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DIFFERENCES IN MACRONUTRIENT AND MICRONUTRIENT INTAKE OF STUNTED TODDLERS IN RURAL AND URBAN AREAS OF BENGKULU PROVINCE

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ABSTRACT

Stunting prevalence in Kepahiang District is the highest compared to other districts. In Bengkulu, the incidence rate is lower than in other districts. Dietary intake is a direct factor causing stunting. This study examines the differences in macronutrient and micronutrient intake in stunted toddlers in rural and urban areas of Bengkulu Province. The study, with a cross-sectional design, was conducted from August to September 2020. A sample of 134 toddlers aged 12-24 months was selected using accidental sampling. Dietary intake data were collected using the Semi-Quantitative Food Frequency Questionnaire (SFFQ), and other data were collected through questionnaires. The collected data were analyzed using univariate and bivariate analyses with T-tests and Mann-Whitney tests. Macronutrient intake in stunted toddlers in rural areas was lower than in urban areas. Micronutrient intake in rural areas was also lower than in urban areas, except for vitamin A. Statistically, there were no differences in macronutrient (carbohydrates, proteins, fats) and micronutrient (vitamin A, calcium, phosphorus, iron, zinc) intake between rural and urban toddler in relation to stunting ($p > 0.05$). Based on the data obtained, the overall nutrient intake provided to the toddlers has not met the toddlers' nutritional needs. Regular counselling sessions from house to house for mothers with stunted toddlers are necessary. This would enable mothers to understand better their toddlers' dietary needs and how to monitor their growth.

Keywords: Intake, Macronutrients, Micronutrients, Toddlers, Stunting

INTRODUCTION

Malnutrition is characterised by over- or under-nutrition, which imposes a significant financial burden on the healthcare system(Kizilyildiz et al., 2016). In 2020, it is estimated that 149 million children under the age of 5 will be stunted, a condition characterized by being below the expected height for their age on a global scale. It is estimated that malnutrition is the cause of death in about 45% of all cases involving children less than 5 years old. This is especially true in countries with low or middle incomes. At the same time, rates of overweight and obesity in children are also increasing in the same countries (WHO, 2021). In general, 99 million micronutrient-deficient children (aged 6-59 months) live in South Asia, 98 million in Sub-Saharan Africa, and 85 million in East Asia and the Pacific (Stevens et al., 2022).

The government has established five pillars to address stunting, including visionary and committed leadership, national education that leads to behavior change, integrated program at all levels of government and food and nutrition sensitivities (Badan Ketahanan Pangan Kementrian Pertanian, 2019). These efforts must be carried out integrated to achieve maximum results. Based on the results of SSGI 2021, stunting nationally has decreased by 1.6%/year, from 27.7% in 2019 to 24.4% in 2021. Most of the 34 provinces showed signs of decline compared to the previous year (Kemenkes RI, 2021).

Toddlers who face stunting often lack proper nutrition. Infectious diseases can also be a significant cause of this problem. In addition, parental health characteristics and background also play an essential role in the development of stunting in children (Ismawati et al., 2020). Food intake and infectious diseases are direct factors in the onset of nutritional problems. The nutrient intake of children under five must fulfil their needs to avoid stunting. Based on observations, children with stunting problems tend to consume foods such as poultry, eggs, and fruits less frequently.

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This is different from children who are not stunted, who generally have a pattern of consuming these foods with a more frequent frequency. The lack of consumption of these nutritious foods can be one of the factors that cause growth problems in children (Mahfouz et al., 2022).

Based on the geographical and socio-economic characteristics of the region, stunting was found to be more common in rural areas than in urban areas. Certain factors in rural areas, such as limited access to health services, income inequality, and possibly less food availability and diversity, may influence the higher prevalence of stunting there compared to urban areas (Kalinda et al., 2023; Sserwanja et al., 2021; Tadesse et al., 2023).

