rural and urban areas of West Java, Indonesia

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ABSTRACT

Introduction: Children's nutritional status is a vital indicator of public health and national development. Sufficient nutrition during early childhood is crucial for supporting physical growth, neural development, and cognitive performance. A well-nourished population serves as the foundation of a productive workforce, contributing significantly to a nation's sustainable economic growth. Maternal education plays a crucial role in determining children's nutritional status, alongside the quality and adequacy of children's dietary intake.

Objectives: This study primarily aims to identify nutrients intake, nutritional status, and determinants of children's nutritional status in both rural and urban areas of West Java, Indonesia.

Methods: This research employed a cross-sectional design, involving a sample of 150 households with children under five in rural areas (Cianjur Regency) and 150 households in urban areas (Sukabumi City), both located in West Java. This study collected primary data from interviews using questionnaires and anthropometric measurements.

Results: The adequacy level of energy and fat is almost 100%. Adequacy levels of protein is above 100% or have far exceeded their needs. All of the micronutrients did not meet the adequacy. As many as 19% of children were underweight (18.6% in rural and 19.4% in urban), 4.3% wasting (2.7% in rural and 6.0% in urban), and 32% stunting (33.4% in rural and 30.7% in urban). The prevalence of children at risk of being overweight in urban areas was 8.7% and in rural areas was 6.7%. The determinant of children's nutritional status was mother's education. Mothers with low education had a higher risk of having children with poor nutritional status (OR 2.45; 95%CI 1.43-4.38; p=0.001).

Conclusion: All of micronutrients did not meet the adequacy in both rural and urban areas. The results of this study indicate that prevalence of chronic malnutrition was still high in both rural and urban areas. Mother's education was the determinant factor of children nutritional status.

KEYWORDS

Dietary Pattern, Nutritional status, Overnutrition, Rural areas, Undernutrition, Urban areas.

INTRODUCTION

The disparity in development between rural and urban regions remains a significant factor contributing to differences in food accessibility between these populations. Although Indonesia has experienced rapid economic growth, rural communities have not benefited to the same extent as their urban counterparts. The human capital of a household's is determined by the socioeconomic attributes of its members, including education, income level, occupation, and family size. Additionally, gender-specific factors play a crucial role. While male-headed households are often linked to higher income levels and improved food access, studies suggest that nutritional outcomes improve substantially when women are involved in family decision-making[1,2]. Women are more likely to allocate household resources toward food, healthcare, and children's education, leading to more beneficial choices for overall household well-being[3].

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Nutrition is one of many important factors in the growth and development of an individual. Nutrition intake brings influences the quality of mankind, especially for children under five years old. During this period, adequate nutrient intake is crucial since these are the times when physical, cognitive, and immune system are developing rapidly. Insufficient nutrient intake can lead to stunted growth, long-term cognitive impairments, and higher infection risk[4]. Nutrition also influences social brain development, with specific nutrients impacting myelination processes crucial for social-emotional skills[5]. Animal protein is an essential nutrient required for both human growth and maintenance. Eggs and fish serve as excellent sources of animal protein[6]. The consumption of animal protein is closely linked to childhood growth, as it provides essential amino acids that support developmental processes. As a macronutrient, protein functions as a receptor influencing DNA activity, thereby stimulating and regulating growth[7].

Nutrient intake is a crucial determinant of the nutritional status of children under five. Consuming a well-balanced, nutritious diet that is both healthy and safe contributes significantly to enhancing immune function and reducing the risk of infectious diseases. Insufficient energy and nutrient intake can result in a decline in nutritional status. Evaluating nutritional intake is crucial for assessing both the quality and quantity of nutrients consumed by young children. Adequate nutrient intake is essential for promoting optimal development and growth. The primary aims of the study is to identify children's nutrient intake, nutritional status, and factors influencing the nutritional status of children in rural and urban areas of West Java.

METHODS

Design and Participant

This research employed a cross-sectional design, with a sample comprising 150 households with children under five in rural areas (Cianjur Regency) and 150 households in urban areas (Sukabumi City) in West Java. The selection of district and city was based on high stunting prevalence.

