

Effectiveness of Pos Gizi

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Abstract

Children under five are prone to malnutrition, and this health problem is detrimental to the growth and development of children. Children experiencing malnutrition are more likely to suffer from infection, thus resulting in a rise in mortality and morbidity rates. Malnutrition is quite high and tends to increase every year in Indonesia. Preventive and management programs to address malnutrition have been developed by government and non-government bodies. Among the programs is Pos Gizi. The present work explored the effectiveness of Pos Gizi in terms of the nutrition intake of people participating in the program. Indicators of the assessment involved the composition of body, weight, and height of children under five. This quantitative study employed a cross-sectional approach with a research sample involving 32 children under five with two criteria: inclusion and exclusion. The anthropometric data consisted of weight, height, and fat thickness. All data were analyzed using a multiple linear regression method. Pos Gizi was significant to the weight ($R^2 = 0,347$; $p\text{-value} = 0,018$), height ($R^2 = 0,376$; $p\text{-value} = 0,010$), and fat thickness ($R^2 = 0,468$; $p\text{-value} = 0,001$) of the children under five. This research concluded that Pos Gizi effectively increases the weight, height, and fat thickness of its participants. Therefore, Pos Gizi should be implemented in areas with a high prevalence of nutrition problems.

1. Introduction

Malnutrition is defined as a condition where a child's weight is disproportionate to height. This problem is common to children under five, and it is detrimental to the growth and development of children. Children experiencing malnutrition are more likely to suffer from infection, thus resulting in a rise in mortality and morbidity rates. One of the long-term consequences of malnutrition includes a decline in motor, cognitive and mental development (Perdana *et al.*, 2020). Malnutrition is also a threat to human resources and economic development.

Other than malnutrition, a problem in children under five requiring immediate responses is stunting. Stunting refers to children with low body height for their age (Hafid, 2016; Akombi *et al.*, 2017). This health problem poses a serious threat to children's bodies. Some examples of health problems caused by stunting involve a higher risk of morbidity and mortality, short stature, reproductive system anomaly, declined cognitive functions and productivities, and obesity in adulthood (Dewey and Begum, 2011; World Health Organization

(WHO), 2013; Akombi *et al.*, 2017). Stunting and malnutrition prevalence should be minimized, considering their consequences.

Since the prevalence of stunted toddlers in Indonesia is still significant and represents a public health issue that needs to be addressed, the WHO defines a public health concern as one where the prevalence of stunted toddlers is 20% or above. Stunting affects as many as 22.2%, or around 150.8 million, children under five worldwide (WHO, 2022). According to the data from Basic Health Research of 2018, the prevalence of malnutrition based on the height indicator in Indonesia was 10.2% for underweight and severely underweight. The prevalence of malnutrition in overweight children was 8% (Badan Penelitian dan Pengembangan Kesehatan, 2019). In Gorontalo, the cases of malnutrition in underweight and severely underweight children outnumber that of the national data measuring 14.4%; the prevalence of malnutrition in overweight children was 5.4% (Badan Penelitian dan Pengembangan Kesehatan, 2019).

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Height index is an important indicator other than weight index that determines the stunting prevalence in children under five. A report by Basic Health Research in 2018 recorded 30.8% of stunting and severe stunting. The prevalence of stunting (stunted and severely stunted category) in Gorontalo is higher than the national index at 32.5% (Badan Penelitian dan Pengembangan Kesehatan, 2019). With the high number of cases of such health problems in the province, the prevention and management of malnutrition and stunting in Gorontalo is of paramount importance.

Programs to tackle malnutrition have been developed by government and non-government bodies. Among the programs is Nutrition Post, or Pos Gizi. Pos Gizi is a positive deviance-based program that focuses on public empowerment approaches to improve the nutritional status of children under five (Yudhawati, 2016). This program specifically targets parents and caregivers, equipping them with the insight of quality food intake, nurturing, and personal hygiene (Yudhawati, 2016). The positive deviance approach adopted in the Pos Gizi program requires the involvement of resources and local wisdom, e.g., local food sources and engagement of posyandu (Centre Prenatal and Postnatal Health Care and Information) personnel (Hayati *et al.*, 2012). It is expected that the program, implemented in many provinces with a high prevalence of nutrition problems, will improve the nutritional status of children under five.

Pos Gizi has been conducted in Gorontalo, specifically Gorontalo Regency, since 2013. The program was initially aimed at changing the behavior and comprehension of people regarding the preventive measures and management of nutrition problems; the local people and health professionals funded this program for four years. After four years, village funds were allocated to support the program (Kementerian Kesehatan Republik Indonesia, 2018). Pos Gizi in Gorontalo Regency emphasizes disseminating local food utilization for healthy diets to increase children's weight and personal hygiene (Kementerian Kesehatan Republik Indonesia, 2018).

