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The Effect of Giving Biscuits Made from Haruan Fish Flour and Yellow Pumpkin on the Nutritional Status of Toddlers

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ABSTRACT

This study aims to investigate the effect of biscuits made from haruan fish flour and yellow pumpkin on the nutritional status of toddlers in the working area of Puskesmas Mangkupalas. A quasi-experimental pre-post test with control group design was employed, with a single-blind approach. The study was conducted from September to November 2021. A total of 22 toddlers were selected using purposive sampling. Respondents were divided into two groups: the intervention group, which received biscuits made from haruan fish and yellow pumpkin flour, and the control group, which received government-provided biscuits. Data on energy and protein intake were collected using a Food Recall, and nutritional status was assessed based on Weight-for-Age index using anthropometric measurements. In the control group, the average Z-score before the intervention was -1.4345 (normal nutritional status), which increased to -1.3536 post-intervention (still normal). The intervention group had an average Z-score of -2.0009 before the intervention, which decreased to -2.1691 (indicating moderate malnutrition). The control group's average energy intake was 956.864 kcal before the intervention and 792.564 kcal during the intervention. In the intervention group, energy intake was 1010.891 kcal before and 793.109 kcal during the intervention. Protein intake in the control group was 34.436 g before the intervention and decreased to 31.691 g during the intervention. The intervention group saw an increase from 38.164 g to 58.75 g. The intervention with biscuits made from haruan fish flour and yellow pumpkin flour did not significantly affect the nutritional status or energy and protein intake of the toddlers.

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- The findings suggest that while haruan fish and yellow pumpkin-based biscuits have nutritional value, additional factors may need to be considered to optimize their impact on toddler nutrition

Introduction

Toddlers are a group that exhibits rapid physical growth, necessitating high levels of nutrients per kilogram of body weight. This age group is the most frequently affected by malnutrition due to their developmental stage and reliance on parental care for their quality of life. Protein-Energy Malnutrition (PEM) in children can hinder growth, increase susceptibility to infectious diseases, and result in lower intelligence levels (1,2). Protein-Energy Malnutrition (PEM) remains a significant nutritional issue in Indonesia (3). One of the indicators for assessing public health issues based on the nutritional status of toddlers is the prevalence of undernutrition (4).

In 2018, the prevalence of undernutrition (both severe and moderate) in Indonesia was 17.7% (5). Therefore, effective management of undernutrition cases is crucial to prevent an increase in the number of undernourished toddlers and to accelerate the reduction of such cases. Commercially available complementary foods for infants (MP-ASI) are often unaffordable for low-income families (6,7). Government policies regarding MP-ASI for infants and children aged 6–24 months aim to promote MP-ASI that meets health standards, encourage the production of homemade MP-ASI (local fortified blended food) to be accessible to all societal levels, and provide nutrition education and counseling for all prospective mothers.

Biscuits are suitable for consumption by individuals of all ages, from infants to the elderly, with variations in composition to meet different nutritional needs (8). Developing biscuit production with

alternative flours that are high in nutritional value and locally available is crucial to enhance their nutritional content. This study aims to investigate the effect of giving complementary food biscuits made from Haruan fish flour and yellow pumpkin on the nutritional status of toddlers in the working area of the Mangkupalas Health Center, Samarinda City.

Methods

This study employs a quantitative research approach with a quasi-experimental pre-post test with control group design and is single-blind. The research was conducted from September to November 2021 in the working area of Puskesmas Mangkupalas. The population consisted of all toddlers in the Puskesmas Mangkupalas area, Samarinda City. A sample of 22 toddlers was selected from the population using purposive sampling.

Nutritional status of toddlers: This variable reflects the nutritional status of toddlers before and after the study, assessed based on the Weight-for-Age index using the standards from the Indonesian Ministry of Health. Measurements were taken by weighing the toddlers. Energy intake: This variable represents the average energy intake from food consumed by toddlers before and during the study, measured using a Food Recall Form. Protein intake**:** This variable represents the average protein intake from food consumed by toddlers before and during the study, measured using a Food Recall Form.

Data Collection Procedure and Instruments

At the beginning of the intervention, interviews were conducted with mothers to gather information on the characteristics of the respondents, their parents, and their families. The respondents were divided into two groups: the treatment group, which received biscuits made from Haruan fish and yellow pumpkin, and the control group, which received government-program biscuits. No counseling was provided in this study, but mothers were allowed to consult with cadres or researchers regarding nutrition. Before the intervention, a socialization session was held with the mothers, which included interviews using questionnaires about the characteristics of the mothers and toddlers, and filling out food recall forms. The food recall was used to provide data on the toddlers' food intake before the intervention.

During the one-week study, each respondent in both groups received biscuits daily. The treatment group received three servings per day, each containing three biscuits with a total weight of 38 grams per serving. The control group received MP-ASI biscuits, with each serving containing four biscuits. Throughout the week, daily food recalls were conducted to assess the toddlers' intake. To evaluate the expected changes in nutritional status, anthropometric measurements were taken to assess weight and height before and after the study.

