

The Effect of Substitution of Purple Sweet Potato Flour and Tempeh on Organoleptic Quality of MP-ASI Biscuit

Radeny Ramdany^{1*}, Yulia Rachmawati², La Supu³, Anwar Mallongi⁴

^{1,2,3}Poltekkes Kemenkes Sorong, Indonesia

⁴Environmental Health Department, Faculty of Public Health, Hasanuddin University, Makassar, Indonesia

Corresponding Author: Radeny Ramdany
Poltekkes Kemenkes Sorong, Indonesia
Email: radeny_ramdany@yahoo.com

ABSTRACT

Biscuits are generally made from wheat flour, but in some cases, the gluten protein found in flour may cause allergies. Therefore, the use of flour, especially in complementary feeding biscuits, must be limited or replaced with other foods that are low or without allergens, one of which is purple sweet potato flour. The purpose of this study was to determine the effect of substitute purple sweet potato flour and tempeh on the organoleptic quality of complementary feeding biscuits. This type of research is a pure experiment with a completely randomized design (CRD) with 4 repetitions. Samples were complementary feeding biscuits with 6 variations in composition, namely samples X1, X2, X3, X4, X5, and X6. The independent variable is the variation in the composition of purple sweet potato flour and tempeh, while the dependent variable is the organoleptic quality (color, aroma, texture, and taste). Data collection used the hedonic test form which was given to 20 panelists. Data analysis used the Kruskal-Wallis test. The results showed that variations in the composition of purple sweet potato flour and tempeh had an effect on color ($p = 0.046$) and aroma ($p = 0.043$), but had no effect on texture ($p = 0.172$) and taste ($p = 0.164$). It is suggested to the next researchers to study the nutritional content and physicochemical properties of the Complementary feeding biscuits made from purple sweet potato flour and tempeh.

Keywords: Purple sweet potato flour, tempeh, complementary feeding biscuits organoleptic quality

Correspondence:

Radeny Ramdany
Poltekkes Kemenkes Sorong, Indonesia
Email: radeny_ramdany@yahoo.com

INTRODUCTION

Food and nutrition have a strategic role in the development of a nation. The phenomenon that continues to develop is a strong awareness from various circles that food and nutrition have a very strong role in forming a healthy and productive individual⁽¹⁾. Infants need adequate nutritional intake for their growth and development. Infants aged 0-6 months can still meet their needs with breast milk. It is even recommended to be given exclusively. However, gradually, after the age of 6 months, nutrition from breastmilk is not adequate. Infants need to be introduced to complementary feedings which are adjusted to the infants' digestive system, soft and easy to digest, can be in the form of porridge, rice cereal, fruit, and biscuits⁽²⁾. The provision of complementary feeding in the form of biscuits is intended to familiarize infants with the sensation of solid and textured food so that it can stimulate teeth growth⁽³⁾. Besides, giving biscuits also aims to improve infants' ability to hold objects with their thumb and forefinger⁽³⁾. Biscuits are generally made from wheat flour, but in some cases, the gluten protein found in flour can cause allergies when consumed. Therefore, wheat flour must be limited or replaced especially for complementary feeding with other foods that are low or without allergens. One of them is purple sweet potato flour which is rich in vitamin A (beta-carotene), vitamin C, and manganese⁽²⁾. Study conducted by Arief (2012) found that biscuit products with substitute sweet potato flour had a moisture content of 0.48% - 2.40%, an ash content of 1.48% - 2.37%, a protein content of 7.24% - 9.35%, a fat content of 8.45% - 19.52%, carbohydrate content 68.27% - 80.44%, crude fiber 0.57% - 0.78%, β carotene 11.31 μ g/g - 16.69 μ g/g, vitamin C 0.05mg - 0.09mg, texture 3575 N/mm² - 4239.34 N/mm², as well as