However, the program did not discuss weight issues in undernutrition children since its significance was primarily seen in the improvement of the body weight of its participants. This condition highlights the urge to develop modules regarding the indicators of healthy children, e.g., body composition and nutrient intake.

Body composition refers to the fat and non-fat mass, e.g., muscle, bone, and liquid. Balanced composition of fat mass or FM and fat-free mass or FFM contributes to optimum growth. This notion correlates with the risk of obesity in children under five, which poses a serious

threat to their health.

Children being overweight can increase the risk of obesity in adulthood, which is associated with increased morbidity and mortality from cardiovascular diseases, including coronary heart disease, stroke, hypertension (a risk factor for cardiovascular metabolism), cancers, type II diabetes, gallbladder disease, osteoarthritis, apnea, and breathing problems (Bass and Eneli, 2015; Chi *et al.*, 2017). Childhood obesity is also associated with psychosocial consequences, e.g., low self-esteem and self-blame (Chi *et al.*, 2017). Obesity can be caused by excessive intake and lack of physical activity (Childhood Obesity Foundation, 2019).

Thus, indicators of the success of Pos Gizi, which focuses on children's weight gain, need to be further developed to incorporate other indicators, i.e., body composition and child intake. Monitoring body composition is essential to prevent the occurrence of long-term negative consequences, e.g., overweight and obesity. Meanwhile, intake indicators are required to evaluate children's type and amount of food consumed. The present work explored the effectiveness of Pos Gizi in terms of the nutrition intake of people participating in the program. Indicators of the assessment involved the composition of body, weight, and height of children under five. On an international scale, this study's results will contribute to stunting and malnutrition program development.

2. Materials and methods

2.1 Design

This quantitative study relied on a cross-sectional approach. The present study was conducted in the working areas of Puskesmas (Community Health Center) Tilango, consisting of eight villages: Dulomo, Tilote, Lawonu and Ilotideaa, Tabumela, Tualango, Tenggela, and Tinelo.

2.2 Sample

Numbers of the research sample were adjusted to meet the minimum requirement of a cross-sectional study (Lemeshow and David, 1997).

$$n = \frac{Z^2 1 - \alpha/2 P (1 - P)}{d^2}$$

Where n = number of samples, $Z_{1 - \alpha/2}$ = standard normal distribution at $\alpha = 0.05$ (1.96), p = proportion of underweight and stunted children under five in Gorontalo Regency based on the Health Profile of Gorontalo Province, 2018 (6.7%) (Dinas Kesehatan Provinsi Gorontalo, 2019) and d = degree of accuracy (10%).

The minimum sample of this research is 24. However, the total sample needed became 32 to fulfill the criteria of statistical hypothesis tests. All samples were the participants of Pos Gizi in Gorontalo Regency with two criteria: (1) inclusion criteria comprised physically and mentally healthy and exclusion, aged 12 to 59 months, under the care of their mother/caregiver who can communicate actively, based on Gorontalo Regency, the mother/caregiver is willing to participate in the study, and did not suffer from NCDs and CVDs and their complications; and (2) Exclusion criteria consisted of not being present at the site of data collection and withdrawing from the data collection phase.

2.3 Data collection

2.3.1 Anthropometric data

Bodyweight data were retrieved using a digital weight scale with an accuracy of 0.1 kg. Further, the body height data of the samples were measured using a stadiometer with an accuracy of 0.1 cm. Data regarding the age of the samples were collected from the records on the sample's Family Card (KK) or health record of the mother.

2.3.2 Bodyweight classification

Bodyweight data of the samples were classified into four groups based on the calculation of z-score of the bodyweight index in accordance with the body height. Provided are the categories of the nutritional status of the samples (Badan Penelitian dan Pengembangan Kesehatan, 2019): a. Underweight (severe) = z-score < -3.0; b. Underweight = z-score \geq -3.0 to < -2; c. Normal = z-score \geq -2.0 to < 2.0; d. Overweight = z-score > 2.0; e. α

2.3.3 Classification of height

Body height data of the samples were classified into four groups based on the calculation of z-score of the body height index in accordance with the age. Provided are the categories of the nutritional status of the samples (Badan Penelitian dan Pengembangan Kesehatan, 2019): a: Severely stunted = z-score < -3.0; b. Stunted = z-score \geq -3.0 to z-score < -2.0; c. Normal = z-score \geq -2.0

2.3.4 Body composition data

A skinfold caliper was used to measure the body composition of children. This pair of calipers is used as one of the equipment to estimate body fat from subscapular, triceps, biceps, and suprailiac.

2.3.5 Nutrient intake data

Data regarding the macronutrients (carbohydrate, protein, and fat) and micronutrients (vitamins and

minerals) were retrieved using a multiple 24-hr food recall technique.

