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Test of Acceptance of Batawoli-Based Nugget Modificationslocal Food Materials Milk Fish (Chanos Chanos) as Alternative Snack for Stunting Toddlers

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ABSTRACT

Stunting, a growth disorder in children characterized by height or length below the standard for their age, can be prevented by ensuring adequate intake of energy and protein. This study aims to assess the acceptability of modified Batawoli nuggets as a potential snack alternative for toddlers with stunting. The research employed a true experimental design with control and treatment groups. Organoleptic tests were conducted on Batawoli nugget formulations with varying ratios: F0 (1:0:1:1), F1 (1:2:1:1), F2 (1:1:1:1), and F3 (2:1:1:1). Data analysis utilized the Mann Whitney test. The findings reveal organoleptic test scores for each formulation: F0 scored 3.35 (somewhat liked), F1 scored 3.9 (somewhat liked), F2 scored 3.46 (somewhat liked), and F3 scored 3.52 (somewhat liked). The study concludes that the most preferred formulation, based on all indicators, is F1 (1:2:1:1), which provides an energy value of 3.5 kcal/g (>1.5 kcal/g) and a Protein Efficiency Ratio of 12.6% (within the range of 10% - 16%). Consequently, this formulation presents a promising local complementary food option for toddlers with stunting.

INTRODUCTION

The toddler age is the best period for growth and development.[1] During the toddler years, there is a high risk of nutritional problems due to their growth phase requiring more nutrients than other age groups.[2] Stunting is one of the nutritional issues under review in developing countries, including Indonesia.[3] Stunting is a health problem that receives significant attention because it relates to optimal brain development, thus posing risks of morbidity and mortality, hindered motor development, and delayed psychic development.[4] Stunting represents a serious threat to children and is an index of poor human resource quality, potentially reducing a country's productive capacity in the future.[5]

Based on the National Medium-Term Development Plan (National Medium Term Development Plan) 2020-2024, the primary goal is to reduce the prevalence of stunting in toddlers. The prevalence of stunting incidents in Indonesia has decreased over the years, from 37.2% in 2013 (Basic Health Research, 2013) to 30.8% in 2018 (Basic Health Research, 2018), further dropping to 27.7% in 2019 (Indonesian nutritional status survey, 2019), and to 24.4% in 2021 (Indonesian nutritional status survey, 2021). The prevalence of stunting in East Java currently is not much different from the national prevalence, with stunting rates in East Java at 26.9% in 2019 (Indonesian nutritional status survey, 2019), and a decrease to 23.5% in 2021 (Indonesian

nutritional status survey, 2021). However, this reduction in prevalence still does not meet the National Medium Term Development Plan 2024 target of 14%. Even if the 14% target is achieved, it does not mean Indonesia will be free from stunting issues. The next goal would be to reduce the stunting rate to the lowest stratum, or below 2.5%.[6]

Prolonged low intake of nutrients in the form of energy and protein can lead to stunting, characterized by suboptimal growth as age increases.[7] One of the animal protein foods with high energy and protein content, containing essential amino acids beneficial for stunted toddlers, is milkfish.[8] Milkfish has a complete amino acid composition and can be easily digested by the body, playing a specific role in growth, development, and immune function for toddlers.[9]

Nuggets are an easy-to-make dish with high protein content and can be consumed by various age groups. The public's acceptance of nugget products is increasingly high, as evidenced by the abundance of nugget products in the market with various main ingredients.[10]

Based on the description and issues mentioned, the author is interested in creating an alternative snack for stunted toddlers using local food ingredients from the Sidoarjo area, namely milkfish. Besides containing the nutrients needed for toddler growth and development, nuggets can also be consumed by children who dislike vegetables. Moreover, fish consumption can support the government's implementation of the national movement GEMARIKAN (Movement to Popularize Eating Fish).[11]

MATERIALS AND METHODS

Type Of Study

This study employs a true experimental design because the subject groups were chosen randomly, and there are both control and treatment groups.[12] The purpose of this study is to observe the preference level for nugget products made from local food ingredients. Therefore, it necessitates a hedonic scale acceptance test or preference test with four different treatments.

The evaluation of each product uses a 5-point scale, namely 1 = strongly dislike, 2 = dislike, 3 = somewhat like, 4 = like, 5 = strongly like. The acceptance test phase was conducted by 25 semi-trained panelists. This took place from September 28, 2022, to May 2023. The preparation and testing of batawoli nuggets were carried out at the Nutrition Department of Poltekkes Kemenkes Surabaya, located at Jalan Pucang Jajar Selatan No 24 B.

