



EFFICACY OF BISCUITS ENRICHED WITH BANANA SKY (*Musa troglodyarium*) AND FLOUR TUNA SKIPJACK AS A SUPPLEMENTARY FOOD FOR UNDERWEIGHT CHILDREN UNDER-FIVE YEARS IN AMBON

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ABSTRACT

Background. Diversifying the formulation of supplementary food should consider the nutrition aspects, health benefits, acceptance, economic value, durability and the qualified resources to optimize the handling of nutritional problems in children under-fives age. Purpose. This study was aimed to analyze the efficacy of biscuits enriched with banana sky and flour tuna skipjack on the nutrition status of underweight children under-fives (2-5 years old). **Methodology.** An experimental study was designed with Single Blind Pre-post Randomized Controlled Trial (RCT) Study applied for this research. 22 underweight children aged 2-5 years old (Z-score BB/U < -2 SD) in the Health Centers of Tawiri and Nania were the samples of the study. The treatment group was treated with biscuits enriched with banana sky and flour tuna skipjack and the control group was treated with milk biscuits for 4 week. Weight, height and 24-hour recall were measured before and after the intervention. **Results.** There was an increase on energy and protein consumption after the intervention. The sensory perceptions and obedience level on consuming biscuits enriched with banana sky and flour tuna skipjack with a portion of 50g per day during the intervention were high. There was significant increase on weight after being treated with supplementary biscuits enriched with banana sky and flour tuna skipjack while there was not any significant increase observed on the height. There was greater increase on nutritional status on treatment group compared to control group after the intervention. **Conclusion.** Supplementary biscuits enriched with banana sky and flour tuna skipjack can increase the weight and improve the nutritional status of children under-fives.

Keywords : biscuit, banana sky, flour tuna skipjack, nutritional status, children under-fives

INTRODUCTION

Nutritional problem among children under-fives is a big trouble in developing countries. The implications of malnutrition among children under-fives are irreversible, durable.⁽¹⁾ Nearly half of all deaths in children under five are attributable to undernutrition; undernutrition puts children at greater risk of dying from common infections, increases the frequency and severity of such infections, and delays recovery. The interaction between undernutrition and infection can create a

potentially lethal cycle of worsening illness and deteriorating nutritional status. Poor nutrition in the first 1,000 days of a child's life can also lead to stunted growth, which is associated with impaired cognitive ability and reduced school and work performance. One out of three children under-fives or over 200 millions children are either malnourished or overweight, while nearly two out of three children aged between six months and two years do not have proper food supplementation for their growth(2) .

Globally, stunted children under-fives are around 22.2% or 150.8 million, and the numbers of wasting of children are around 7.5% or 50.5 million in 2017(3). Based on the national data from Riskesdas in 2018, the proportion of underweight children in 2013 was 19.6% and 17.7% in 2018. Furthermore, the proportion of stunted children under-fives in 2013 was 37.2% and 30.8% in 2018. A number of under-fives wasting of children was 12.1 % in 2013 and decreased by 10.2% in 2018(4).

WHO recommends the providing of nutrient-dense supplementary food for under nourished children to meet the needs for weight and height gain and functional recovery. The dietary management of acute malnourished children is based on the optimal use of locally available food to improve nutritional status. Supplementary food has been used to treat the children with moderate acute malnutrition under the condition of inadequacy food or insufficient nutrients on local food.

Children with a history of low birth weight, or acute or chronic malnutrition, have a higher risk of experiencing morbidity and mortality during childhood time. In addition, they may also be at high risk of being overweight and obesity, and developing non-communicable diseases (NCD) after improperly given high-energy food supplements as the way to treat or prevent moderate wasting. As the consequence, the improper unhealthy weight gained(5) .

The number of proportion of children under-fives aged 6 to 59 months in Indonesia who did not get supplementary feeding was 59% compared to 41% who did while only 58.3% had the get supplementary feeding program⁽⁴⁾. Therefore, biscuits are well-acceptable among other supplementary food. However, in fact that the supplementary food provided is still in the form of flour-based manufacturing food and has not been enriched much by exploring the potential of local food which are rich in nutrients, such as bananasky and flour tuna skipjack.