Bengkulu Province is one of the regions in Indonesia that also faces nutrition issues in children under five. Data in 2018 from e-PPGBM shows that the stunting rate among children under five reached 17.2%, while the rate of severe stunting children was 6.3%. Kapahyang district recorded the highest rate of stunted children under five with 28.2% and severe stunting children with 7.77%. Meanwhile, in Bengkulu City, the stunting rate of the under-fives was 10.7%. Based on this background, this study wants to see the differences in macronutrient and micronutrient intake in stunted toddlers in rural and urban areas.

METHODS

This research is an analytical survey with a cross-sectional design. The study is planned to take place from August to September 2020. The research location was selected based on predetermined criteria. An accidental sampling method was used to collect samples. The target population of this study were mothers with children aged 12-24 months in the August-September 2020 period. This age group was chosen purposively because it is in the first 1000 days of life period, a golden age for stunting prevention. The minimum sample size was calculated using Sample Size Determination in Health Sciences using 80% CI. The minimum sample based on that calculation was 63(Ogston et al., 1991). Furthermore, to minimize sample loss by adding 5% of the minimum sample, (Dettori, 2011) 67 samples were obtained in each group. In total, this study involved 134 respondents, divided into 67 toddlers from Sidodadi Health Centre (rural area) and 67 from Pasar Ikan Health Centre (urban area). The inclusion criteria were willingness to participate in the study and aged 12-24 months during the study period. Exclusion criteria included children with mental disorders or physical disabilities and children who were sick or receiving medical treatment. The variables studied include nutrient intake, which refers to the amount of food children consume, such as macronutrients including carbohydrates, protein, and fat, and micronutrients, including vitamin A, calcium, phosphorus, iron and zinc. In addition, stunting is defined as the level of a child's length/height as measured by age. To collect data on intake and nutritional status, the Semi-Food Frequency Questionnaire (SFFQ) tool and other data related to children's characteristics were used to measure their nutritional status. Data collection using semi-FFQ showed the diversity of foods generally consumed by the people of Bengkulu. There is no difference in the type of food between urban and rural communities. The collected data were then analyzed for univariate and bivariate. In the bivariate analysis, the T-test and Mann-Whitney test were used to determine the extent of the relationship between the independent variable and the dependent variable. In 2020, the Poltekes Ethics Committee of the Ministry of Health Bengkulu approved study protocol KEPK/093/19/2020. Health Research Ethics Committee confirms informed consent and instruments.

RESULTS AND DISCUSSIONS

All mothers under five are over 20 years old; in urban residents, mothers' height is mostly more than 150 cm (100%), higher education (82.09%), and mothers work more in rural than urban areas. For the characteristics of babies, most have birth weight and normal birth length both in rural and urban areas. In addition, the mother provides exclusive breastfeeding and early initiation of breastfeeding.

Based on the table above, the average carbohydrate intake of rural toddlers is 91.19 grams, while urban children's is 92.36 The average protein intake of rural toddlers is 31.1985, and

Table 1. Characteristics of Mothers and Toddlers in Rural and Urban

Variable	Rural		Urban	
	n	%	n	%
Mother Age (years)				
<20 years	0	0.0	0	0.0
≥20 years	67	100.0	67	100.0
Mother Height (cm)				
<150 cm	6	8,9	0	0.0
≥150 cm	61	91.0	67	100.0
Mother Education				
Low	40	59.7	12	17.91
Hight	27	40.3	55	82.09
Mother Occupation				
No	60	89.6	59	88.06
Yes	7	10.4	8	11.94
Birth Weight				
Low	7	5.2	3	2.2
Normal	60	44.8	64	47.8
Birth Length				
Short	11	8.2	5	3.7
Normal	56	41.8	62	46.3
Exclusive breastfeeding				
Yes	52	38.8	57	42.5
No	15	11.2	10	7.5
Early Breastfeeding Initiation				
Yes	50	37.3	62	46.3
No	17	12.7	5	3.7

Table 2. Distribution of Macronutrient and Micronutrient Intake of Rural and Urban Children in Bengkulu in 2020.