Research Sample

The protein nutrient content of each formulation was calculated through the Indonesian food composition table (Total Ideal Protein Requirement). The nutritional value can vary among the different formulation ingredients, even if their weights are the same. Each formulation can be made into 50 nugget pieces. The differences in nutritional values can be reviewed in the following table.

Table 1. Formulated Nutrients F0

Ingridients	Formula 0 (F0) (1:0:1:1)	Nutrient Energy (kkal)	Protein (g)
Milkfish	150 g	184.5	30
Tofu	0 g	0	0
Broccoli	50 g	11.6	1.6
Carrot	50 g	18	0.5
Wheat Flour	200 g	666	18
Tapioca Flour	30 g	108.9	0.33
Bread Crumbs	50 g	166.5	5
Egg	30 g	46.2	3.7
Cooking Oil	50 g	431	0
TOTAL		1632.7	59.13
Total for 1 piece		32.7	1.2
Total for 5 piece		163.3	5.9
KE		3.3 kal/g	
PER		14.70%	

Source: Indonesian food composition table, 2021

The results from Table 1 show the nutritional content found in one recipe of Batawoli nugget under formulation 0 with the ratio of Milkfish: Tofu: Carrot: Broccoli = 1:0:1:1, resulting in energy of 32.7 g and protein of 1.2 g per piece. The energy density is 3.3 kcal/g with a Protein Efficiency Ratio (PER) of 14.7%. In one nugget recipe formulation, 50 pieces are produced, each weighing 10 g.

Table 2. Formulated Nutrients F1

Ingridients	Formula 1 (F1) (1:2:1:1)	Nutrient Energy (kkal)	Protein (g)
Milkfish	50 g	61.5	10
Tofu	100 g	80	10.9
Broccoli	50 g	11.6	1.6
Carrot	50 g	18	0.5
Wheat Flour	200 g	666	18
Tapioca Flour	30 g	108.9	0.33
Bread Crumbs	50 g	166.5	5
Egg	30 g	46.2	3.7
Cooking Oil	50 g	431	0
TOTAL		1589.7	50.03
Total for 1 piece		31.8	1.001
Total for 5 piece		158.9	5.003
KE		3.2 kal/g	
PER		12.60%	

Source: Indonesian food composition table, 2021

The results from Table 2 indicate the nutritional content found in one recipe of Batawoli nugget under formulation 1 with the ratio of Milkfish: Tofu: Carrot: Broccoli = 1:2:1:1, resulting in energy of 31.8 g and protein of 1 g per piece. The energy density is 3.2 kcal/g with a Protein Efficiency Ratio (PER) of 12.6%. In one nugget recipe formulation, 50 pieces are produced, each weighing 10 g.

Table 3. Formulated Nutrients F2

Ingridients	Formula 2 (F2)	Nutrient	
	(1:1:1:1)	Energy (kkal)	Protein (g)
Milkfish	75 g	92.25	15
Tofu	75 g	60	8.2
Broccoli	50 g	11.6	1.6
Carrot	50 g	18	0.5
Wheat Flour	200 g	666	18
Tapioca Flour	30 g	108.9	0.33
Bread Crumbs	50 g	166.5	5
Egg	30 g	46.2	3.7
Cooking Oil	50 g	431	0
TOTAL		1600.45	52.33
Total for 1 piece		32.01	1.1
Total for 5 piece		160.04	5.2
KE		3.2 kal/g	
PER		13.10%	

Source: Indonesian food composition table, 2021

The results from Table 3 show the nutritional content found in one recipe of Batawoli nugget under formulation 2 with the ratio of Milkfish: Tofu: Carrot: Broccoli = 1:1:1:1, resulting in energy of 32.01 g and protein of 1.1 g per piece. The energy density is 3.2 kcal/g with a Protein Efficiency Ratio (PER) of 13.1%. In one formulation of this recipe, 50 nuggets are produced, each weighing 10 g.

