



# Assessing the Relationship between Dietary Macronutrient Intake and Nutritional Status of Toddlers in the Lepo-Lepo Primary Health Care Work Area

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**Abstract.** Nutrient intake is a direct factor influencing the nutritional status of toddlers. According to the World Health Organization (WHO) in 2020, about 45.4 million children worldwide experienced wasting (low weight-for-height) and 38.9 million children were overweight. This study aimed to investigate the relationship between macronutrient intake and nutritional status among toddlers in the Lepo-Lepo Primary Health Care Work Area. This study employed an analytical observational design with a cross-sectional approach. The independent variable was macronutrient intake, while the dependent variable was nutritional status. The study sample comprised 107 toddlers aged 6-59 months in the Lepo-Lepo Primary Health Care Work Area, selected using purposive sampling. Data analysis was performed using the Rank Spearman correlation test. Among the 107 samples, 70 (65.4%) toddlers had good nutritional status, 19 (17.8%) were undernourished, 14 (13.1%) were overweight, and 4 (3.7%) had poor nutritional status. The statistical analysis revealed that carbohydrate intake ( $p=0.000$ ,  $r=0.638$ ) and protein intake ( $p=0.000$ ,  $r=0.679$ ) showed a strong positive correlation with nutritional status among toddlers in the Lepo-Lepo Primary Health Care Work Area. Additionally, fat intake ( $p=0.000$ ,  $r=0.370$ ) demonstrated a weak positive correlation with nutritional status. The study concluded that carbohydrate, protein, and fat intake were significantly correlated with the nutritional status of toddlers in the Lepo-Lepo Primary Health Care Work Area. These findings emphasize the importance of macronutrient intake in maintaining optimal nutritional status among toddlers. The results provide valuable insights for healthcare providers and policymakers to develop targeted interventions aimed at improving the nutritional status of toddlers.

**Keywords:** Macronutrient Intake, Nutritional Status, Toddlers.

## 1 Introduction

The nutritional status of an individual refers to their physical condition, which is determined by the equilibrium between energy intake and expenditure. The utilization of nutrients by the human body and the intake of food can both have an impact on an

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individual's nutritional status. When the human body has an adequate supply of nutrients and utilizes them well, it attains an optimal nutritional status, which facilitates physical growth, enhances cognitive functioning, and promotes overall well-being to the greatest extent possible. According to [1], Childhood malnutrition has been identified as a significant factor contributing to the onset of enduring physical, mental, social, and intellectual developmental impairments that endure into adulthood [2].

The occurrence of malnutrition among toddlers is influenced by both direct and indirect factors. The primary factors contributing to this phenomenon are the consumption of food and the contraction of infectious diseases. The indirect factors encompassed in this study are family income, nutritional understanding, care patterns, food security, environmental sanitation, and health services [3]. The nutritional intake of toddlers emerges as a prominent factor that might exert a direct influence on their nutritional health. We can derive the acquisition of essential nutrients from a variety of sources, specifically micro and macro nutrients. Micronutrients are essential elements that play a crucial role in supporting the appropriate functioning of macronutrients. Micronutrients are essential dietary components that are required at trace levels, yet are naturally present in various food sources. Micronutrients consist of minerals and vitamins. Macronutrition encompasses three essential components: carbs, proteins, and lipids. These substances are essential in significant amounts for bodily functions and primarily contribute to the provision of energy. The nutritional status of young individuals can be influenced by the level of macronutrient intake [4].

Insufficient macronutrient intake can cause alterations in tissue composition and body weight, so affecting the growth and maturation of the kid and giving rise to various health complications. According to [5], hence, a strong correlation exists between the consumption of macronutrients and an individual's nutritional state. The impact of nutritional intake on children's nutrient status is substantiated by a study conducted by [6], whereby it was seen that the consumption of carbs, proteins, and fats has a significant role. The age group most frequently affected by malnutrition or belonging to a population group sensitive to nutritional deficiencies is young children, namely those aged 0-5 years. According to [7], inadequate nutritional intake and suboptimal nutrition among the youth have led to impairments in both physical growth and overall health. Indirectly, inadequate nutrition and poor dietary practices can give rise to enduring nutritional deficiencies in young children, which can have significant ramifications for their health, growth, susceptibility to infectious diseases, and cognitive abilities, stemming from the impact of specific ailments [8].