The sample size is based on an assumption that α=5% (Zα=1.96), power of test=90% (Zβ=1.28). Food Security Agency reported that the percentage of food insecurity in rural area was 17.1% while in urban area the percentage was 5.1% on 2019 Food Security Index[8]. The sample calculation is as follow:

$$n = \frac{\left(z_{1-\alpha/2}\sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)}\right)^2}{(P_1-P_2)^2}$$

n = [1.96√0.222(0.889) + 1.28√0.171(0.829) + 0.051(0.949)]^2 / (0.171-0.051)^2

n = [1.96√0.222(0.889) + 1.28√0.142 + 0.048)]^2 / (0.171-0.051)^2

n = [1.96(0.444) + 1.28(0.436)]^2 / (0.12)^2

n = [0.870 + 0.558]^2 / 0.0144

n = 2.039 / 0.0144

n = 141.6

To anticipate the subjects who may drop out of this study, the number of samples was added by 9 households for each group. The total subjects were 150 households in every area.

Data Collection

The study gathered primary data through interviews with mothers using questionnaires and anthropometric measurements. The data collected were household data, gender-related characteristics, children's daily nutrient intake, and anthropometric measurements. Household data (household sociodemographic, socioeconomic factors, dietary intake, and gender) are collected through structured questionnaire interviews with respondents. Data on household sociodemographic and socioeconomic factors including household size, headship, occupation, monthly expenditure, education level, ethnicity, and maternal nutritional knowledge. Household size, employment, and education level are determined using questions adapted from the 2018 Indonesia Basic Health Research Questionnaire[9]. Household expenditure (both food and non-food) are measured using instruments derived from the 2020 National Social Economic Survey on household food expenditure and consumption. Maternal nutritional knowledge is evaluated using pre-tested questions about infant and young child feeding (IYCF) and balanced nutrition.

Gender-related characteristics are evaluated using a series of pre-tested questions. Intra-household food allocation is measured using a series of questions about household meal behavior, such as prioritizing eating order among family members, menu differentiation, and portion distribution. Decision-making on food-related matters was analyzed to determine mother's participation in household nutrition choices. The daily activities of mothers were also documented to assess their level of empowerment and time allocation for activities beyond domestic duties.

Assessment of children's daily nutrient intake was carried out using a 24-hour recall method conducted through their mothers[10]. Nutrient intake was calculated using an Indonesian food composition. Furthermore, the daily nutrient intake was compared to the Ministry of Health's 2019 recommended dietary allowance (RDA).

Anthropometric measurements were taken on children under five within the participating households. Children's weight was measured using a digital scale with 0.1 kg precision, and height or length was recorded using a height board for children over 24 months and a length board for younger children. Each measurement was taken twice, and the average value was recorded. All measurement equipment was routinely calibrated to ensure accuracy.

The children's weight and height/length were calculated using WHO Anthro Analyser, an online tool designed by WHO and UNICEF to evaluate anthropometric survey data completely. The program is available online at https://worldhealthorg.shinyapps.io/anthro/. The software produced data on the height-for-age Z-score (HAZ), weight-for-age Z-score (WAZ), and weight-for-height Z-score (WHZ). The categories of child nutritional status were determined using the Ministry of Health of the Republic of Indonesia's Regulation No. 2 Year 2020 for those indicators. Based on the Z-score, the cut-off for child nutritional status for underweight (WAZ) is -3≤ Z-score <-2, stunting (HAZ) is -3≤ Z-score <-2, wasting (WHZ) is -3≤ Z score <-2, overweight is 2 < Z-score ≥ 3, obese is Z-score ≥ 3.

Data Analysis

Data were analyzed using SPSS Version 22.0 for Windows. Descriptive statistics were used to summarize household and child characteristics. Continuous variables were presented as means and standard deviations, while categorical variables were expressed as proportions. The determinants of children's nutritional status were analyzed using multiple logistic regression. A p-value <0.05 was considered statistically significant

Ethical Considerations

This study adhered to ethical guidelines for research involving human subjects. Informed consent was obtained from all participants before data collection. Confidentiality and voluntary participation were ensured. Ethical approval for the study was granted by the Ethics Committee of IPB University (No. 680/IT3.KEPMSM-IPB/SK/2022).

