

RELATIONSHIP BETWEEN INFECTIOUS DISEASE, ENERGY AND MACRONUTRIENT INTAKE, AND NUTRITIONAL STATUS OF TODDLERS AGED 6–59 MONTHS IN GEMPOL SARI VILLAGE, BANTEN

Hubungan penyakit infeksi, asupan energi dan zat gizi makro terhadap status gizi balita usia 6–59 bulan di Desa Gempol Sari, Banten

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ABSTRACT

Toddlers are a group vulnerable to nutritional problems and illness because they are in a period of rapid growth and development. Nutritional status may be influenced by dietary intake and infection. This study aimed to determine the relationship between infectious disease, energy and macronutrient intake and the nutritional status of toddlers in Gempol Sari Village, Sepatan District, Tangerang Regency, Banten. This cross-sectional study used purposive sampling and included 65 toddlers aged 6–59 months living in Gempol Sari Village. Energy, protein, fat, and carbohydrate intake were assessed using two 24-hour food recalls conducted on a weekday and a weekend day, while infection history was collected using a questionnaire. Nutritional status was assessed using weight-for-age (WFA) and height-for-age (HFA) indicators. Statistical analysis was conducted using fisher's exact test. Most toddlers had good nutritional status based on WFA (100.0%) and normal nutritional status based on HAZ (93,8%). Most participants had inadequate energy intake (97%), excessive protein intake (61.5%), normal fat intake (52.3%), and inadequate carbohydrate intake (95.4%). Reported infections included diarrhea and fever accompanied by cough and runny nose. No statistically significant associations were found between energy, protein, fat, carbohydrate intake, or infection history and nutritional status based on HFA.

Keywords: Infectious Disease, Energy Intake, Macronutrients, Nutritional Status, Toddlers

ABSTRAK

Balita merupakan kelompok usia yang rentan terhadap masalah gizi dan penyakit karena berada pada masa pertumbuhan dan perkembangan yang pesat. Status gizi balita dapat dipengaruhi oleh asupan makanan dan kondisi infeksi. Penelitian ini bertujuan untuk mengetahui hubungan penyakit infeksi, asupan energi, dan asupan zat gizi makro dengan status gizi balita di Desa Gempol Sari, Kecamatan Sepatan Timur, Kabupaten Tangerang, Banten. Penelitian ini menggunakan desain cross-sectional dengan teknik purposive sampling. Subjek terdiri atas 65 balita usia 6–59 bulan yang tinggal di Desa Gempol Sari. Data asupan energi, protein, lemak, dan karbohidrat diperoleh melalui wawancara food recall 2×24 jam pada hari kerja dan akhir pekan, sedangkan riwayat penyakit infeksi diperoleh melalui kuesioner. Status gizi dinilai berdasarkan indikator berat badan menurut umur (BB/U) dan tinggi badan menurut umur (TB/U). Analisis hubungan dilakukan menggunakan uji statistik fisher's exact. Hasil penelitian menunjukkan bahwa

sebagian besar balita memiliki status gizi baik berdasarkan BB/U (100,0%) dan status gizi normal berdasarkan TB/U (93,8%). Sebagian besar subjek memiliki asupan energi kurang (97%), asupan protein lebih (61,5%), asupan lemak normal (52,3%), dan asupan karbohidrat kurang (95,4%). Riwayat infeksi yang dilaporkan antara lain diare dan demam disertai batuk dan pilek. Tidak ditemukan hubungan yang signifikan antara asupan energi, protein, lemak, karbohidrat, maupun riwayat penyakit infeksi dengan status gizi berdasarkan TB/U.

Kata kunci: Penyakit Infeksi, Asupan Energi, Zat Gizi Makro, Status Gizi, Balita

INTRODUCTION

Toddlers are an age group that requires particular attention because they are in a period of rapid growth and development. Adequate nutritional intake during this period is essential to support optimal child growth and development. Mothers play an important role in selecting and providing food to ensure that children receive adequate nutrient intake according to their nutritional needs.