Table 4. Formulated Nutrients F3

Ingridients	Formula 3 (F3)	Nutrient	
	(2:1:1:1)	Energy (kkal)	Protein (g)
Milkfish	100 g	123	20
Tofu	50 g	40	5.3
Broccoli	50 g	11.6	1.6
Carrot	50 g	18	0.5
Wheat Flour	200 g	666	18
Tapioca Flour	30 g	108.9	0.33
Bread Crumbs	50 g	166.5	5
Egg	30 g	46.2	3.7
Cooking Oil	50 g	431	0
TOTAL		1611.2	54.43
Total for 1 piece		32.2	1.1
Total for 5 piece		161.1	5.4
KE		3.2 kal/g	
PER		13.80%	

Source: Indonesian food composition table, 2021

The results from Table 4 indicate the nutritional content found in one recipe of Batawoli nugget under formulation 3 with the ratio of Milkfish: Tofu: Carrot: Broccoli = 2:1:1:1, resulting in energy of 32.2 g and protein of 1.1 g per piece. The energy density is 3.2 kcal/g with a Protein Efficiency Ratio of 13.8%. In one formulation of this recipe, 50 nuggets are produced, each weighing 10 g.

Data Collection Technique

The data collection technique involves providing samples on small plates, each sample labeled according to the treatment. Then, panelists will be given a form for the acceptance test, one form for each trial. The acceptance testing is conducted with a target of 25 semi-trained panelists. The results of the acceptance test are then analyzed using the Kruskal Wallis statistical test to determine the acceptance and the formulation most preferred by the panelists with an error level of 0.05 (α = 0.05).

RESULTS

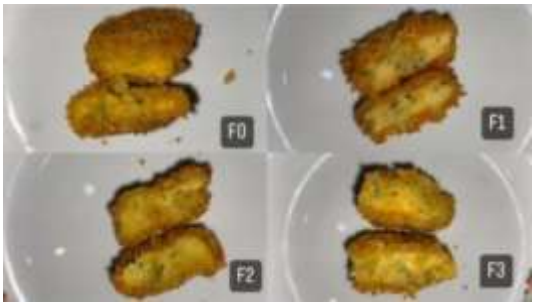
Characteristics of Batawoli Nugget Formulations

The difference in composition aims to analyze the variance in characteristics among each formulation. This can be observed in the following table:

Table 5. Characteristics of Batawoli Nugget Formulations

IndIcator	F0 (Milkfish: Tofu: Carrot: Broccoli = 1:0:1:1)	F1 (Milkfish: Tofu: Carrot: Broccoli = 1:2:1:1)	F2 (Milkfish: Tofu: Carrot: Broccoli = 1:1:1:1)	F3 (Milkfish: Tofu: Carrot: Broccoli = 2:1:1:1)
Color	Brownish yellow for the filling	Slightly brownish yellow for the filling	Slightly brownish yellow for the filling	Slightly brownish yellow for the filling
Texture	Somewhat hard	Somewhat soft	Somewhat hard	Somewhat hard
Aroma	Characteristic of milkfish and slightly fishy	Characteristic of milkfish but not fishy	Characteristic of milkfish but not fishy	Characteristic of milkfish and slightly fishy
Taste	Savory and characteristic of fish	Savory	Savory	Savory and characteristic of fish

Source: Primary Data, 2023



Picture 1. Characteristics of Batawoli Nugget Formulations

Formulation F0 produced nugget fillings with a yellowish-brown color and a slightly hard texture, a distinctive milkfish aroma with a slight fishy smell, and a savory taste characteristic of fish. Formulation F1 produced nugget fillings with a slightly yellowish-brown color and a slightly soft texture, a distinctive milkfish aroma without a fishy smell, and a savory taste. Formulation F2

produced nugget fillings with a slightly yellowish-brown color and a slightly hard texture, a distinctive milkfish aroma without a fishy smell, and a savory taste characteristic of fish. Formulation F3 produced nugget fillings with a slightly yellowish-brown color and a slightly hard texture, a distinctive milkfish aroma with a slight fishy smell, and a savory taste characteristic of fish.

Organoleptic Test of Batawoli Nugget Formulation

The results of organoleptic tests carried out by 25 panels can be seen in the table as:

Table 6. Formulations of Batawoli Nugget

Indicator	F0 (Milkfish: Tofu: Carrot: Broccoli = 1:0:1:1)	F1 (Milkfish: Tofu: Carrot: Broccoli = 1:2:1:1)	F2 (Milkfish: Tofu: Carrot: Broccoli = 1:1:1:1)	F3 (Milkfish: Tofu: Carrot: Broccoli = 2:1:1:1)
Color	3.6	4.16	4.04	3.64
Texture	3.32	3.84	3.24	3.48
Aroma	3.32	3.76	3.36	3.56
Taste	3.16	3.84	3.2	3.4
Average	3.35	3.9	3.46	3.52

Source: Primary Data, 2023

Based on Table 6, the results of the organoleptic evaluation (Hedonic Test) for the four formulations of Batawoli nuggets reveal that the overall average preference for color, texture, aroma, and taste most favored by the panelists is formulation F1, which scored the highest with a value of 3.9, falling into the "somewhat like" category. Meanwhile, the formulation with the lowest score is F0, with a value of 3.35, also categorized under "somewhat like."