Variable	Mean	SD	Min	Max
Carbohydrate (g)				
- Rural	91.19	32.90	34.0	201.6
- Urban	92.36	33.11	33.6	203.4
Protein (g)				
- Rural	32.19	11.8	9.7	66.7
- Urban	38.13	16.2	11.2	93.7
Fat (g)				
- Rural	26.22	8.67	6.0	52.0
- Urban	26.73	9.89	8.2	50.0
Vitamin A (RE)				
- Rural	1192.38	912.66	105	4832
- Urban	1230.59	1063.71	70.8	8001
Calcium (mg)				
- Rural	277.0	225.2	56.0	11.55
- Urban	449.8	431.5	73.8	25.63
Phosphor (mg)				
- Rural	443.38	198.33	3.8	232.2
- Urban	557.45	378.29	2	975.0
Iron (mg)				
-Rural	5.71	3.06	1.9	16.5
-Urban	6.75	3.62	1.2	17.0
Zinc (mg)				
-Rural	3.39	1.46	1.3	9.75
-Urban	4.03	2.02	1.2	10.7
HAZ (SD)				
-Rural	-1.45	1.31	-4.05	3.67
-Urban	-1.01	1.61	-3.89	4.54

urban 38.134. The average fat intake of rural toddlers is 26.22, and urban 26.737. Rural children under two's average vitamin A intake were 1192.3896 RE, and urban 1230.59 RE. The average calcium intake of rural children under five is 277.01; for urban children, it is 449.77. The average phosphorus intake of rural children under five was 443.77, and for urban children was 577.456. The average iron intake of rural children under five was 5.71, and urban 6.75. The average zinc intake of rural children under five is 3.39 mg and urban 4.03. The mean nutritional status of rural children under five was -1.453 and urban -1.0151 (Table 2).

To answer the research objectives, the stunting variable was analyzed to see the nutritional and stunting status frequency distribution. The results of the analysis found that 41 people were stunted. Furthermore, of the 41 people with stunting nutritional status, 7 had severe stunting status, and 34 had short status, as shown in Table 3. The next analysis looked at differences in macronutrient intake and specific micronutrients in stunted children in rural and urban areas, which can be seen in Table 4.

Data from the table above show that the average carbohydrate intake of severe stunting

Table 3. Distribution of Nutritional Status of Rural and Urban Toddlers in 2020

Variable	Rural		Urban	
	n	%	n	%
Nutritional Status				
Not Stunting	46	68.6	47	70.1
Stunting	21	31.3	20	29.8
Stunting Status				
< -3SD (Severe stunting)	3	14.3	4	20.0
-3SD to <-2SD (Short)	18	85.7	16	80.0

Table 4. Differences in Macronutrient and Micronutrient Intakes among Rural and Urban Stunting Children in Bengkulu Province in 2020

Variable	> -3SD (Severe Stunting)					-3 SD s.d < -2SD (Stunting)					p value
	n	mean	SD	Min	Max	n	mean	SD	Min	Max	
Carbohydrates (g)											
- Rural	3	79.3	59.6	41	148	18	205.04	453.12	47	201.6	0.40
- Urban	4	101.7	67.8	58	203	16	97.44	44.29	33	203.4	
Protein (g)											
- Rural	3	47.3	14.9	35	64	18	33	12.4	15	66	0.99
- Urban	4	43.2	34	18	93	16	34.18	12.2	12	55	
Fat (g)											
- Rural	3	21.0	11	9	32	18	28.4	10.2	14	52	
- Urban	4	18.3	6.29	11	24	16	26	7.8	8	39	0.99
Vitamin A (RE)											
- Rural	3	908.0	927.6	355	1979	18	1417	1320	105	4832	0.99
- Urban	4	710.3	602.6	70	1336	16	1216	800.6	103	1054	
Calcium (mg)											
- Rural	3	215.0	173.5	89	413	18	272	209	56	737	0.16
- Urban	4	787.0	1184.7	138	2563	16	331.2	240.39	103	1054	
Phosphor (mg)											
- Rural	3	498.0	225	266	772	18	498.2	240.5	185	975	0.68
- Urban	4	838.7	993.9	236	232.2	16	493.2	215.6	248	1054	
Iron (mg)											
-Rural	3	5.0	3.6	2	9	18	4.7	2.5	1	12	0.68
-Urban	4	4.2	2.21	1	6	16	5.6	3.6	1	15	
Zinc (mg)											
-Rural	3	3.0	2	1	5	18	2.83	1.33	1	12	0.85
-Urban	4	4.0	4.08	1	10	16	3.125	1.45	1	7	