microbiological tests which include the calculation of the total plate count (ALT) and yeast mold numbers that meet the SNI standard for biscuits. Biscuits with a 50% substitution of sweet potato flour have the best quality in terms of chemical, physical, and microbiological properties and are preferred because they have good taste, color, texture, and aroma⁽⁴⁾. Apart from these main ingredients, other ingredients can also be added to the making of complementary feeding biscuits to increase their nutritional value, for example, tempeh. A nutritionist from the Department of Nutrition, Faculty of Medicine, University of Indonesia said that tempeh contains fiber and nutrients that are easily digested so that it is good for complementary feeding for infants aged over six months. The fiber contained in tempeh is very good for preventing constipation in infants which often occurs when they are given complementary feeding. Tempeh yeast has digested the hard soybean cell walls to become soft so that the protein and other nutrients in the tempeh are easily absorbed by the digestive system. Nitrogen is part of the essential amino acid, that is found in tempeh can be better digested and absorbed to give more benefits for infants' growth and development. Besides, tempeh also contains vitamin B12 which is needed especially by the nerves⁽⁵⁾. The purpose of this study was to analyze the effect of purple sweet potato flour and tempeh substitution on the organoleptic quality of the complementary feeding biscuits.

SUBJECTS AND METHODS

Types of research

This type of research was a true experiment with a completely randomized design (CRD). The independent variable was the variation in the composition of purple sweet potato flour and tempeh and the dependent

variable was the quality of the organoleptic including color, aroma, texture, and taste. The research was conducted in the Culinary Laboratory of the Nutrition Department of the Health Polytechnic of the Ministry of Health, Sorong.

The research sample was complementary feeding biscuits with 6 variations in composition, namely X₁ (100% Wheat Flour, 0% Purple Sweet Potato Flour, 0% Tempeh), X₂ (0% Wheat Flour, 90% Purple Sweet Potato Flour, 10% Tempeh), X₃ (Wheat Flour 0%, Purple Sweet Potato Flour 80%, Tempeh 20%), X₄ (Wheat Flour 0%, Purple Sweet Potato Flour 70%, Tempeh 30%), X₅ (Wheat Flour 0%, Purple Sweet Potato Flour 60 %, Tempeh 40%), X₆ (Wheat Flour 0%, Purple Sweet Potato Flour 50%, Tempeh 50%).

Determination of the samples size using the replication formula by Montgomery (2001) ⁽⁶⁾ obtained the number of repetitions of 4 times resulted to total 24 sample units. The research instrument was the hedonic test form. Data collection was done by distributing hedonic test forms to panelists. On the hedonic test form, the panelists were asked to assess the sample on a scale of really like (4), like (3), dislike (2), and very dislike (1)⁽⁷⁾. The panelists

were 20 students of the Nutrition Department of the Health Polytechnic of the Ministry of Health, Sorong. Data processing using the SPSS computer program. Data analysis used the Kruskal-Wallis test at a 95% confidence level.

RESEARCH RESULT

Panelist Characteristics Overview

Panelists who were involved in conducting the hedonic test were 20 slightly trained panelists who were taken from students of the Nutrition Department of the Health Polytechnic of the Ministry of Health Sorong. There were 16 female panelists (80%) and 4 male panelists (20%). The panelists' ages ranged from 17 to 22 years old.

Results of the Complementary Feeding Biscuits

The complementary feeding biscuits were made with the main ingredients of purple sweet potato which is processed into flour then mixed with mashed tempeh, butter, eggs, and cheese. These ingredients are mixed until blended. The dough was then molded into a 10 grams weight, round-shaped, and then baked. These complementary feeding biscuits were made with a variety of compositions as shown in Table 1.

Table 1. Variations in the Composition Complementary Feeding Biscuits

Ingredients	Complementary Feeding Biscuits					
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆
Wheat Flour (g)	92.5	-	-	-	-	-
Purple Sweet Potato Flour(g)	-	83.25	74	64.75	55.5	46.25
Tempeh (g)	-	9.25	18.5	27.75	37	46.25
Butter (g)	62.5	62.5	62.5	62.5	62.5	62.5
Egg (g)	25	25	25	25	25	25
Cheese (g)	50	50	50	50	50	50

In order for the food served to maintain its quality, the food served must be evaluated. One way is to calculate the consumer's food acceptance. Food acceptability is the percentage of food consumed of the total provided. This acceptance is influenced by several factors, including the appearance of the food when it is served and the taste of the food ⁽⁸⁾. To find out the results of the panelists' acceptance or level of preference, an organoleptic test was carried out by testing several parameters, such as the organoleptic properties of color, aroma, texture, and taste.