Batawoli Nugget Test Differences

Kruskal Wallis Test

The Kruskal Wallis test is conducted to determine whether there are any differences across each indicator. The results of the Kruskal Wallis test for Batawoli nuggets can be reviewed in the following table.

Table 7. Kruskal Wallis Test

No	Indicator	Kruskal Wallis Test Value
1	Color	0.000
2	Texture	0.022
3	Aroma	0.108
4	Taste	0.007

Source: Primary Data, 2023

Based on Table 7, the results of the Kruskal Wallis test on the aroma indicator with a p-value > 0.05 indicate that the hypothesis is rejected, meaning there is no difference in aroma across the Batawoli nugget formulations (milkfish, tofu, carrot, broccoli). Meanwhile, the results of the Kruskal Wallis test on the indicators of color, texture, and taste with a p-value < 0.05 indicate that the

hypothesis is accepted, meaning there are differences in color, texture, and taste across the Batawoli nugget formulations (milkfish, tofu, carrot, broccoli).

Man Whitney Test

Based on the Kruskal Wallis test results, the indicators of color, texture, and taste show that the hypothesis is accepted. It will be followed by the Mann-Whitney test to determine whether there are any differences. The results of the Mann-Whitney test for the formulations can be reviewed as follows:

Table 8. Man Whitney Test

No	Indicator	Man Whitney Value Test					
		F0:F1	**F0:F2**	**F0:F3**	**F1:F2**	**F1:F3**	**F2:F3**
1	Color	0,001	0,014	0,725	0,397	0,001	0,0,18
2	Texture	0,009	0,741	0,556	0,002	0,121	0,372
3	Taste	0,001	0,730	0,239	0,003	0,084	0,348

Source: Primary Data, 2023

Based on Table 8 and the Mann-Whitney test results: Color Indicator: For formulations F0:F3 and F1:F2, the p-value is >0.05, indicating that the hypothesis is rejected, which means there is no significant difference in color between these formulations. For formulations F0:F1, F0:F2, F1:F3, and F2:F3, the p-value is <0.05, indicating that the hypothesis is accepted, which means there is a significant difference in color between these formulations.

Texture Indicator: For formulations F0:F2, F0:F3, F1:F3, and F2:F3, the p-value is >0.05, indicating that the hypothesis is rejected, which means there is no significant difference in texture between these formulations. For formulations F0:F1 and F1:F2, the p-value is <0.05, indicating that the hypothesis is accepted, which means there is a significant difference in texture between these formulations.

Taste Indicator: For formulations F0:F2, F0:F3, and F1:F3 (with the notation F1:3) as well as F2:F3, the p-value is >0.05, indicating that the hypothesis is rejected, which means there is no significant difference in taste between these formulations. For formulations F0:F1 and F1:F2, the p-value is <0.05, indicating that the hypothesis is accepted, which means there is a significant difference in taste between these formulations.

These results help in identifying which formulations of the Batawoli nuggets have significant differences in color, texture, and taste, guiding further development or selection for preferred characteristics.

DISCUSSION

Acceptance Test

The acceptance test is a method used to assess the quality of a material or product using human senses, with indicators such as color, taste, aroma, and texture.[14] Organoleptic evaluation using a scoring method or quality score of a product aims to assign a specific value to the characteristics or quality of a product.[15] Based on the results of the acceptance test, the formulation (F0) received the lowest average scores for each organoleptic parameter compared to the other formulations. The presence of characteristics that were less liked by the panelists led to a low level of liking for the formulation. Meanwhile, formulation (F1) received the highest average scores for each organoleptic parameter compared to the other formulations. The presence of characteristics that were liked by the researchers caused a high level of liking for formulation (F1).

a. Color

Color is the most attractive factor and provides the quickest impression of acceptance to consumers. This is because the appearance of food can stimulate the nerves through the sense of sight, thus arousing appetite.[16]