toddlers in rural areas was 79.3 gram and in urban areas 101.7 gram, while the average carbohydrate intake of short toddlers in rural areas was 204.6 and in urban areas 204.61. Statistical tests showed no difference in the carbohydrate intake of stunted children in rural and urban areas (p-value = 0.80). The average protein intake of severe stunting toddlers in rural areas was 47.3 gram and in urban areas 43.25 gram, while the protein intake of short toddlers in rural areas was 33 gram and in urban areas 12.4 gram. Statistical test results showed no difference in the protein intake of stunted toddlers in rural and urban areas (p-value = 0.99). The average fat intake of severe stunting toddlers in rural areas was 21 gram and in urban areas 18.25 gram, while the fat intake of short toddlers in rural areas was 28.4 gram and in urban areas 26 gram. Statistical test results showed no difference in fat intake of stunted toddlers in rural and urban areas (p-value = 0.99).

The average vitamin A intake of severely stunted toddlers in rural areas is 908. In urban areas, it is 710.3 gram, while the vitamin A intake of short toddlers in rural areas is 1417 and in urban areas is 1216. Statistical tests showed no difference in vitamin A intake between rural and urban stunted children (p-value = 0.99). The average calcium intake of severe stunting toddlers in rural areas is 215 mg and in urban areas 787 mg, while the calcium intake of short toddlers in rural areas is 272 and in urban areas 331.2. Statistical tests showed no difference in calcium intake between rural and urban stunted children (p-value = 0.16). The average phosphorus intake of severe stunting toddlers in rural areas was 498 mg, and in urban areas, 838.7 mg. In comparison, the phosphorus intake of short toddlers in rural areas was 498.2 mg and in urban areas 493.3 mg. Statistical tests showed no difference in phosphorus intake between rural and urban stunted children (p-value

= 0.68). The average iron intake of severe stunting toddlers in rural areas was 5 mg and in urban areas 4.2 mg, while the iron intake of short toddlers in rural areas was 4.7 mg and in urban areas 5.6 mg. Statistical tests showed no difference in iron intake between rural and urban stunted children (p-value = 0.68). The average zinc intake of severe stunting toddlers in rural areas was 3 mg and in urban areas 4 mg, while the zinc intake of short toddlers in rural areas was 2.83 mg and in urban areas 3.125 mg. Statistical test results showed no difference in the protein intake of stunted toddlers in rural and urban areas (p-value = 0.85).

The amount of macro and micronutrients consumed by severe stunting toddlers is less compared to short toddlers in the village and the city. The nutritional intake of toddlers needs to be considered so that the dietary needs of toddlers are met. Stunted toddlers tend to consume fewer macronutrients (carbohydrates, protein and fat) than toddlers who are not stunted. (Elisanti et al., 2023; Limardi et al., 2022). In addition to micronutrients, toddlers need micronutrients to prevent stunting. Toddlers who consume less vitamin A, iron, calcium, phosphorus and zinc are more at risk of stunting. (Chairunnisa et al., 2018).

Children who are stunted due to inadequate nutritional intake. The cause of lack of intake is related to the level of maternal education; in research, it was found that maternal education in rural areas is lower, so the possibility of mothers not understanding the nutritional needs of children. In addition, food consumption is also related to production; working mothers will help the family economy. Most mothers have non-working status. This is in line with previous studies, which show that deficiencies in macronutrients and micronutrients are the main factors affecting the nutritional status of children in many countries (Verma & Prasad, 2021). The study found no differences between the intake of zinc and vitamin A nutrients between rural and urban children and the incidence of stunting, in line with previous research, which states that the consumption of nutritional supplements between rural and urban areas is not different (Sharif et al., 2020). In contrast to research conducted by Zou, which resulted in the findings of vitamin A intake between children living in cities and villages, there are differences. Urban children consume more vitamin A than rural children (Zou et al., 2023). Ssentongo study showed a significant association between vitamin A deficiency and linear growth failure in preschool children in Uganda (Ssentongo et al., 2020).