According to the World Health Organization (WHO), it is projected that by the year 2020, there will be a global prevalence of 149.2 million children experiencing stunting, which refers to a deficiency in length or height relative to their age. Additionally, an estimated 45.4 million children are expected to be affected by wasting, characterized by a decline in weight relative to their height. According to the World Health Organization (WHO), it is projected that by the year 2020, there will be a global population of 149.2 million children dealing with stunting, which refers to a reduction in length or height relative to their age. Additionally, an estimated 45.4 million children are expected to suffer from wasting, characterized by thinness in terms of height and weight, while 38.9 million children are anticipated to be overweight. The prevalence of

malnutrition among young individuals, as measured by weight-for-age indicators, was found to be 17.7% for poor nutritional status and 3.1% for overnutrition status. The prevalence of poor and undernourished individuals, as determined by the body weight to height ratio (W/H), was found to be 10.2%. Conversely, the prevalence of well-nourished young children, as determined by the body weight to height ratio (W) divided by the total body weight (H), was found to be 8.0%. Based on the findings of the Indonesian Nutritional Status Study (SSGI) in 2022, there was a rise in the prevalence of malnourished adolescents, with the percentage increasing from 7.1% in 2021 to 7.7% in 2022 [9].

The prevalence of malnutrition and undernourishment, specifically body mass index for age (W/H), in Southeast Sulawesi was found to be 11.9%. Similarly, the prevalence of malnutrition and subnourishment, measured by body mass index for age (W/Age), in Southeast Sulawesi was reported to be 22.0%. The prevalence seen in this study was higher than the national prevalence rate of 10.2%. According to the Indonesian Nutrition Status Study (SSGI) conducted in 2022 in the South Eastern Sulawesi region, the prevalence of underweight (W) was found to be 8.7%, while the prevalence of underweight and stunting was reported to be 21.1%. In 2022, the Central Statistical Agency (BPS) of Kendari City reported a total of 371 cases of malnutrition (Body Mass Index/Height) in Kendari City. According to a preliminary investigation conducted in the Lepo-Lepo Puskesmas Working Region in February 2023, it was observed that out of a total of 2,187 infants, there were 45 cases of undernourishment and 6 cases of malnourishment recorded during the year 2022. Based on the aforementioned context, scholars are inclined to investigate the potential correlation between macronutrient consumption and the nutritional state of adolescents within the Lepo-Lepo Puskesmas Working Region.

This study is an observational analytical investigation utilizing a cross-sectional design. The purpose of this study is to examine the association between an independent variable and a dependent variable by conducting a single measurement simultaneously. The research was conducted in June 2023 inside the working region of Lepo-Lepo Puskesmas. The samples utilized in this study were obtained from newspapers within the 6-59 months old Lepo - Lepo puskesmas Working Area. A total of 107 samples were selected using the Purposive Sampling approach, and the data analysis was conducted using the Spearman Rank test. The ethical certification for this research has been granted by the Health Research Ethics Commission of the Faculty of Medicine at the University of Halu Oleo, with the reference number 026/UN29.17.1.3/ETIK/2023.

## **2 Analysis**

### **2.1 Univariate Analysis**

Univariate analysis refers to the statistical analysis of a single variable in a dataset. It involves examining the distribution, central tendency, and The characteristics of the respondents, including age, gender, order of birth, mother work, father's work, and family income, may be discerned from Table 1. The data indicates that the largest proportion of respondents, at 62.6% of the total, fell between the age range of 1-3 years.

This was followed by respondents aged 6-11 months. Out of the total sample size of 30 participants, 28% (n=30) were respondents, while specifically within the age range of 4-6 years, 10 respondents (9.3%) were included.

**Table 1.** Subject's Characteristics.

<b>Characteristics</b>	<b>n</b>	<b>%</b>
<b>Age</b>		
<b>6-11 months</b>	30	28
<b>1-3 yrs</b>	67	62,6
<b>4-6 yrs</b>	10	9,3
<b>Jenis Kelamin</b>		
Boys	48	44,9
Girls	59	55,1
<b>Family member's order</b>		
1 <sup>st</sup>	49	45,8
2 <sup>nd</sup>	30	28
3 <sup>rd</sup>	20	18,7
4 <sup>th</sup>	6	5,6
5 <sup>th</sup>	2	1,9
<b>Mother's Job</b>		
Housewives	67	62,6
Civil Servants	3	2,8
Teacher	4	3,7
Self Employed	21	19,6
Others	12	11,2
<b>Father's Job</b>		
Farmers	10	9,3
Civil Servants	12	11,2
Teacher	6	5,6
Self Employed	43	40,2
Others	36	33,6
<b>Family Income</b>		
< UMR	22	20,6
≥ UMR	85	79,4

(Source: Primary data, 2023)

In terms of gender, the female respondents were more represented than the male respondents, including 59 respondents (55.1%) and 48 respondents (44.9%), respectively. According to the birth order, the initial child participants exhibited the greatest proportion, with 49 respondents (45.8%). This was followed by the second child, with 30 respondents (28%), the third child, with 20 respondents (18.7%), the fourth child, with 6 respondents (5.6%), and the fifth child, with 2 respondents (1.9%).