RESULTS

The nutritional status of children is primarily influence by their nutrient intake. Therefore, evaluating nutritional intake is essential to assess both the quality and quantity of nutrients consumed by children under five. Table 1 presents the adequacy levels of children's nutrient intake.

Overall, except for carbohydrate intake, which exceeds 100%, macronutrient intake, particularly energy, protein, and fat, remained insufficient. However, all recorded micronutrient consumption levels were below the recommendation. These deficiencies may play a role in the high occurrence of persistent nutritional problems among children. Macronutrients in urban areas are slightly higher than in rural areas, meanwhile micronutrients slightly higher in rural areas than in urban areas.

Children's nutritional status was assessed using Weight-for-Age (WAZ), Height-for-Age (HAZ), and Weight-for-Height (WHZ) indicators. Table 2 presents the distribution of children's nutritional status in West Java, Indonesia.

Table 1. Mean energy and nutrients adequacy in West Java, Indonesia (%RDA).

Nutrients	Rural n= 150	Urban n= 150	Total n= 300
Energy	84.9	86.9	86.2
Protein	151.9	161.3	156.5
Fat	80.6	84.1	82.9
Carbohydrate	76.4	79.8	77.7
Calcium	46.4	45.4	46.1
Iron	67.2	65.1	66.1
Zinc	89.2	82.5	85.5
Vitamin A	78.3	78.0	78.2
Vitamin C	61.9	61.0	61.1

The prevalence of underweight children was 19%, with similar rates in urban (19.4%) and rural areas (18.6%). Stunting, indicating chronic malnutrition, was prevalent in 32% of children (33.4% in rural and 30.7% in urban areas). Wasting prevalence was 4.3%, with higher rates in urban areas (6.0%) than in rural areas (2.7%). Additionally, the prevalence of children at risk of being overweight in urban areas was 8.7% and in rural areas was 6.7%.

Table 3 presents the key determinants of children's nutritional status. The results showed that maternal education was a significant risk factor of child stunting. As shown in Table 3, mothers with lower levels of education were 2.45 times more likely to have stunted children (OR 2.45; 95% CI 1.43-4.38; p=0.001). Other factors, such as household size, maternal employment, and food expenditure, were not significantly associated with children's nutritional status. Overall, the logistic regression analysis of all determinant variables in West Java yielded a coefficient of determination (R^2) of 0.08, indicating that only 8% of the variation in stunting prevalence could be explained by the included variables.

DISCUSSION

The findings of this study highlight the persistent issue of malnutrition among children in both rural and urban areas of West Java. Despite some improvements in macronutrient intake, micronutrient deficiencies remain a major concern, potentially contributing to the high prevalence of stunting. A well-balanced diet comprising diverse and nutritious foods ensures optimal nutrient intake[11]. Micronutrients have an important role in nutritional status especially in toddlers. Lack of micronutrient can lead to several health problem such as anemia which can lead to stunting incident. Providing iron sup-

Table 2. The distribution of children's nutritional status in West Java, Indonesia

Nutritional status	Rural n= 150	Urban n= 150	Total n= 300
WAZ, n (%)			
- Severe underweight (Z score <-3)	2 (1.3)	7 (4.7)	9 (3.0)
- Underweight (-3≤ Z score <-2)	26 (17.3)	22 (14.7)	48 (16.0)
- Normal (-2 ≤Z score ≤1)	118 (78.7)	113 (75.3)	231 (77.0)
- Risk of overweight (Z score >1)	4 (2.7)	8 (5.3)	12 (4.0)
Mean±SD	-1.05 ± 1.00	-0.97 ± 1.25	-1.01 ± 1.13
HAZ, n (%)			
- Severe stunting (Z score <-3)	13 (8.7)	15 (10.0)	28 (9.3)
- Stunting (-3≤ Z score <-2)	37 (24.7)	31 (20.7)	68 (22.7)
- Normal (Z score ≥-2)	100 (66.7)	104 (69.4)	204 (68.0)
Mean±SD	-1.57 ± 1.16	-1.29 ± 1.40	-1.44 ± 1.29
WHZ, n (%)			
- Severe wasting (Z score < -3)	0 (0.0)	3 (2.0)	3 (1.0)
- Wasting (-3 ≤ Z score <-2)	4 (2.7)	6 (4.0)	10 (3.3)
- Normal (-2 ≤ Z score ≤1)	128 (85.3)	125 (83.3)	253 (84.3)
- Risk of overweight (1 < Z score ≥2)	10 (6.7)	13 (8.7)	23 (7.7)
- Overweight (2 < Z score ≥ 3)	7 (4.7)	1 (0.7)	8 (2.7)
- Obese (Z score ≥ 3)	1 (0.7)	2 (1.3)	3 (1.0)
Mean± SD	-0.23 ± 1.12	-0.34 ± 1.27	-0.28 ± 1.20