2.4 Ethical clearance

This research was approved by the ethical committee at Health Polytechnic of Gorontalo with the number LB.01.01/KEPK/40/2021.

2.4 Data analysis

A univariate analysis was employed to examine the data by focusing on the mean and frequency of the variable of nutritional status, body composition, and nutrient intake. The analysis results were then displayed in a frequency distribution table. A multiple linear regression analysis was applied to identify the correlation among the variables. Ethical approval of this study was obtained from the Committee of Research Ethics of Gorontalo Polytechnic of Health of Ministry of Health Number LB.01.01/KEPK/60/2021.

3. Results and discussion

3.1 Samples characteristics

The characteristics of the samples involve age (in months), sex, nutrition status based on bodyweight, and nutrition status based on the index of body height and age (Table 1).

Table 1. Characteristics of the respondents

Characteristics	Category	n	%
Age (in months)	0-23	4	12.5
	24-35	7	21.88
	36-59	21	65.62
Sex	Male	16	50
	Female	16	50
Nutritional Status (Weight/Height)	Severely Underweight	2	6.24
	Underweight	15	46.88
	Normal	15	46.88
	Overweight	0	0
Nutritional Status (Height/Age)	Severely Stunted	9	28.12
	Stunted	11	34.37
	Normal	12	37.51

Most of the samples are 36 to 59 months. Male and female participants were equal in numbers. Further, the number of children under five with low bodyweight and normal bodyweight is the same (15 children), and none of the participants fell under the obese category. Children with short stature dominate the sample in the body height/age index category. The details regarding the data are in the following Table 2.

Table 2 shows that the average fat thickness measures 7.5%, with a minimum and maximum thickness of 4.56% and 11.8%, respectively. Fat thickness is the result of measurement in four areas, namely subscapular, triceps, biceps, and suprailia. Based

on the classification of fat thickness in children, a thickness less than 8 to 13% is deemed lean or underweight (Slaughter *et al.*, 1988). Thereby, all samples of this research fell under the underweight category.

Table 2. Description of fat thickness and intake

Characteristics	Minimum	Median	Maximum
Fat thickness (%)	4.56	7.50	11.80
Intake			
Energy (kcal)	581.11	773.28	1434.33
Protein (g)	7.13	36.88	59.70
Fat (g)	7.51	28.35	58.72
Carbohydrates (g)	44.28	98.87	191.20

The average energy intake of the samples is 773.28 kcal, with a minimum and maximum intake of 581.11 kcal and 1434.33 kcal, respectively. Further, the average protein intake of the samples is 36.88 g, with a minimum and maximum intake of 7.13 g and 59.70 g, respectively. The samples' fat intake is 28.35 g on average, with a minimum and maximum intake of 7.51 g and 58.72 g, respectively. The intake of carbohydrates of the samples is 98.87 g on average, with a minimum intake of 44.28 g and a maximum intake of 191.20 g.

According to the nutritional adequacy rate, the normal intake for children aged 1 to 6 years ranges from 1350 to 1400 kcal for the energy intake, 20 g to 25 g for the protein intake, 45 g to 50 g for the fat intake, and 215 g to 220 g for the carbohydrates intake (Menteri Kesehatan Republik Indonesia, 2019). Considering the results of this study, the energy, fat, and carbohydrate intake of all participants of Pos Gizi is lower than the standard nutrient adequacy ratio (NAR) of 2019. The protein intake, however, is greater than that of the adequacy rate.

3.2 Correlation of intake with weight, height, and fat thickness

Table 3 displays the correlation of intake with weight, height, and fat thickness.

Table 3. Correlation of intake with weight, height, and fat thickness.

Dependent Variables	Predictors (Intake of Energy, Protein, Fat, Carbohydrate)	
	r ²	p-Value
Weight	0.347	0.018
Height	0.376	0.01
Fat Thickness	0.468	0.001

Results of the multiple linear regression analysis confirm that the nutrient intake provided during Pos Gizi significantly contributes to weight (34%), height (37%), and fat thickness (46%). The percentage of the significance of macronutrients (protein, fat, and

carbohydrate) to weight, height, and fat thickness is less than 50%. Such indicates other variables with considerable significance.

Nutrient intake and infectious diseases are central to the children's nutritional status (Kementerian Kesehatan Republik Indonesia, 2011). All participants of Pos Gizi followed a high protein and calorie diet throughout the program (12 days). This approach aims to improve the nutritional status of children under five, specifically bodyweight. Such is because bodyweight is a variable that fluctuates the most.