**Table 2.** Subject's Categories Based on Nutritional Status.

Categories	n	%
Severe Wasted	4	3,7
Wasted	19	17,8
Normal	70	65,4
Obesity	14	13,1

(Source: Primary data, 2023)

Based on the findings of the study, it was observed that a significant proportion of mothers (62.6%) were unemployed or engaged in informal, irregular, or temporary work, as indicated by a total of 67 respondents. In contrast, the majority of fathers (40.2%) were employed in various occupations such as police, livestock management, sewing, trading, and car driving, with a total of 43 respondents. Other occupations, including civil servants (PNS) with 12 respondents (11.2%), farmers with 10 respondents (9.3%), and teachers with 6 respondents (5.6%), were also reported by a smaller proportion of respondents (33.6%). Based on the analysis of the respondents' income, it was found that 22 individuals (20.6%) had an income below the Upper Middle Range (UMR), whereas 85 individuals (79.4%) had an income equal to or over the UMR.

**Table 3.** Distribution of Subjects based on Macronutrients Intake.

Categories	n	%
<b>Carbohydrate, gr/day</b>		
< RDA	29	27,1
= RDA	73	68,2
> RDA	5	4,7
<b>Protein, gr/day</b>		
< RDA	13	12,1
= RDA	6	5,6
> RDA	88	82,2
<b>Fat, gr/day</b>		
< RDA	68	63,6
= RDA	35	32,7
> RDA	4	3,7

(Source: Primary data, 2023)

The bivariate analysis of Table 4 revealed that the examination of the association test using Rank Spearman demonstrated a significant relationship between the intake of carbohydrates, proteins, and fats and the nutritional status of young individuals within the working region of Lepo-Lepo Puskesmas ( $p < 0.05$ ). The Rank Spearman relationship test was conducted to analyze the relationship between carbohydrate intake, protein intake, and fatty intake. The obtained p-values for carbohydrate intake, protein intake, and fatty intake were all found to be statistically significant at  $p < 0.001$ .

The correlation coefficient ( $r$ ) for carbohydrate intake was 0.638, for protein intake was 0.679, and for fatty intake was 0.370. If the  $p$ -value (0.000) is less than the significance level  $\alpha = 0.05$ , then the alternative hypothesis  $H_1$  is accepted. Therefore, it can be inferred that there exists a correlation between the consumption of carbohydrates, proteins, and fats, and the nutritional status of the youth residing in the working region of Lepo-Lepo Puskesmas. The correlation coefficient  $r=0.638$  suggests a strong positive relationship between carbohydrate intake and the nutritional status of youth. Similarly, the correlation coefficient  $r=0.679$  indicates a strong positive relationship between protein intake and youth nutritional status. On the other hand, the correlation coefficient  $r=0.370$  suggests a weak positive relationship between fat intake and toddler's nutritional status.

**Table 4.** Correlation Between Macronutrients Intake and Nutritional Status in Toddlers.

Variables	Nutritional Status (W/H)				$r$	$p^a$
	Severe Wasted (n)	Wasted (n)	Normal (n)	Obesity (n)		
<b>Carbohydrate, gr/day</b>						
< RDA	4	16	8	1	0,638	0,000
= RDA	0	3	60	10		
> RDA	0	0	2	3		
<b>Protein, gr/day</b>						
< RDA	2	11	0	0	0,679	0,000
= RDA	2	2	2	0		
> RDA	0	6	68	14		
<b>Fat, gr/day</b>						
< RDA	4	18	40	6	0,370	0,000
= RDA	0	1	29	5		
> RDA	0	0	1	3		

<sup>a</sup>Spearman Correlation Test

### 3 Discussion

#### 3.1 Carbohydrate Intake and Nutritional Status of Toddlers

This study effectively demonstrated a significant correlation ( $p=0.000$ ,  $r=0.638$ ) between the consumption of carbohydrates and the nutritional status of individuals in the toddler's population. This is due to the fact that a significant proportion of the participants in this study exhibit adequate nutritional status, as seen by their average consumption of carbohydrates surpassing that of the recommended daily intake as per the Acceptable Macronutrient Distribution Range (AMDR). The findings presented here align with the research undertaken by [10], which demonstrated a correlation between carbohydrate consumption and the nutritional state of children. The findings

of [11] study suggest that there is no significant correlation between carbohydrate consumption and nutritional status.

