RESEARCH ARTICLE OPEN ACCESS

Available at http://jurnal.utu.ac.id/jons/article/view/7182

The Effect of Adding Purple Yam Flour on the Organoleptic Properties of Biscuits

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ABSTRACT

Biscuit is a type of dry food that is popular among the community. In the making of biscuits, additional ingredients are added to increase nutritional value, such as the addition of purple yam tuber. Purple yam contains high levels of carbohydrates and calories. Its carbohydrate content has a high amylose level of 26.98-31.02%. One of the food products that can be made into a healthy snack with high fiber and nutritional value is biscuits. The aim of this study is to determine the effect of adding purple yam flour to the acceptability of biscuits as a high fiber snack. This study is experimental using a Completely Randomized Design (CRD) Non-Factorial with 3 treatments and 3 replications. To influence acceptability, sensory tests were conducted on taste, aroma, texture, and color using 25 panelists. The results showed that the acceptability of biscuits with the addition of purple yam flour from the color aspect was most preferred by panelists in treatment A (150 g) compared to B (125 g) and C (100). The addition of purple yam flour has no significant effect on taste, aroma, and texture, while there is a significant effect on color.

ARTICLE INFORMATION

Submitted: 25/2/2023
Revised: 24/03/2023
Accepted: 29/03/2023
Published Online: 31/05/2023

Keywords:
Biscuits
High fiber snacks
Purple yam
Nutritional value
Sensory tests

How to cite this article: Annisa, D., Affan, I., Ahmad, A., Muliadi, T., Fitriyaningsih, E., Nur Azizah, A. P., & Arifin, S. R. (2023). The Effect of Adding Purple Yam Flour on the Organoleptic Properties of Biscuits. *Journal of Nutrition Science, 4*(1), 6-9. doi:10.35308/jns.v4i1.7182

Introduction

Biscuit is a type of dry food that is popular among the public (Manley D, 2011). As a snack, biscuits are expected to provide energy, especially carbohydrates and fats, with added fat used to make the biscuits crispy (Firdausi, R., Hardiyanti, Y., & Trisnawati, E. (2019). Meanwhile, protein is used as fuel when the body's energy needs are not met by carbohydrates and fats (Rana, AK., & Bhattacharya, S, 2013). The development of biscuit production is increasingly diverse, such as by substituting wheat flour with other flours that have high nutritional value and are easily obtained in production to increase the economic value of biscuits. Biscuit production is also developed by utilizing natural resources that are potential in local areas (Law No. 18, 2012).

The main ingredient in making biscuits is wheat flour. A new food ingredient added is purple yam. Purple yam is a biogenic source of tubers that has not been optimally utilized. The potential of purple yam is as a source of carbohydrates, phenolic compounds, and high antioxidant anthocyanins (Oluwole, O. B., & Oluwamukomi, M. O, 2016).

Purple yam has a high content of carbohydrates and calories. Its carbohydrates have a high amylose content of 26.98-31.02% and have a stable structure at high temperatures, low pH, and are hypoglycemic. Purple yam contains nutrients and functional components such as mucin, dioscin, allantoin, choline, and essential amino acids. Purple yam contains a lot of anthocyanins (Kim, M. J et al., 2015). Purple yam is a local food that can be used as a valuable source of food. In addition to its high carbohydrate content, purple yam also has a high protein and fiber content, as well as containing vitamin C which is suitable as a good antioxidant source (Chua, M. T., Chuah, L. J., & Cheng, S. F. 2017).

The researchers' observations show that purple yam contains phenolic compounds, namely anthocyanins, which function as antioxidants (Purwaningsih, 2014). Anthocyanins are natural water-soluble pigments in the flavonoid family that produce red, blue, or purple colors. The function of anthocyanins as antioxidants is believed to be able to cure degenerative diseases. Many studies also show that another effect of anthocyanins is to

protect the stomach from damage, inhibit tumor cells, and act as anti-inflammatory compounds (Oluwole, O. B., & Oluwamukomi, M. O. 2016). Based on the observations of several researchers, it is evident that the Dioscorea alata L. tuber not only contains important nutrients but also plays an important role in preventing diseases and protecting the body from pathogen attacks (Yuniarti, N., & Susilowati, A, 2018)

The fiber content in purple yam is higher than that in corn, which is around 2.1%-2.3% in 100 grams of corn, while the fiber content in corn flour is around 1.5% in 100 grams of corn flour (Kim, M. J et al., 2015). Moreover, purple yam can also be used as a diet for diabetic patients, and raw purple yam is used to treat diarrhea (Ngwuluka, N. C et al., 2016).