"Banana sky" (*Musa troglodyarium*), one of the unique banana varieties, is found in Maluku province. It is unique for its bunch which stands upright instead of downward and so it is named by Maluku people as " *TongkatLangit* banana" ("Tongkat": Stick, "Langit": Sky)⁽⁶⁾. Meanwhile, Skipjack tuna is a source of protein that is widely produced in Maluku province. It is amounted to 51,318.6 tons in 2012, 51,237.4 tons in 2013 and 51,705.2 tons in 2014.

Research⁽⁶⁾ shows that by adding of 10% fish flour to biscuits in the ratio of 40% banana flour and 60% wheat flour could add enough carbohydrate and protein as well as they are acceptable and preferred by consumers (carbohydrate: 77.38%, protein: 9.07%, vitamin C (0.23%) and β -carotene (0.19%).

Diversifying the formulation of supplementary food should consider the nutrition aspects, health benefits, acceptance, economic value, durability and the qualified resources to optimize the handling of nutritional problems in children under-fives age⁽⁷⁾. Biscuits enriched with banana sky and flour tuna skipjack are potentially examined for its efficacy as one of the solutions to reduce the prevalence of malnourished infants while increasing the energy, protein and β carotene.

MATERIALS AND METHOD

An experimental study was designed with Single Blind Pre-post Randomized Controlled Trial (RCT) Study applied for this research. The treatment group was treated with biscuits enriched with banana sky and flours tuna skipjack while the control group was treated with milk biscuits for 4 weeks. 22 underweight children aged 2-5 years old (Z-score BB/U < -2 SD) in the Health Centers of Tawiri and Nania were the samples of the study. The variables measured were the acceptance and obedience level, nutritional consumption (energy, protein, fat and carbohydrates and vitamin A), weight, and nutritional status. The data obtained were nutrition consumption, body weight, nutritional status (Z score). The normality was tested by Shapiro-Wilk test and homogeneity was tested with Levene's Test. T-Test would be performed for homogeneous and normally distributed data with a confidence interval of 95%. The difference was declared significant if P < 0.05. Mann-Whitney nonparametric test would be performed after not meeting the requirements.

RESULTS AND DISCUSSION

Acceptance and Obedience Level of Toddler Consuming Biscuits

Biscuits made of 40% bananasky flour and 60% wheat flour and 10% skipjack tuna flour is added. Most of nannies of the children under-fives in the treatment group (90.91 %) claimed the biscuits were tasty.

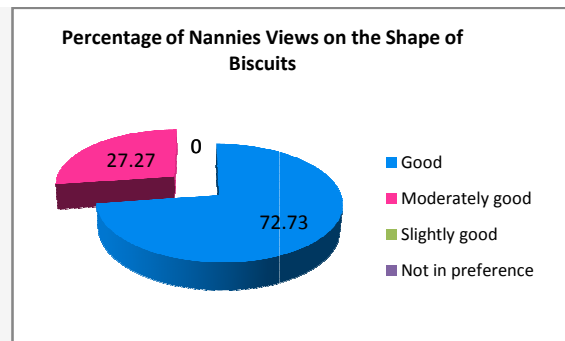
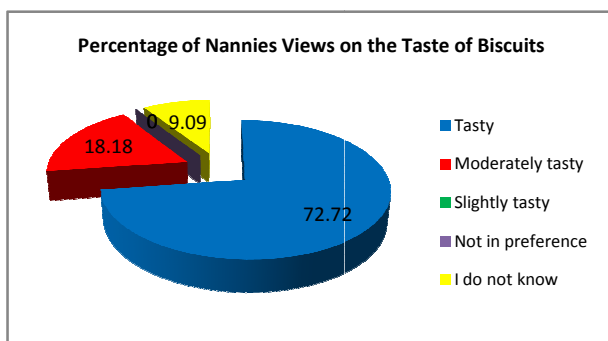