Data Analysis

An independent t-test was used to determine differences in nutritional status, energy intake, and protein intake between the treatment and control groups. A paired t-test was used to analyze the average Z-Score of nutritional status in the treatment group and to compare nutritional status, energy intake, and protein intake at the beginning and end of the study within each group.

Results

Table 1 shows that the majority of respondents in the control group are male (54.5%), while in the intervention group, the majority are female (54.5%). Distribution based on age shows that most respondents are aged 12-36 months, with 63.6% in the control group and 45.5% in the intervention group. For the age group 37-59 months, there are 36.4% in the control group and 54.5% in the intervention group.

Table 1. Distribution of Respondents Based on Characteristics in the Control and Intervention Groups

Characteristic	Control		Intervention	
	n	%	n	%
Sex				
Male	6	54.5	5	45.5
Female	5	45.5	6	54.5
Age				
12 – 36 Months	7	63.6	5	45.5
37 – 59 Months	4	36.4	6	54.5

Table 2. Distribution of Respondents' Nutritional Status Based on Weight-for-Age Index in the Control and Intervention Groups

Z-Score	Control		Intervention		p-value
	Mean	SD	Mean	SD	
Before Intervention	-1.4345	1.25546	-2.0009	2.10482	0.300
After Intervention	-1.3536	1.40661	-2.1691	1.41027	0.065
Change	0.0809	0.37572	-0.1682	1.27490	

Table 2 shows that the mean Z-Score in the control group before the intervention was -1.4345, indicating normal nutritional status based on Weight-for-Age. After the intervention, the mean increased to -1.3536, still indicating normal nutritional status. In the intervention group, the mean Z-Score before the intervention was -2.0009, and after the intervention, it changed to -2.1691, indicating moderate malnutrition based on Weight-for-Age. There were no significant differences in the Z-Score between the two groups either at the beginning or the end of the intervention ($p > 0.05$).

Table 3. Distribution of Nutrient Intake (Energy and Protein) of Respondents in the Control and Intervention Groups

Intake	Control		Intervention		p-value
	Mean	SD	Mean	SD	
Energy					
Before Intervention	956.864	576.1272	1010.891	398.2874	0.606
After Intervention	792.564	280.9550	793.109	285.9200	1.000
Protein					
Before Intervention	34.436	15.7304	38.164	14.9872	0.606
After Intervention	31.691	11.0253	58.75	38.6630	0.088

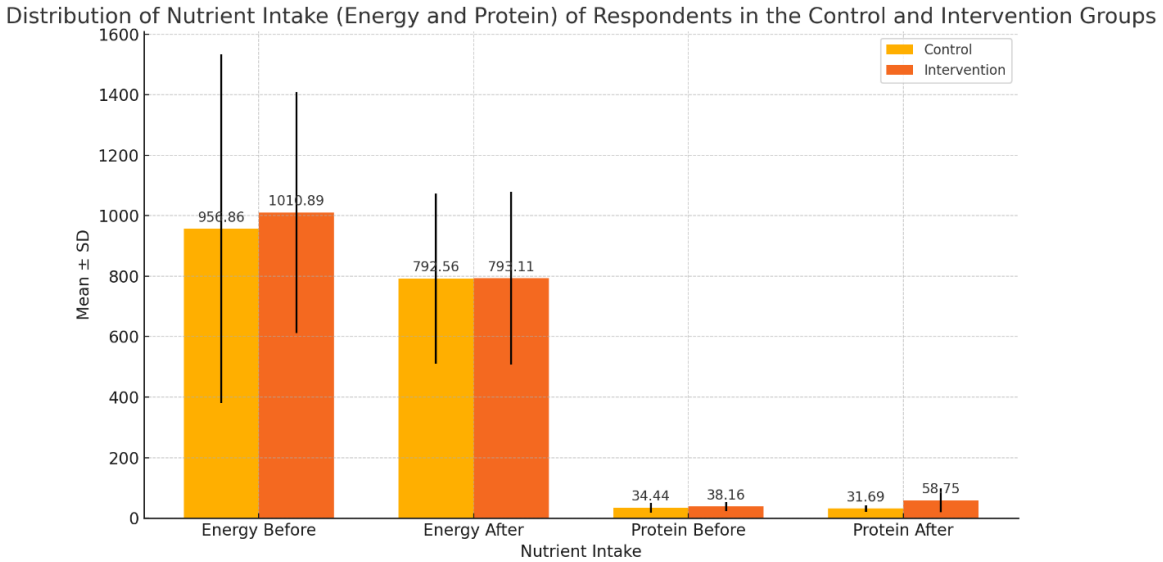

Figure 1. The Distribution of Nutrient Intake (Energy and Protein) Among Respondents in The Control and Intervention Groups, Both Before and After The Intervention.