The use of purple yam can be done by converting it into purple yam flour. After being converted into flour, this purple yam flour is formulated with wheat flour so that it can be processed into various products that can be accepted by the public. Based on the above description, I am interested in conducting research on the effect of adding purple yam (Dioscorea alata L) and the acceptance of biscuits as high-fiber food

Method

Experimental research was conducted using a Completely Randomized Non-Factorial Design with 3 treatments and 3 replications to test the effect of adding purple sweet potato on the acceptability of high-fiber biscuits. Trained panelists (15-25 individuals) were tested using a hedonic scale to measure their levels of liking and disliking towards the color, taste, aroma, and texture of the purple sweet potato biscuits. The study was conducted on May 25th, 2021 at the Food Science and Organoleptic Laboratory, Department of Nutrition, Poltekkes Kemenkes Aceh, Aceh Besar. Data processing was done using analysis of variance (ANOVA) and the results were analyzed using Microsoft Excel and SPSS version 20. Data was presented in both tabular and textual forms.

Results

Here are the results of the research on the effect of adding purple yam flour to biscuits on taste, aroma, texture, and color, presented in the following tables:

Table 1. Average Organoleptic Test of Taste of Biscuits with the Addition of Purple Yam Flour Treatment Average

Treatman	Average	P-Value
150 g purple yam flour(A)	3.48	
125 g purple yam flour(B)	3.40	0.827
100 g purple yam flour(C)	3.56	
Overall average	3.48	

In this study, there were 25 panelists (15 females and 10 males) aged 18-23 years who conducted an organoleptic test on the taste of biscuits with the addition of purple yam flour in three different treatments. The results of the variance analysis showed that the addition of purple yam flour did not have a significant effect on the taste of the biscuits. The average organoleptic test results showed that the panelists somewhat liked the taste of the biscuits in all three treatments.

Table 2. Average Organoleptic Test of Aroma of Biscuits with the Addition of Purple Yam Flour.

Treatman	Average	P-Value
150 g purple yam flour(A)	3.80	
125 g purple yam flour(B)	3.56	0.439
100 g purple yam flour(C)	3.84	
Overall average	3.48	

After conducting an organoleptic test on the aroma of biscuits with the addition of purple yam flour, the results of the variance analysis showed that the addition of purple yam flour did not have a significant effect on the aroma of the biscuits. However, the average organoleptic test results showed that the panelists liked the aroma of the biscuits in treatments A and C, and somewhat liked the aroma in treatment B.

Table 3. Average Organoleptic Test of Texture of Biscuits with the Addition of Purple Yam Flour.

Treatman	Average	P-Value
150 g purple yam flour(A)	3.64	
125 g purple yam flour(B)	3.64	0.950
100 g purple yam flour(C)	3.72	
Overall average	3.67	

Based on the organoleptic test results on the texture of biscuits with different amounts of purple yam flour, as shown in Table 3, the highest average score was obtained in treatment C, while the lowest average scores were obtained in treatments A and B. The overall average score for all treatments was 3.67. The results of the variance analysis showed that the P-value (0.950) > (0.05), indicating that the addition of purple yam flour did not have a significant effect on the texture of the biscuits.

Table 4. Average Organoleptic Test of Texture of Biscuits with the Addition of Purple Yam Flour.

Treatman	Average	P-Value
150 g purple yam flour(A)	3.92	
125 g purple yam flour(B)	3.80	0.032
100 g purple yam flour(C)	3.20	
Overall average	3.67	

Regarding the organoleptic test results on the color of the biscuits, as shown in Table 4, the highest average score was obtained in treatment B, while the lowest average score was obtained in treatment C. The overall average score for all treatments was 3.64. The results of the variance analysis showed that the P-value (0.032) < (0.05), indicating that

the addition of purple yam flour had a significant effect on of the biscuits.

In terms of the panelists' responses to the aroma of the biscuits with the addition of purple yam flour, it can be seen that treatment A (150 g) and B (125 g) were slightly liked, while treatment C (100 g) was liked, as shown in Tables 3 and 4.

Discussion

Purple sweet potato or purple yam (Ipomoea batatas L.) is a tuberous root vegetable that is native to Central and South America. It is known for its purple color, which comes from the presence of anthocyanins, a group of plant pigments with potential health benefits. Purple sweet potato is rich in antioxidants, fiber, and vitamins, making it a nutritious food source (Ishikawa, S., & Nishimura, N., 2018).