Figure 2 Percentage of Nannies' Views on the Form of Biscuits

Figure 1 Percentage of Nannies' Views on the Taste of Biscuits

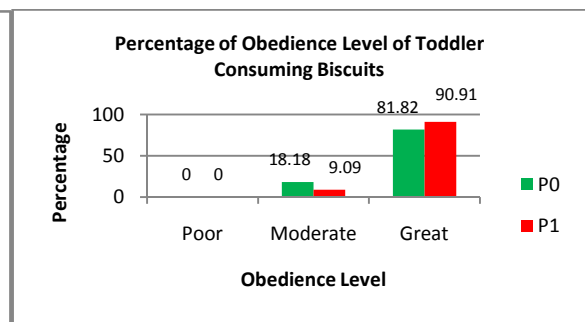
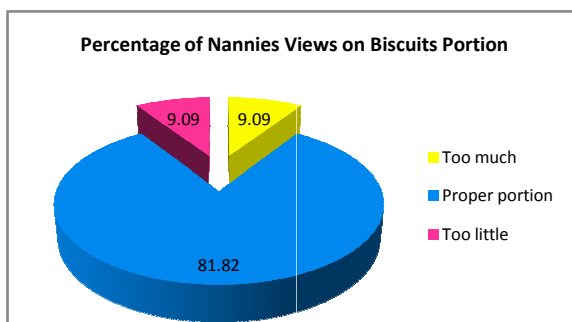


Figure 3 Percentage of Nannies' Views on Biscuits Portion

Figure 4. Percentage of Obedience Level of Toddler Consuming Biscuits

Table 1. Average of daily contribution of energy and protein of functional biscuits to nutritional adequacy

Treatment group / nutrition	Amount per unit	% AKG
P0		
Energy (Kal)	270.4	19.88
Protein (g)	3,2	16.00
Vitamin A (µg)	126.4	31.6
P1		
Energy (Kal)	272.22	20.02
Protein (g)	4.68	23.40
Vitamin A (µg)	133.43	33.36

P0: Control group and P1: Treatment group

Dietary Intake of Children Under-fives

Table 2. Dietary Intake of Children Under-fives

Variabel	Average Dietary Intake ± SD		<i>P</i>
	P0	P1	
0 week			
Energy	596,19 ± 127,68	573,72 ± 149,44	0,709
Protein	20,13 ± 5,45	22,46 ± 5,54	0,331
Fat	13,4 ± 4,12	11,1 + 3,32	0,700
Carbohydrate	91,95 ± 30,04	89,65 ± 28,67	0,563
Vitamin A	102,4 ± 77,56	179,49 ± 214,15	0,275
4 week			
Energy	813,71 ± 121,26	946,76 ± 150,27	0,033*
Protein	20,64 ± 5,7	27,37 ± 5,33	0,010*

Fat	20,86 ± 3,15	26,59 ± 3,31	0,238
Carbohydrate	116,65 ± 26,87	118,95 ± 28,68	0,891
Vitamin A	95,4 ± 43,77	307,53 ± 199,27	0,003*

* signifikan p < 0,05. P0: Control group and P1: Treatment group

There was no significant difference (P > 0.05) on controlled (P0) and treatment group (P1) on energy, protein, fat, carbohydrate and vitamin A consumption at the early intervention. There was a difference (P < 0.05) on energy, protein, and vitamin A consumption at the end of the intervention.

Efficacy of Biscuits Enriched With Banana Sky and Flour Tuna Skipjack as a Supplementary Food on Body Weight and Height of Under-Five Children (2 - 5 Years Old)

Table 3. The average of children under-fives' body weight and height

Variable	Average Weight and SD		p
	P0	Q1	
Weight			
Early Intervention	10.09 ± 1.86	10.30 ± 1.93	0.799
End of Intervention	10.42 ± 1.87	11.12 ± 2.08	.251
Change	0.33 ± 0.26	0.83 ± 0.69	0.039 *
Height			
Early Intervention	86.09 ± 7.96	85.76 ± 9.94	0.933
End of Intervention	86.20 ± 7.89	86.00 ± 10.02	0.968
Change	0.13 ± 0.21	0.24 ± 0.24	0.268

P0: Control group and P1: Treatment group

There was no difference (P > 0.05) on the average of children under-fives' weight on the early intervention between the controlled and treatment groups. There was significant difference (P < 0.05) on weight gain between the controlled group and the treatment group. In contrast, there was no difference on height gain (P > 0.05).