Based on Table 3, the average energy intake in the control group before the intervention was 956.864 kcal and 792.564 kcal during the intervention. The average energy intake in the intervention group was 1010.891 kcal before the intervention and 793.109 kcal during the intervention. There was no significant difference in energy intake between the two groups at the start of the intervention. Protein intake in the control group before the intervention was 34.436 g, which decreased to 31.691 g during the intervention. In the intervention group, the protein intake increased from an average of 38.164 g before the intervention to 58.75 g during the intervention. There was no significant difference in protein intake between the control and intervention groups at the start of the study.

Figure 1 shows that the mean energy intake decreased after the intervention in both the control and intervention groups, but the decrease was not statistically significant as indicated by the p-values (0.606 for energy before intervention, 1.000 for energy after intervention). The mean protein intake slightly decreased in the control group after the intervention, while it increased significantly in the

intervention group, although the p-value (0.088) suggests that the difference is not statistically significant. The intervention appears to have had a more substantial effect on protein intake compared to energy intake, particularly in the intervention group.

Discussion

The results of the study indicate that most of the undernourished toddlers who received BURUAN *(Biskuit Labu Kuning dan Ikan Haruan)* biscuits had insufficient energy intake, both before and after the intervention. This is due to the intervention not meeting the recommended serving size because of the study's limitations. Carbohydrates are crucial as the primary energy source for all cells, especially red blood cells and the brain, which depend solely on glucose for energy(9) Sugar for the brain: the role of glucose in physiological and pathological brain function. If a diet does not provide enough carbohydrates, the body will produce glucose from protein through gluconeogenesis (10,11). In this study, the average carbohydrate intake in both treatment groups was also relatively low, around 40% of the RDA for the BURUAN biscuit group and about 43% for the PMT biscuit group. The body will break down proteins in the blood and tissues into amino acids, which are then converted into glucose (12). If the body uses protein for energy, it cannot be used for other functions. Carbohydrates help proteins focus on their functions (13).

This study found that neither energy nor protein intake from the intervention significantly impacted the intake levels after the intervention. Although there was an increase in protein intake in the BURUAN biscuit treatment group, this study's one-week intervention period, limited by funding and pandemic conditions, was insufficient to observe significant changes. One of the indicators to assess nutritional status is the z-score value. The Weight-for-Age index measures body mass, physical growth rate, and nutritional status. Body weight is an anthropometric parameter that reflects body mass and can change quickly in response to sudden factors like infections, appetite loss, and reduced food intake.

Based on the weight data before and after the one-week intervention, the average weight gain in the BURUAN biscuit group was from 10.6 kg (pre-test) to 10.9 kg (post-test), with an average increase of 299 grams. In the Puskesmas PMT biscuit group, the average weight gain was from 10.9 kg (pre-test) to 11.1 kg (post-test), with an average increase of 200 grams, aligning with the standard monthly weight gain for toddlers. The Weight-for-Age Index showed changes in the z-score in both the control and treatment groups, based on the average z-score differences before and after the intervention. In the BURUAN biscuit group, the z-score decreased by an average of -0.119, while in the Puskesmas PMT biscuit group, the z-score increased by an average of 0.16. This indicates changes in the z-score values before and after the intervention with the modified haruan fish flour and yellow pumpkin biscuits.

Studies have shown that integrating high-protein sources into complementary foods can significantly improve growth parameters and overall health in children suffering from malnutrition (14). Thigh-protein foods can enhance muscle mass and repair tissues, adequate carbohydrate intake is essential to prevent the diversion of protein for energy production, thereby ensuring optimal growth and development (15). Other research shows that fish anchovy Biscuit intervention show a difference in improving the nutritional status after being given the fish anchovy Biscuit intervention on Young Women in Vocational High School 01 Rangas, Mamuju Regency (16). The provision of biscuits made from pumpkin seed flour has an effect on increasing body weight of malnutrition Wistar rats and has no effect on serum zinc levels, so further research is expected to use different doses (17). The provision of catfish sweet potato biscuits and nutritional counselling can be an alternative model in an effort of children under five years old babies with under nutrition and severe under nutrition, especially in poor families (18). High-protein complementary foods can significantly improve child growth and health by optimizing protein utilization, while various food-based interventions, such as fish anchovy biscuits, haruan fish, pumpkin seed flour biscuits, and catfish sweet potato biscuits, have shown potential in addressing malnutrition, although further research is needed to optimize their impact.

Conclusion

Despite initial differences in nutritional status and energy intake between the control and intervention groups, the provision of biscuits made from haruan fish flour and yellow pumpkin did not significantly improve the nutritional status of toddlers as measured by weight-for-age, nor did it affect their overall energy or protein intake. The findings suggest that while haruan fish and yellow pumpkin-based biscuits have nutritional value, additional factors may need to be considered to optimize their impact on toddler nutrition.

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Conflicts of Interest: The authors declare no conflict of interest

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