In this study, the calcium intake of children living in rural and urban areas showed no difference. This is in line with previous research, which states no calcium consumption difference between rural and urban areas (Zou et al., 2023). Calcium intake in rural areas was lowest compared to urban and metropolitan areas. In the metropolitan and urban groups, diets tended to be high in calories, containing more milk, dairy products, and vegetables than subjects in rural areas. Dietary calcium intake was significantly lower ($p<0.001$) in subjects in rural areas than in urban and metropolitan areas. (Harinarayan & Ramalakshmi, 2015; Valaei et al., 2017)

Phosphorus is crucial in bone mineralization, making it particularly important in the growth phase. Low levels of phosphorus consumption in respondents were associated with low consumption of animal products in both the case and control groups. However, the analysis showed no significant difference. This result is in line with other studies that found no correlation between phosphorus intake and the incidence of stunting in children aged 24-59 months. This indicates that several other nutrients need to interact with phosphorus. In the context of this study, it was found that only intake of phosphorus, vitamin A, and the proportion between calcium and phosphorus intake was adequate, while intake of other nutrients was considered insufficient (Wessells & Brown, 2012).

This study found no difference in iron consumption between children living in rural and urban areas. This contrasts previous studies that found iron intake was lower in rural children than urban children. The estimated FeBio intake in Mexican children aged 12 to 59 months was deficient (less than 1 mg per day) and negatively associated with low socioeconomic status and living in rural areas. We also found that iron absorption from food was less than 10%. This is because: 1) the majority of iron consumed by

our population was non-heme, which has lower absorption compared to heme iron; 2) there was high consumption of ingredients that inhibit iron absorption, such as phytate and calcium, and low consumption of meat, which can increase iron absorption (Venegas-Aviles et al., 2020).

This study found no difference in zinc consumption between rural and urban toddlers, which aligns with Zou's findings. Zou's study found that serum zinc levels in village children and adolescents tended to be higher than in cities. The specific cause of this difference requires further research. The primary source of zinc in our body comes from food. To avoid zinc deficiency, it is recommended to have a balanced diet and consume red meat, which is a good source of zinc, and some seafood, such as oysters, but in moderation. (Zou et al., 2023). Another study conducted in Bengkulu City found that fish biscuits are foods rich in zinc and can improve the nutritional status of toddlers. (Yunita et al., 2022).

This study found no association between macro and micronutrient intake and the incidence of stunting. In contrast to Siringoringo study, where carbohydrate and protein intake were associated with the incidence of stunting in under-fives, this did not apply to fat consumption. Likewise, Vitamin A, Calcium, Iron and Zinc were related to stunting in under-five children (Siringoringo et al., 2020). The study conducted by Suryani found the same thing: the intake of macronutrients and micronutrients is not associated with stunting in toddlers (Suryani et al., 2022). This could be because all children under five who were analyzed were stunted. In addition, most of the nutritional needs of stunted toddlers have not been met. This study is in line with previous research that found no difference in the diversity of food consumption of short and severe stunting children. Differences in the variety of food consumed affect the adequacy of nutrients.(Rahmawati et al., 2020) In addition, the ability of families to meet food needs also affects the consumption patterns of stunted and severely stunted toddlers (Nkurunziza et al., 2017)

The limitation of this study are the sample size and recall bias, where mothers may forget the food given to toddlers. However, to anticipate memory bias by giving mothers free time to remember the food given to toddlers. If gaps in consumption patterns are found, confirmation will be repeated with the mother.

CONCLUSION

Each toddler has different nutritional needs. Stunted toddlers in urban areas consume more macro and micronutrients than in rural areas. Education regarding the need for macro and micronutrients and sources of nutrients in food needs to be carried out, especially in rural areas.

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