Efficacy of Providing Biscuits Enriched with Banana Sky and Flour Tuna Skipjack on Nutritional Status of Children under-fives

There was a greater increase on nutritional status between the treatment group and the controlled

group at the end of the intervention. There was a significant difference ($P < 0.05$) on the nutritional status (weight for age) between the controlled and treatment groups at the end of the intervention.

Table 4. Distribution of children under-fives based on nutritional status at the early and end of the intervention

Nutritional status	P0				P1			
	Early		End		Early		End	
	N	%	n	%	n	%	n	%
Z score weight/Age								
Severely Underweight	0	0.00	8	72.70	0	0.00	1	9.10
Moderately Underweight	11	100.00	3	27.30	11	100.00	10	90.90
Total	11	100.00	11	100.00	11	100.00	11	100.00
Z score Height/Age								
Severely Stunted	2	18.20	3	27.30	2	18.20	2	18.20
Moderately Stunted	7	63.60	6	54.50	5	45.50	6	54.50
Marginally Stunted	0	0.00	2	18.20	4	36.40	3	27.30
Normal	2	18.20	0	0.00	0	0.00	0	0.00
Total	11	100.00	11	100.00	11	100.00	11	100.00
Z score Weight/Height								
Severely Wasted	2	18.20	1	9.10	1	9.09	0	0.00
Moderately wasted	0	0.00	1	9.10	2	18.18	0	0.00
Marginally Wasted	9	81.80	9	81.80	8	72.72	11	100.00
Normal	0	0.00	0	0.00	0	0.00	0	0.00
Total	11	100.00	11	100.00	11	100.00	11	100.00

Table 5.Average Z-score

Average of Z Score	P0	P1	P
Z score weight/Age			
Early Intervention	-2,55 ± 0,26	-2,39 ± 0,34	
End of Intervention	-2,35 ± 0,37	-1,79 ± 0,33	
Change	0,20 ± 0,25	0,60 ± 0,43	0,016*
Z score Height/Age			
Early Intervention	-2,18 ± 1,24	-2,42 ± 0,97	
End of Intervention	-2,36 ± 1,26	-2,31 ± 1,02	
Change	0,18 ± 0,36	0,10 ± 0,16	0,025*
Z score Weight/Height			
Early Intervention	-1,89 ± 1,11	-1,45 ± 0,76	
End of Intervention	-1,58 ± 1,04	-0,59 ± 1,03	
Change	0,31 ± 0,57	0,85 ± 0,56	0,036*

There was a difference ($P < 0.05$) on the deviation of Z scores in weight for age, height for age and weight for height between the control and treatment groups.

Discussion

Inability of parents and families to afford the proper and adequate food (especially animal-source food) causes the use of locally available food as one of the ways to produce formula food especially in developing countries where nutritional problems are largely presented. A proper selection and combination of food ingredients can be used to formulate multiple mixtures of home-made supplementary food⁽⁸⁾.

The acceptance on a new product is influenced by the evaluation on the acceptance of food – in this case, biscuits, and considered as one of the essential tests on the new product of food. Taste is an important parameter in evaluating the acceptance of a food product. An interesting food product with a high energy consumption yet tasteless is possibly not accepted as taste is essential for involving the tongue – one of the five-senses⁽¹⁰⁾.

Taste is very essential in determining the acceptance and quality of food⁽¹¹⁾. Taste assessment results showed that most of the children under-fives' nannies (90,91 %) in all treatment groups claimed that the biscuits were tasty, in contrast to a small number of groups (9.09%) who claimed that they did not know about it. This generally meant that the taste of functional biscuits as a supplementary

food for children under-fives could be well received by the targetted children under-fives. The preference on taste appeared could increase the willingness (appetite) of children under-fives to consume the biscuits provided and could maintain a high appetite on consuming the food during the intervention.