Nutritional problems among toddlers can be influenced by various factors. Direct causes include inadequate nutrient intake and infectious diseases, whereas indirect factors may include maternal knowledge and education, family socioeconomic conditions, food security, and caregiving practices. These factors may interact with one another and ultimately affect children's nutritional status (Apriliana & Rakhma, 2017).

According to the 2018 Basic Health Research (Riset Kesehatan Dasar [Riskesdas]) conducted by the Ministry of Health of the Republic of Indonesia, 17.7% of children under five years of age experienced nutritional problems (Kemenkes, 2019). This figure comprised 3.9% of children with severe malnutrition and 13.8% with undernutrition. The prevalence of nutritional problems among children

under five was targeted to decrease to 17%. Meanwhile, the prevalence of stunting, defined as a height-for-age below the standard, was 30.8%, representing a decrease from 37.2% reported in Riskesdas 2013.

Energy and macronutrient intake are important components of meeting children's nutritional requirements. The 2014 Total Diet Study reported that the national mean energy intake among children aged 0–59 months was 1,137 kcal, compared with an energy requirement of 1,118 kcal. The mean protein intake in the same age group was 36.8 g, which was higher than the recommended protein requirement of 25.5 g. Fat and carbohydrate intake also constitute important components of dietary patterns among children under five (Siswanto, 2014).

In addition to dietary intake, infectious diseases are among the factors that may be associated with nutritional status. Infections can affect food intake and nutrient utilization. Conversely, poor nutritional status may increase susceptibility to infections. Therefore, the relationship between dietary intake, infectious diseases, and nutritional status should be considered among children under five years of age.

Pondok Jaya Village is located in Sepatan Subdistrict, Tangerang Regency, and is one of the villages prioritized for

stunting reduction (PROKOPIM, 2021). Based on data on the prevalence of malnutrition in Tangerang Regency, Sepatan Subdistrict was selected as the study site because it remains one of the areas experiencing stunting problems compared with other subdistricts.

METHODS

This study employed a cross-sectional design and was conducted in April 2022 at integrated health posts (posyandu) in Gempol Sari Village, Sepatan Timur Subdistrict, Tangerang Regency, Banten, Indonesia. The study population comprised all children aged 6–59 months registered at the posyandu in Gempol Sari Village. A total of 65 children who met the inclusion criteria were recruited using purposive sampling. The inclusion criteria were: (1) toddlers aged 6–59 months who lived and resided permanently in Gempol Sari Village and (2) toddlers whose mothers or caregivers agreed to participate in the study.

Data on participants' characteristics were collected using a structured questionnaire. Energy, protein, fat, and carbohydrate intakes were assessed through two non-consecutive 24-hour dietary recalls, covering one weekday and one weekend day. Nutritional status was assessed using weight-for-age (WFA) and height-for-age (HFA) indicators. Information on a history of infectious diseases was collected through questions regarding the occurrence of infections during the previous month, including diarrhea, fever accompanied by cough and runny nose, and symptoms of acute respiratory

infection (ARI). All interviews were conducted with the mothers of the children.

Data were analyzed using Fisher's exact test to examine the associations between the independent variables and nutritional status. Statistical significance was set at $p < 0.05$.

The study was conducted in accordance with established research ethics principles. Written informed consent was obtained from the participants' mothers or caregivers before data collection. Participant confidentiality and anonymity were maintained throughout the study, and the safety, privacy, and rights of all participants were ensured.

RESULTS

Characteristics of the Toddlers

The study included 65 toddlers aged 6–59 months from Gempol Sari Village. The characteristics assessed included age, sex, place of birth, and nutritional status. The characteristics of the study participants are presented in Table 1.

Most of the toddlers were aged 36–59 months (37 toddlers, 56.9%), were female (44 toddlers, 67.7%), and were born at a community health center (*puskesmas*) (25 toddlers, 38.5%). Based on weight-for-age (WFA), all toddlers were classified as having normal nutritional status. Based on height-for-age (HFA), 61 toddlers (93.8%) were classified as having normal height, while 2 toddlers (3.1%) were classified as stunted (short) and 2 toddlers (3.1%) as tall.