Organoleptic Quality

Color

The color of a product is greatly influenced by appearance/presentation. The addition of a variety of different composition variations will result in a different color of the complementary feeding biscuit products. Based on Table 2, it can be seen that most of the panelists liked the color of the biscuits with wheat flour as a base ingredient (average value = 4.50) compared to the colors of the biscuits with variations in the composition of purple sweet potato flour and tempeh.

Table 2. Test Results of the Average Color Likeness Level

Complementary Feeding Biscuit	Replication				Mean	P-value
	R1	R2	R3	R4		
X ₁	4.80	4.25	4.30	4.65	4.50	0.046
X ₂	4.05	3.80	3.65	3.80	3.83	
X ₃	3.75	3.80	3.70	3.50	3.69	
X ₄	3.90	4.00	3.45	3.55	3.73	
X ₅	3.95	3.90	3.65	3.55	3.76	
X ₆	3.80	3.85	3.80	3.85	3.83	

Among the colors of the biscuits with variations in the composition of purple sweet potato flour and tempeh, the most preferred were X₂ and X₆ biscuits (average value = 3.83) with the composition of X₂ biscuits was 83.25 grams of purple sweet potato flour and 9.25 grams of tempeh; and X₆, namely 46.25 grams of purple sweet

potato flour and 46.25 grams of tempeh. The results of the Kruskal-Wallis statistical test showed a P value of 0.046<0.05, which means that variations in the composition of purple sweet potato flour and tempeh affected the resulting color.

Aroma

The aroma is one aspect of determining the delicacy of the food. The aroma felt by the sense of smell. The sensitivity of this sense of smell is higher than the sense of taste. Based on Table 3, it can be seen that most of the

panelists liked the aroma of biscuits with wheat flour as a base ingredient (average value = 4.23) compared to the color of the biscuits with variations in the composition of purple sweet potato flour and tempeh.

Table 3. Test Results of Mean of Favorite Aroma Levels

Complementary Feeding Biscuit	Replication				Mean	P-value
	R1	R2	R3	R4		
X ₁	4.35	4.10	4.10	4.35	4.23	0.043
X ₂	3.90	3.60	3.80	3.85	3.79	
X ₃	4.10	3.80	3.95	3.90	3.94	
X ₄	3.95	4.05	3.60	3.90	3.88	
X ₅	4.00	3.90	4.00	4.00	3.98	
X ₆	4.15	4.05	3.90	3.55	3.91	

However, among the aroma of the biscuits with variations in the composition of purple sweet potato flour and tempeh, the most preferred was the X₅biscuit with a composition of 55.5 grams of purple sweet potato flour and 37 grams of tempeh. The results of the Kruskal-Wallis statistical test showed a P value of 0.043<0.05, which means that the variation in the composition of

purple sweet potato flour and tempeh affected the resulting aroma of the biscuits.

Texture

Based on Table 4, it can be seen that most of the panelists liked the texture of biscuits with wheat flour as a base ingredient (average value = 4.08) compared to the texture of biscuits with variations in the composition of purple sweet potato flour and tempeh.

Table 4. Test Result of Meanof Preferred Texture Level

Complementary Feeding Biscuit	Replication				Mean	P-value
	R1	R2	R3	R4		
X ₁	4.25	3.90	3.65	4.50	4.08	0.172
X ₂	3.75	3.80	2.70	3.55	3.45	
X ₃	3.50	3.90	3.10	3.65	3.54	
X ₄	4.00	3.95	3.15	3.65	3.69	
X ₅	3.50	4.10	3.45	3.50	3.68	
X ₆	3.40	3.55	3.25	3.45	3.41	

Nonetheless, among the textures of biscuits with variations in the composition of purple sweet potato flour and tempeh, the most preferred is the X₄ biscuit with 64.75 grams of purple sweet potato flour and 27.75 grams of tempeh.

The results of the Kruskal-Wallis statistical test showed a P value of 0.172>0.05, which means that the variation in

the composition of purple sweet potato flour and tempeh did not affect the resulting texture of the biscuits.

Taste

Based on Table 5, it can be seen that most of the panelists liked the taste of biscuits with wheat flour as the base ingredient (average value = 4.13) compared to the color of the biscuits with variations in the composition of purple sweet potato flour and tempeh.