plementation can enhance growth and improve nutritional status of anemia children in Ecuador[12].

Inadequate energy intake often indicates deficiencies in other essential nutrients. When these deficiencies persist over time, they can hinder bone growth and contribute to stunting in young children. Protein deficiency, in particular, can delay growth and impair bone development, as protein plays a crucial role in growth. Additionally, protein serves a unique function that cannot be replaced by other nutrients, specifically in the formation and maintenance of body cells and tissues[13]. Several studies have also shown that the nutrient adequacy of energy, protein, and vitamin C among stunted children in both urban and rural areas is generally insufficient. Several studies have also shown that the nutrient adequacy of energy, protein, and vitamin C among stunted children in both urban and rural areas is generally insufficient[14,15]. In a study conducted in rural central Tanzania, complementary meals for infants were analyzed for nutrient content. The findings revealed that porridge, the main infant food, had high carbohydrate but poor caloric, protein, and fat content, as well as insufficient meal frequency and portion sizes[14]. A study in China similarly found that the nutritional intake of children aged 6 to 18 months is still below WHO recommendations[15].

There were no major disparities in children's energy and nutrient intake between urban and rural communities. Nevertheless, stunted children in urban areas tend to consume an adequate amount of protein compared to their rural counterparts. This finding is consistent with a previous study using data from the National Individual Food Consumption Survey (SKMI) 2014 among children aged 6-35 months, which found that 73.9% of children, particularly those aged 6-11 months, had insufficient protein intake in urban areas and

Table 3. Determinants of children's nutritional status in West Java, Indonesia

Variables	OR	95% CI	*p*
Household size	0.96	0.79 – 1.18	0.716
Fathers work as non-employee (ref: employee)	0.79	0.38 – 1.64	0.526
Working mothers (ref: not working)	1.45	0.78 – 2.68	0.238
Low mother education (ref: high education)	2.45	1.43 – 4.38	0.001*
Mothers' nutritional knowledge	0.98	0.95 – 1.02	0.456
Mothers/girls eat last (ref: mothers/girls eat first)	1.72	0.60 – 4.95	0.316
% food expenditure	0.91	0.12 – 6.61	0.922
Energy adequacy (%)	0.77	0.67 – 2.11	0.547
Protein adequacy (%)	0.75	0.38 – 1.56	0.461
Inadequate women empowerment (ref: adequate)	1.06	0.62 – 1.82	0.837
Decision making on food menu			
- Fully shared (husband and wife)	1.00	1.00	-
- Partially shared (husband dominant/wife dominant)	1.02	0.19 – 5.60	0.982
- Individual (husband only/wife only)	0.59	0.14 – 2.54	0.477
Decision making on food amount			
- Fully shared (husband and wife)	1.00	1.00	-
- Partially shared (husband dominant/wife dominant)	0.53	0.02 – 17.43	0.477
- Individual (husband only/wife only)	2.19	0.12 – 38.80	0.380
Decision making on food expense			
- Fully shared (husband and wife)	1.00	1.00	-
- Partially shared (husband dominant/wife dominant)	1.55	0.05 – 49.79	0.594
- Individual (husband only/wife only)	1.20	0.07 – 19.32	0.962

* Logistic regression, $p<0.05$, $r^2= 0.077$.

82.8% in rural areas[16]. A study of children aged 6-18 months conducted in China found that urban children consumed more important nutrients than rural children[15].

The insufficient energy intake observed among stunted toddlers may be influenced by maternal feeding practices, despite the relative affordability of staple foods. A lack of awareness among mothers regarding appropriate portion sizes is a contributing factor, as many tend to provide food portions based on what they perceive their children can finish rather than what is nutritionally adequate[17].