Table 1.
Characteristics of the toddlers

Characteristics	n	%
Age		
0 – 12 months	2	3.1
13 – 35 months	26	40.0
36 – 59 months	37	56.9
Gender		
Laki-laki	21	32.3
Perempuan	44	67.7
Place of Birth		
Midwife	19	29.2
Puskesmas	25	38.5
Hospital	21	32.3
Nutritional status (WFA)		
Normal	65	100.0
Nutritional status (HFA)		
Stunting	2	3.1
Normal	61	93.8
Tall	2	3.1
Total	65	100.0

Maternal Characteristics

The maternal characteristics assessed included the number of toddlers in the family, maternal education, maternal occupation, and the primary caregiver of the toddlers. Most

families had one toddler (78.5%). More than half of the mothers had completed senior high school (55.4%). Nearly all mothers were housewives (98.5%), and most toddlers were primarily cared for by their mothers (98.5%). Maternal characteristics are presented in Table 2.

Table 2.
Maternal characteristics

Maternal characteristics	n	%
Number of toddlers in the family		
1	51	78.5
2	11	16.9
3	3	4.6
Maternal education		
Elementary	1	1.5
Junior high school	9	13.8
Senior high school	36	55.4
Academy	14	21.5
Bachelors	5	7.7
Maternal occupation		
Employee	1	1.5
Housewife	64	98.5
Primary caregiver		
Mother	64	98.5
Caregiver	1	1.5
Total	65	100.0

Energy and Macronutrient Intake

Most toddlers had inadequate energy intake (97.0%). Protein intake was most commonly classified as excessive (61.5%), whereas fat intake

was most commonly classified as adequate (52.3%). Most toddlers also had inadequate carbohydrate intake (95.4%). The distribution of toddlers according to energy and macronutrient intake is presented in Table 3.

Table 3.
Distribution of toddlers by energy and macronutrient intake

Intake	n	%
Energy		
Severely Inadequate	1	1.5
Inadequate	63	97.0
Adequate	1	1.5
Excessive	0	0.0
Protein		
Severely Inadequate	1	1.5
Inadequate	1	1.5
Adequate	23	35.5
Excessive	40	61.5
Fat		
Severely Inadequate	0	0.0
Inadequate	24	36.9
Adequate	34	52.3
Excessive	7	10.8
Carbohydrate		
Severely Inadequate	0	0.0
Inadequate	62	95.4
Adequate	1	1.5
Excessive	2	3.1
Total	65	100.0

History of Infectious Diseases

A history of infection was assessed based on diarrhea and acute respiratory infection (ARI) symptoms experienced by the toddlers during the previous month. The distribution of toddlers according to their history of infection is presented in Table 4. A total of 17

toddlers (26.2%) were reported to have experienced diarrhea during the previous month. None of the toddlers included in the study were reported to have experienced ARI symptoms during the previous month. The history of infectious diseases among the toddlers is presented in Table 4.

Table 4.
Distribution of toddlers by history of infectious disease

Indicator	n	%
Diarrhea [>3 times a day]		
Yes	17	26.2
No	48	73.8
ARI symptoms		
Yes	0	0.0
No	65	100.0
Total	65	100.0

Association Between Energy and Macronutrient Intake and Nutritional Status

Nutritional status was assessed using weight-for-age (WFA) and height-for-age (HFA) indicators. However, all toddlers were classified as having normal nutritional status based on WFA; therefore, bivariate analysis was conducted only using the HFA indicator. For statistical analysis, the four intake categories were combined into two categories: (1) severely inadequate–

inadequate and (2) adequate–excessive. Based on Fisher's exact test, no significant associations were found between energy intake ($p=0.969$), protein intake ($p=0.939$), fat intake ($p=0.697$), or carbohydrate intake ($p=0.752$) and the nutritional status of toddlers based on HFA. The results of the statistical analysis of the associations between energy and macronutrient intake and nutritional status are presented in Table 5.