Although the participants' average intake of energy, fat and carbohydrates was below the NAR of 2019, the statistical data revealed that the intake has a positive impact on bodyweight, height, and fat thickness. The majority of the calorie intake is from protein, as the results of multiple 24-hour food recall confirm that the protein intake is above the recommended intake of NAR 2019.

Protein has a vital role in the growth and development of children under five. This nutrient is significant to the cell formation and repairment of damaged tissue, the growth of brain cells, the formation of antibodies, strengthening of bones and muscles (Rahmi, 2019). Bodyweight increases as protein intake increases since these nutrients function as a building block of life. In addition, protein contributes to an increase in height due to its role in the growth of tissue masses, including bone tissues.

Intake of several types of protein, such as peanuts, fish, and chicken meat, can prevent cardiovascular diseases, diabetes, and cancers.

The protein composition in the daily menu of children participating in Pos Gizi is 1-2 grams per kilogram of their body weight (Kementerian Kesehatan Republik Indonesia, 2018). The intake needs to be maintained considering the significance of protein in the growth and development of children under five. Another consideration is the food or the source of protein. Recommended protein sources involve peanuts, fish, chicken, and egg; these protein sources are accessible and affordable, which helps mothers or caregivers maintain the diet of their children after completing the Pos Gizi program.

Dissemination of the importance of protein and protein sources for children is also necessary. Enhancement of insight of mothers after participating in Pos Gizi is impactful on the improvement of children's nutritional status (Gizella *et al.*, 2016; Yudhawati, 2016; Perdani *et al.*, 2017). Such emphasizes that the expected goals of Pos Gizi have been met.

The notable flaw of Pos Gizi is the intake of fat that is below the NAR 2019 standard. However, the intake of fat still positively contributes to weight, height, and fat thickness. Fat is classified macronutrients, similar to protein. Fat is a source of energy and a solvent for vitamin A, D, E, and K. Further, these nutrient conserves the use of protein for protein synthesis, protect the body's organs, and keep body temperature warm (Rahmi, 2019; National Health Service United Kingdom, 2021).

Fat stored in the body is in the form of adipose tissues. Adipose tissues are located in subcutaneous areas, e.g., subscapular, triceps, biceps, and suprailiac (Permana, 2017). Measurement of the fat layer in those areas helps one obtain data regarding total body fat. The thicker the fat in those four areas, the greater the total body fat percentage. According to the present study results, the average fat thickness of children is in the thin category. The average fat intake only meets 63% of the recommended NAR 2019.

Low fat intake blames several factors, e.g., household food security, women's knowledge, and income (Febriani *et al.*, 2019; Firman and Mahmudiono, 2019). The majority of Pos Gizi participants are from low-income families. As a result, the family cannot afford a healthy diet (especially fat sources) for children. The low-fat intake of Pos Gizi participants is due to food processing, as many parents prefer stir-fry and boil the food. Also, low-fat products, e.g., skim milk, are still the most picked option for the children's diet.

Adequate fat intake ranges from 15% to 30% of the total calorie (Ernawati *et al.*, 2019). Excess fat intake will have an impact on increasing the risk of non-communicable diseases, obesity, and metabolic syndrome (Ernawati *et al.*, 2019). However, inadequate fat intake leads to weight loss, impaired metabolism of fat-soluble vitamins, and impaired development of nerve cells and brain cells (Firman and Mahmudiono, 2019; Fuentes-Albero *et al.*, 2019). Based on the data above, the fat intake of Pos Gizi participants should be optimized while maintaining the principles of balanced nutrition and the fulfillment of essential fatty acids, such as omega 3 and omega 6.

Carbohydrates are the main energy-producing macronutrients. This nutrient plays a significant role in the formation of cell structures, tissues, and organs. Carbohydrates also act as energy reserves stored in the liver and muscles. This energy reserve is in the form of glycogen, i.e., glucose from the breakdown of carbohydrates that are not processed after being digested (The European Food Information Council (EUFIC), 2020). Lack of carbohydrate intake is detrimental to the

nutritional status and organ function of children under five.

In this research, the participants only met 46% of the recommended carbohydrate intake stated in NAR 2019. The diet for the participants of Pos Gizi is mostly rice, yet the children did not like rice. Such a condition is the cause of low carbohydrate intake. For this reason, officers of Pos Gizi should come up with creative solutions to utilize local food as a source of carbohydrates. Some studies have reported that food diversification by incorporating local food products is significant in increasing children's bodyweight (Chomawati dan Handayani, 2019; Khamis *et al.*, 2019).

5. Conclusion

Pos Gizi has a positive contribution to the weight, height, and fat thickness despite the nutrient intake of the children that are still below the recommended nutrient adequacy ratio (NAR). For this reason, Pos Gizi should be implemented in areas with a high prevalence of nutrition problems.

Conflict of interest

The authors declare no conflict of interest.

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