The nutritional status of children under five is a critical indicator of overall child health. The HAZ reflects chronic nutritional status, WHZ indicates acute nutritional status, and WAZ represents a combination of both acute and chronic nutritional conditions[18,19]. The HAZ indicator, which measures chronic nutritional issues, revealed a stunting prevalence of 32% in this study. This rate is significantly higher than the 24.5% stunting prevalence reported in West Java by the 2021 Indonesian Nutritional Status Survey (SSGI). Additionally, stunting prevalence in the urban area of Sukabumi City was

recorded at 30.7%, notably exceeding the 19.1% reported by the 2021 SSGI. In rural areas, the stunting prevalence in Cianjur Regency was 33.4%, which closely aligns with the 33.7% reported by the 2021 SSGI[20]. The high prevalence of stunting in this study suggests that long-term nutritional deficiencies and inadequate feeding practices persist. This is concerning, as stunting is associated with long-term developmental delays, lower cognitive performance, and increased risk of chronic diseases in adulthood[4]. The discrepancy between urban and rural stunting rates may be due to differences in food security, healthcare access, and maternal nutrition knowledge.

By WHZ indicator the prevalence of acute malnutrition, specifically wasting, remained relatively low at 4.3%. This figure is slightly lower than the 5.3% wasting prevalence reported in West Java by the 2021 Indonesian Nutritional Status Survey (SSGI). Furthermore, the prevalence of wasting was higher in urban areas compared to rural areas. The 2021 SSGI data also indicated that wasting prevalence in Sukabumi City (7.1%) was significantly higher than in Cianjur Regency (2.9%)[20]. Based on the WAZ indicator, 19% of children were classified as underweight. Based on an analysis of children's nutritional status using the three anthropometric indicators (WAZ, HAZ, and WHZ), chronic malnutrition emerged as the most prominent nutritional issue in the study area.

The description of the remaining independent variables in the equation is provided elsewhere[21-24]. Table 3 shows that mothers with lower levels of education were 2.45 times more likely to have stunted children. This finding aligns with research conducted in rural Concepción, which identified maternal education as a key factor influencing infant nutritional status[25]. Similar findings were reported in The 2017 Indonesia Nutritional Status Monitoring Survey found that mothers with primary school education or less are 1.587 times more likely than mothers with a college education to have stunted children under the age of two[26]. According to other survey, the 2018 Nigeria Demographic and Health Survey (NDHS), children born to uneducated mothers (OR = 1.55; 95% CI = 1.32-1.82) and mothers with primary education (OR = 1.49; 95% CI = 1.28-1.72) were more likely to be stunted compared to children born to mothers with at least secondary education[27].

These results suggest that low maternal education is a significant risk factor for stunting. Mothers with higher levels of education tend to have greater awareness of nutrition, enabling them to make informed dietary choices for their children. This, in turn, contributes to improved feeding practices and healthier food selections, positively impacting children's growth and development[28]. Therefore, stunting intervention programs should be primarily targeted at families with children under five whose mothers have lower levels of education. Besides, strengthening community-based nutrition programs, particularly in rural areas, could help mitigate childhood malnutrition. Initiatives such as school-based nutrition education, fortified food programs, and improved access to healthcare can play a crucial role in reducing stunting and micronutrient deficiencies.

CONCLUSION

In conclusion, macronutrient and micronutrient intake levels were below recommended adequacy. The nutritional challenges faced by children in rural and urban areas are closely linked to their insufficient energy and nutrient intake. Chronic malnutrition emerged as the primary nutritional issue in both rural and urban areas, with stunting remaining highly prevalent across both areas.

One of the key determinants of children's nutritional status in West Java is maternal education. Low maternal education levels are strongly associated with the incidence of stunting in the region. Furthermore, inadequate nutrient intake likely contributes to the high prevalence of chronic malnutrition. Addressing this serious issue requires the implementation of targeted nutrition programs. Given that malnutrition is closely related to insufficient energy and nutrient intake, a food-based nutrition program should be prioritized. Such an approach can effectively address both macronutrient and micronutrient deficiencies simultaneously.

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