Table 5. Test Results of Mean of Favorite Taste Level

Complementary Feeding Biscuit	Replication				Mean	P-value
	R1	R2	R3	R4		
X ₁	4.20	4.20	3.90	4.20	4.13	0.164
X ₂	4.00	3.45	2.70	3.70	3.46	
X ₃	4.11	3.70	2.60	3.25	3.42	
X ₄	3.75	3.50	3.00	3.75	3.50	
X ₅	3.30	3.95	3.25	3.70	3.55	
X ₆	3.15	4.00	3.65	3.30	3.53	

Moreover, among the flavors of biscuits with variations in the composition of purple sweet potato flour and tempeh, the most preferred was the X₅biscuit with a composition of 55.5 grams of purple sweet potato flour and 37 grams of tempeh. The results of the Kruskal-Wallis statistical

test showed a P value of 0.164>0.05, which means that the variation in the composition of purple sweet potato flour and tempeh did not affect the resulting taste of the biscuits.

DISCUSSION

Color

The sense of sight is often used in product evaluation. Colors are the quickest and easiest to make an impression, but they are the most difficult to describe and difficult to measure. Therefore, the sense of sight is a subjective assessment but still significant in product selection. The results showed that variations in the composition of purple sweet potato flour and tempeh in the making of complementary feeding biscuits affected the color of the biscuit. The color of the biscuits is assumed to be influenced by the pigment contained in purple sweet potatoes which gives the impression of a purplish red color.

Aroma

The sensitivity of the sense of smell is higher than taste, even substances that can stimulate the sense of smell are needed less than the sense of taste. The results showed that variations in the composition of purple sweet potato flour and tempeh affected the aroma of the biscuits. The aroma is assumed to be much influenced by the composition of the ingredients used such as purple sweet potato flour which gives a distinctive purple sweet potato aroma and a strong distinctive aroma from the butter used.

Texture

The texture of a food is felt by the sense of touch. The sense of touch is not limited to special organs, but almost to the entire skin surface. Three kinds of touch stimulation originate from mechanical, physical, and chemical stimuli. The results indicate that the variation in the composition of purple sweet potato flour and tempeh did not affect the resulting texture. The texture of the biscuits is influenced by the composition of the ingredients used. The texture of the biscuits is very crunchy after baking, the grated cheese gives a slightly rough texture⁽⁹⁻¹³⁾.

Taste

Taste involves more of the senses of taste. Taste sensing can be divided into 4 main tastes which are salty, sour, sweet, and bitter. Sweet and salty are mostly detected and distinguished by the buds on the tip of the tongue while the buds at the base of the tongue are sensitive to bitterness. The results showed that the variation of the composition of purple sweet potato flour and tempeh did not affect the taste of the biscuits. The taste of the biscuits is influenced by the composition of the ingredients used, such as purple sweet potato which gives a sweet taste, while cheese and butter give a savory and salty taste⁽¹⁴⁻¹⁸⁾.

CONCLUSION

Based on the study conducted, it can be concluded that the variation in the composition of purple sweet potato flour and tempeh affected color ($p = 0.046$) and aroma ($p = 0.043$), but did not affect texture ($p = 0.172$) and taste ($p = 0.164$).

SUGGESTION

It is suggested to the next researchers to examine the nutritional content and physicochemical properties of the complementary feeding biscuits made of purple sweet potato flour and tempeh. It is recommended to make complementary biscuits made of purple sweet potato and tempeh to as an alternative to enrich and develop local food potentials with a high nutritional value which is a benefit for regional food security.

ACKNOWLEDGEMENT

We highly appreciate and thanks to the Culinary Laboratory of the Nutrition Department of the Health Polytechnic of the Ministry of Health, Sorong that have analyzed the sample accordingly.