Table 5.
Association between energy and macronutrient intake and nutritional status

Association between energy and macronutrient intake and nutritional status							
Intake	Nutritional status [HFA]						<i>p</i>
	Stunting		Normal - tall		Total		
	n	%	n	%	n	%	
Energy							
Severely inadequate–inadequate	2	3.1	62	96.9	64	100	0.969
Adequate–excessive	0	0.0	1	100.0	1	100	
Protein							
Severely inadequate–inadequate	0	0.0	2	100.0	2	100	0.939
Adequate–excessive	2	3.2	61	96.8	63	100	
Fat							
Severely inadequate–inadequate	1	4.2	23	95.8	24	100	0.697
Adequate–excessive	1	2.4	40	97.6	41	100	
Carbohydrate							
Severely inadequate–inadequate	2	3.2	60	96.8	62	100	0.752
Adequate–excessive	0	0.0	3	100.0	3	100	

Association Between History of Infection and Nutritional Status

The proportion of toddlers in the severely stunted–stunted category who had experienced an infection during the previous month was higher than that of toddlers who had not experienced an

infection. However, based on Fisher's exact test, there was no significant association between a history of infectious diseases and the nutritional status of toddlers based on HFA ($p=0.065$).

Table 6.
Association between history of infection and nutritional status

Association between history of infection and nutritional status							
History of Infection [Diarrhea]	Status gizi [TB/U]						<i>p</i>
	Stunting		Normal - tall		Total		
	n	%	n	%	n	%	
Yes	2	11.8	15	88.2	17	100	0.065
No	0	0.0	48	100.0	48	100	

DISCUSSION

This study found no significant association between energy intake and nutritional status among toddlers, which is consistent with the findings of Bertalina and Amelia (2018). Similarly, macronutrient intake and a history of infectious diseases were not significantly associated with nutritional status in this study. Most toddlers had normal nutritional status based on HFA, with only two toddlers classified as stunted. The predominance of toddlers in the normal nutritional status category resulted in a very small number of participants in the stunted group. This condition should be considered when interpreting the statistical findings, as the ability of the study to detect differences or associations may have been limited.

Most toddlers had inadequate energy and carbohydrate intake, whereas protein intake was predominantly classified as excessive and fat intake as adequate. Although the distribution of nutrient intake indicated inadequate intake of some nutrients, this study found no significant associations between energy, protein, fat, or carbohydrate intake and nutritional status based on HFA.

The absence of an association between energy intake and nutritional status may be considered in the context of the cross-sectional study design. Dietary intake was assessed during the study period, whereas HFA reflects linear growth over a longer period. Therefore, dietary intake measured using two days of 24-hour dietary recalls may not adequately represent long-term

dietary patterns that contribute to linear growth.

The same consideration applies to protein intake. Protein plays an important role in the growth of toddlers; however, height is the result of cumulative growth processes occurring over a longer period (Caro et al., 2025). Therefore, protein intake measured at the time of the study may not reflect intake during the period when growth impairment occurred. These findings are consistent with those of Langi et al. (2019), who found no significant association between protein intake and stunting.

For fat and carbohydrate intake, this study also found no significant associations with nutritional status based on HFA. These findings are consistent with those of Adani et al. (2016), as cited in the source manuscript. However, the findings should be interpreted with caution because only two toddlers were classified as stunted, resulting in a highly imbalanced distribution between the groups.

A history of infectious diseases was also not significantly associated with nutritional status based on HFA. Theoretically, infections may affect nutritional status through reduced appetite, impaired nutrient absorption, and increased nutritional requirements. However, in this study, most toddlers had normal nutritional status, and only a small number were classified as stunted. In addition, the history of infection was assessed based on reported infections during the previous month, whereas HFA reflects a longer-term growth process.

CONCLUSSION

Most toddlers in this study had normal nutritional status based on WFA and HFA. Most toddlers had inadequate energy and carbohydrate intake, excessive protein intake, and adequate fat intake. Diarrhea was reported in 26.2% of toddlers, whereas none were reported to have experienced ARI symptoms during the previous month. No significant associations were found between energy, protein, fat, or carbohydrate intake, or a history of infectious diseases, and nutritional status based on HFA.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest to disclose.

DECLARATION USE AI

The authors declare that generative AI tools were used only for language editing and grammar correction. The authors remain fully responsible for the content and integrity of the manuscript.

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