Based on the analysis of the average level of liking for Batawoli nugget colors, it is known that F1 is the formula with the most preferred color by the panel. This is because the filling with a slightly brownish-yellow color in formulation 1 is appealing to consumers. This difference in color is due to the difference in the specific gravity of the materials used. This finding aligns with the research by Yuwono et al. in 2021, which found that the addition of different types of materials can affect the color of the nugget.[17]

b. Texsture

Texture is a sensation linked with touch or feel. The most important textures in food are softness and ease of chewing. The texture characteristics that are most disregarded include hardness, cohesiveness, and water content.[18]

Based on the analysis of the average level of liking for the Batawoli nugget texture, it was found that F1 is the formula that has the most favored texture by the panel. This is because the texture in formulation 1 is somewhat soft, making it appealing to the panelists. This texture is due to the addition of tofu, which has a relatively high-water content. This is in line with the opinion of Hartono in 2020, where filler and binder materials can help in forming the texture of food products.[19]

c. Aroma

Aroma is an indicator that can be recognized by the sense of smell, which is the nose. The aroma of food can determine the deliciousness of the food material.[20] Aroma is

a specific component that functions to improve and enhance the value to be accepted by the panelists.[21]

Based on the analysis of the average level of liking for the Batawoli nugget's aroma, it was found that F1 is the formula that has the most favored aroma by the panelists. This is because formulation 1 has a distinctive milkfish aroma but is not fishy, making it appealing to the panelists. The aroma can be influenced by the amount of material used. In formulation 1, less milkfish was used compared to the other formulations, so the milkfish aroma is not too strong. This is in accordance with the opinion of Yuwono et al. in 2021 in their research that adding ingredients with a less strong aroma will be dominated by the aroma of stronger smelling ingredients.[17]

d. Taste

Taste is the most important indicator in the acceptability test, because if the taste is not supportive, the product may be rejected.[22] The combination of main ingredients and additives will produce a distinctive taste that can cause an increase or decrease in the taste of food.[23]

Based on the analysis of the average level of liking for the Batawoli nugget's taste, it was found that F1 is the formula that has the most favored taste by the panelists. This is because formulation 1 has a savory taste that is appealing to the panelists. This is in line with the research opinion of Yuwono et al. in 2021 in their research that the taste from the addition of milkfish has a distinctive and savory taste.[17]

Nutritional Content of Batawoli Nugget

The nutritional values contained in each formulation show quite significant differences. These differences in nutritional value are due to the difference in the weight of milkfish and tofu ingredients in each formulation. The nutritional content will be higher if the weight of the ingredients in animal protein is larger. The proportion of ingredients for the protein needs of toddler snacks per day according to the Recommended Dietary Allowance (RDA) averages about 4.5 g.[24] In 1 serving of each Batawoli nugget formulation, it has met the protein needs of the snack. Thus, it can be an alternative snack for stunted toddlers. In addition, the results of Energy Conversion (EC) and Protein Efficiency Ratio (PER) in 1 serving of nugget have met the standard, which is for EC greater than >1.5 kcal/g and for PER ranging from 10% to 16%.[25] This modification of Batawoli nugget is useful for introducing new food variations for children so that their nutritional needs can be fulfilled with various food variations.

CONCLUSION

Based on the research that has been conducted, it can be concluded that the most preferred test results in terms of color, aroma, texture, and taste are the production of Batawoli nuggets (Milkfish, Tofu, Carrot, Broccoli) with formulation ratio 1, i.e., F1 with the substitution of Milkfish (50 g): Tofu (100 g): Carrot (50 g): Broccoli (50 g) = 1:2:1:1. With an Energy Conversion (EC) of 3.5 kcal/g (>1.5 kcal/g) and a Protein Efficiency Ratio (PER) of 12.6% (10% - 16%). Therefore, it can be an alternative local Supplementary Food for stunted toddlers. Additionally, the results of the Kruskal Wallis test and the Mann Whitney test on formulations 0 and 3 (F0 : F3) show no difference in the indicators of color, texture, aroma, and taste ($P<0.05$).

Based on these conclusions, it can be recommended for the community that the Batawoli nugget with the formulation of milkfish, tofu, carrot, broccoli can be used as a local Supplementary Food with a high protein source for stunted toddlers. For institutions, the results of this research can be introduced as a local Supplementary Food for stunted toddlers. Furthermore, future researchers could conduct formulation with preliminary protein content planning using nutrisurvey and analyze other supporting micronutrient contents such as Vit A and Vit C, which are useful for addressing stunting.

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