REFERENCES

1. Anjarsari, B. 2010. *PANGAN HEWANI: Fisiologi Pasca Mortem Dan Teknologi (ANIMAL-BASED FOOD:Post Mortem Physiology and Technology)*. Graha Ilmu. Bandung.
2. Prabantini. 2010. *Makanan Pendamping ASI (Complementary Feeding)*. Andi. Yogyakarta.
3. Novita. 2012. *My Baby*. Tugu. Yogyakarta.
4. Arief, M. D. 2012. *Pemanfaatan Tepung Ubi Jalar (Ipomoea batatas (L). Lam) Cv. Cilembu sebagai Bahan Substitusi Tepung Terigu dalam Pembuatan Biskuit (Utilization of Sweet Potato Flour (Ipomoea batatas (L). Lam) Cv. Cilembu as a substitute for wheat flour in making biscuits)*. THESIS. Fakultas of Technobiology. Atma JayaUniversity. Yogyakarta.
5. Putri, M. R. D. 2012. *Tempe Baik Untuk Makanan Pendamping ASI (Tempe Is Good For Complementary Feeding)*. (Online). (www.antaranews.com, diakses 23 September 2013).
6. Montgomery, D. C. 2001. *Design and Analysis of Experiments. 5th edition*. John Wiley & Sons, Inc., Canada
7. Poste, L. M., Mackie, D. A., Butler, G., dan Larmond, E. 1991. *Laboratory Methods for Sensory Analysis of Food*. Research Branch Agriculture Canada Publication 1864/E, Canada
8. Kamaruddin Mustamir, et al. 2020. *Food Management System and Satisfaction Level of Students of Pesantren Tebuireng Jombang, East Java*. Medico-Legal Update an International Journal. Volume 20 Number 3
9. Agus Erwin Ashari, Irma Muslimin, Anwar Mallongi, The Strategy of Directly Observed Treatment Shortcourse (DOTS) Towards Compliance with Treatment of Tb Lung Patients in Tb Lung Mamuju District Hospital, Indonesia. *Sys Rev Pharm* 2020;11(1):1185-1187.
10. Gemy Nastity Handayani, Trimaya Cahya Mulat, Eka, Anwar Mallongi. Resistance Test of Some Bacterial Synthetic Calcular Cycinaris Invitro Amoxicillin and Ciprofloxacin Antibiotics in TK II Pelamonia Hospital Makassar, Indonesia. *Sys Rev Pharm* 2020;11(6):1181-1184
11. Syamsir, Birawida, A. B., and A. Faisal. "Development of Water Quality Index of Island Wells in Makassar City." In *Journal of Physics: Conference Series*, vol. 1155, no. 1, p. 012106. IOP Publishing, 2019.
12. Mallongi, A., Safiu, D., Amqam, H., Syam, A., Hatta, M., Sutarti, T., Abdul, M., Siyoto, S., Apollo., Modelling of SO₂ and CO pollution due to industry PLTD emission Tello in 2 Makassar Indonesia. *Journal of Engineering and Applied Sciences* Volume 14, Issue 2, 2019, Pages 634-640
13. Birawida, A. B., M. Selomo, and U. W. Ismita. "Environmental health hazards against bacterial contamination of cutlery on the small island of Makassar." *E&ES* 235.1 (2019): 012023.
14. Kayame, R., Mallongi, A. Relationships between smoking habits and the hypertension occurrence

- among the adults of communities in paniai regency, Papua Indonesia. *Indian Journal of Public Health Research and Development* 2018; Volume 9, Issue 1, Pages 332-336
15. Endah Yani, R.W., Mallongi, A., Andarini, S., Prijatmoko, D., Dewanti, I.R. The effect of zinc saliva on the toddlers' nutritional status. *Journal of International Dental and Medical Research*, 2016, Volume 9, Issue 1, Pages 29-32
 16. Masni, Sirajuddin, S., Syaharuddin, Syam, A. Influence of a red palm oil emulsion on the level of retinol in the plasma of primary school children in the coastal area of Makassar city., *Pakistan Journal of Nutrition* Volume 15, Issue 5, 2016, Pages 465-473
 17. Mallongi, A., Parkpian, P., Pataranawat, P., Chinwetkitvanich, S., Mercury distribution and its potential environmental and health risks in aquatic habitat at artisanal buladu gold mine in Gorontalo Province, Indonesia, *Pakistan Journal of Nutrition* Volume 14, Issue 12, 2015, Pages 1010-1025
 18. Jafar, N., Indriasari, R., Syam, A., Kurniati, Y. Exploration on adolescent knowledge related metabolic syndrome (METS) *Indian Journal of Public Health Research and Development* Volume 9, Issue 6, June 2018, Pages 263-266