The overall calorie intake is influenced by the sufficient consumption of carbohydrates, as it is estimated that 55-65% of the energy requirements of young individuals are derived from carbohydrate sources. It is widely recognized in the field of nutrition that every gram of carbs yields around 4 kilocalories (kcal) of energy. The adequate intake of carbohydrates in children has a significant impact on their development. Conversely, low carbohydrate consumption can lead to undernutrition in children. The fundamental reason for this phenomenon may be attributed to the presence of beneficial carbs, which serve as the main source of glucose. Subsequently, glucose is utilized as the primary energy source for the human body.

### **3.2 Protein Intake and Nutritional Status in Toddlers**

The findings of this study have demonstrated a significant correlation between protein intake and the nutritional health of young individuals. This observation can be attributed to the fact that a significant proportion of the participants included in this study exhibit a favorable nutritional status, characterized by an average protein consumption above the recommended daily allowance (RDA) as established by the Adequate consumption for protein. Consequently, it can be inferred that the infants in this study are likely meeting their daily protein requirements as per the RDA. This finding is consistent with the study conducted by [12], which demonstrates a statistically significant correlation between protein consumption and the nutritional status of infants as determined by the W/H index. However, the findings of this study are inconsistent with the research conducted by [13], which concluded that there is no significant correlation between protein intake and the nutritional status of infants (W/H). Soumokil attributed this lack of correlation to the influence of various other factors, including the infant's appetite, energy intake, socio-economic status, and level of nutrition knowledge. Protein plays a crucial role in various physiological processes within the human body, including growth, the development of structural components, the facilitation of nutrient transit and storage, the synthesis of enzymes, the production of antibodies, and serving as a source of energy [14]. Protein exhibits a strong association with the immune system, as insufficient protein consumption can lead to various problems affecting mucous membranes and muscular tissue. Moreover, a diminished immune response may render individuals more susceptible to infectious diseases, particularly gastrointestinal and respiratory infections, hence increasing their vulnerability to malnutrition. In accordance with the perspective of Williams and Wilkins in 2011, it is recognized that proteins serve a fundamental role as a constructive agent, facilitating the maintenance of bodily structures and tissues, while simultaneously serving as an energy source. The significance of protein for a child's body during the growth phase is mostly understood through its various roles [15].

### **3.3 Fat Intake and Nutritional Status in Toddlers**

The findings of this study revealed a statistically significant association between dietary fat consumption and the nutritional status of infants. This is due to the fact that a

significant proportion of participants in this study, with a nutritional status below 18 and poor nutrition in up to 4 children, exhibit an average low fat intake below the recommended Adequate Intake (AI). Conversely, participants with a nutritional status of 30 children or more, as well as more than 8 children, demonstrate an average fat intake that exceeds the recommended AI. Fats, also known as lipids, are a high-energy molecule that functions as the principal source of energy for metabolic processes within the human body [16]. Moreover, adipose tissue plays a crucial role in the management, regulation, and integration of several physiological systems inside the human body. Consequently, it becomes imperative for the optimal growth and development of a kid to obtain a sufficient amount of dietary fat. The findings of this research align with a previous study conducted by [4] that examined the relationship between energy intake, protein, and fat consumption and the prevalence of inadequate nutrition among children aged 24-59 months in the Holy Village of Greek. The statistical analysis revealed a significant association between fat intake and the nutritional status of young individuals ( $p = 0.010$ ). The body's energy intake and metabolic processes might be affected by insufficient fat intake from diet. A reduction in dietary fat consumption, along with a subsequent decline in energy levels inside the body, can lead to various alterations in both temporal and bodily tissues, as well as disruptions in the absorption of fat-soluble vitamins. A further investigation revealed a lack of association between dietary fat consumption and the nutritional state of young individuals, as seen by the presence of young individuals exhibiting fat deficit yet maintaining a normal nutrient status. The findings of this study indicate that among the 40 young individuals examined, there is a notable correlation between their favorable nutritional status and low fat intake. This can be attributed to the necessity of obtaining energy through the consumption of carbohydrates as the primary source of energy, as well as protein as a fundamental building block. Consequently, the body's fat reserves are able to adequately support daily activities, thereby maintaining the overall nutritional well-being of these toddlers.

## 4 Conclusion

Based on the findings, a notable correlation has been observed between the intake of carbohydrates, proteins, and fats and the nutritional state of toddlers within the Puskesmas Working Region of Lepo-Lepo. One suggestion that could be considered is to provide a more comprehensive analysis of the topic at hand. In order to facilitate the monitoring of consumption patterns by future researchers, it is recommended to employ diverse survey methods for assessing food intake. Additionally, it is advisable to incorporate other variables that may influence nutritional status, such as infectious diseases. Furthermore, to minimize potential biases in subsequent anthropometric measurements, it is essential to utilize calibrated devices for accurately determining body weight and height.

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