In determining the attitudes toward food, children especially will be affected by shape as well as color as the first factors affecting the first reaction. The results of the assessment showed that the shape of the biscuits was considered good by most of the nannies (82.81%). Regarding this, the targetted children under-fives could accept the functional biscuit well and they liked it. The preferred biscuits could attract the children under-fives more to consume.

Another thing to consider is food portion, instead of the appearance and serving planning. These are also the causes of food wasted. The assessment on the biscuits portion showed that the majority of the nannies (90.91 %) in treatment group declared that portions of the biscuits served were appropriate. Otherwise, a small number of groups (9.09%) said it was not sufficient. As the consequence, the portion of 50g per day given every day is in accordance with the capacity of children under-fives' consumption so it can reduce the wasted. The ability of children under-fives' stomach to carry on food is limited, or in other words, it is smaller than adults'.

Functional biscuits provided to children under-fives are recommended to be consumed as 1 portion - consisting of about 50g of biscuits (4 pieces/pack), every day. The average energy contribution of the biscuits is above 15% of the adequacy energy nutrition rate. Energy contribution of biscuits enriched with banana sky and flour tuna skipjack is averaged to 20.02 %. On the other hand, milk biscuits contributes energy amounted to 19.88%. The average protein contribution of biscuits enriched with banana sky and flour tuna skipjack is 23.40 % while milk biscuits only contribute 16%.

Children need greater proportion of nutrition than adults as childhood is the golden age on the growth of bones, teeth, muscles and blood. After experiencing a long-term poor appetite of eating, eating limited amount of food or having a lack of nutrients on the diet, children may be at risk of experiencing malnutrition⁽¹²⁾. One of the biological variables with the greatest impact on the long-term health of malnourished children is recovery of status. Certain awareness on food quality during nutrition recovery is very crucial, especially the quality of protein and essential amino acids consumed, to allow the increase in height without undesirable increase in the supply of energy⁽¹³⁾.

High protein functional biscuits as supplementary food can provide a significant increase in protein consumption in underweight children under-fives. Protein plays a significant role in the growth phase as the process of biosynthesis runs quickly, especially the formation of body proteins to support new growth and maintain the cells⁽¹⁴⁾⁽¹⁵⁾. Biscuits enriched with banana sky and flour tuna skipjack can increase the children under-fives' weight. An indicator of weight for age generally shows an improvement on nutritional status after 4 weeks of intervention with functional biscuits. The improvement can be seen from a decrease in malnutrition category and good nutritional status presented compared to none of those presented in the early intervention. This is in line with the research on biscuits enriched with catfish flour and soybean isolates. It can be found that the improvement of nutritional status based on the weight for age, height for age and weight for height index of the treatment group had better improvement in their nutritional status compared to controlled group⁽⁷⁾.

A package of functional biscuits can increase body weight as the age increased. Furthermore, functional biscuits contain higher protein and essential amino acids complete obtained from the

combination of banana sky and flour tuna skipjack. The number of protein as well as the quality of protein (essential amino acids complete) plays a big role in the growth phase⁽¹⁶⁾. On the other hand, the deficiency of essential amino acids is an important and very significant factor supporting malnutrition⁽¹⁷⁾. The protein in skipjack tuna can supply more amino acids to recover malnourished children.

CONCLUSION:

1. Biscuits enriched with banana sky and flour tuna skipjack (functional biscuits) as supplementary meal with a portion of 50g per day can be accepted and has a high obedience level when consumed by children under-fives during the intervention.
2. There was a significant increase on energy consuming at the end of the intervention in the treatment group while the level of consumption classified as 'deficit' (<70% RDA). There was a significant increase ($p < 0.05$) on consuming protein at the end of the intervention, especially in the functional biscuit treatment group while the level of consumption started 'adequate' (> 90% RDA).
3. There was a significant increase on body weight ($P < 0.05$) between treatment and controlled group while there was no significant difference in height.
4. There was a significant increase and better nutrition status between treatment and controlled group. There was a significant difference ($P < 0,05$) with weight for age index on nutrition status. There was significant difference ($P < 0,05$) on the deviation of Z score weight for age, height for age and weight for height.

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