Studies have shown that consuming purple sweet potato can provide several health benefits. For example, anthocyanins found in purple sweet potato have been linked to a reduced risk of chronic diseases such as heart disease, diabetes, and cancer. Additionally, purple sweet potato has anti-inflammatory properties and may help improve gut health. One study investigated the impact of purple sweet potato consumption on cognitive function in older adults. The study found that consuming purple sweet potato for 12 weeks improved cognitive function and increased antioxidant levels in the blood (Chua, K.Y., & Chouu, S.T, 2017)

Another study examined the potential of purple sweet potato as a natural colorant in food products. The study found that purple sweet potato extract could be used as a natural alternative to synthetic food colorants, as it provided an attractive purple color and had no adverse effects on sensory properties. (Oluwole, O. B., & Oluwamukomi, M. O, 2016)

Based on the results of research conducted on biscuits with the addition of purple sweet potato flour, it is indicated that the treatment with 100g of purple sweet potato flour (treatment C) was relatively preferred by the panelists for the taste aspect. This is because the resulting taste of the biscuit was better than the taste of treatments A and B, in which the taste of the purple sweet potato flour was more dominant, hence liked by the panelists. Additionally, purple sweet potato has a higher sugar content than wheat flour, so the more purple sweet potato flour used, the more caramelization and Maillard reactions occur during baking. These browning reactions can cause an undesirable taste (Teng, H et al., 2019).

The results of the research also showed that the treatment with 100g of purple sweet potato flour (treatment C) was relatively preferred by the panelists for the aroma aspect. This is because the aroma of the resulting biscuit was better than that of treatments A and B, in which the aroma of purple sweet potato flour was not detected in the biscuit. Changes in aroma can be caused by the arrangement of components in the food material itself or can also be caused by interactions with other external components. The aroma plays a crucial role in determining the palatability of food material. The odor of food has a great influence on the palatability of the food material. Regarding the sense of smell, the odor is one of the important factors for the human sense of taste (Adiamo, O et al., 2019).

The treatment with the most preferred texture aspect by the panelists was treatment C. This is because the texture of the resulting biscuit was crispier when eaten compared to treatments A and B, hence liked by the panelists. Purple sweet potato flour has a higher amylose content, so the more purple sweet potato flour used, the crispier the biscuit produced. The water content in purple sweet potato flour is lower than in wheat flour, hence the lower water content in the biscuit dough with increasing purple sweet potato flour used. During baking, the steam is released, leaving behind pores, resulting in a porous biscuit structure. Additionally, water is required for gluten formation. A biscuit made with sufficient water content will have the desired crispiness (Kim et al., 2018).

The results of the research also showed that the panelists preferred the treatment A for the color aspect. This is because the resulting biscuit with a weight of 150 g had a bright purple color compared to treatments B and C, hence liked by the panelists. Color is a critical component in determining the quality or degree of acceptance of a food material. Even though a food material is perceived as delicious and has excellent texture, if it has an unpleasant color or deviates from its natural color, it should not be consumed. In general, the assessment of food material is determined by color, as color is the first thing that catches attention (Ngwuluka N et al., 2016). Color is also one of the critical physical parameters of a food material. Consumers' preferences for food products are also influenced by the color of the food. The color of a food material is influenced by the light absorbed and reflected from the material itself and is also determined by dimensional factors, i.e., product color, brightness, and clarity of the product color (Rana, A. K., & Bhattacharya, S. (2013). The water content in the biscuit dough also affects the color of the biscuit. The lower the water content in the dough, the higher the purple sweet potato flour used, resulting in a shorter baking time. With the same baking time, the heat from the oven will caramelize the sugar in the dough more, resulting in a biscuit with a darker color (Yuniarti, N., & Susilowati, A, 2018)

Conclusion

In conclusion, adding purple yam flour to biscuits can increase their nutritional value, especially in terms of fiber content. While there is no significant

effect on taste, aroma, and texture, adding 150 g of purple yam flour can enhance the color of biscuits and improve their acceptability. Therefore, incorporating purple yam flour into biscuit formulations can be a promising way to develop healthy and tasty snacks.

Acknowledgement

The authors would like to express their gratitude to all the individuals and institutions who have contributed to the completion of this research article. Special thanks to the research funding agency for their financial support, as well as to the research participants for their cooperation and time. The authors would also like to thank the editor and reviewers for their valuable comments and suggestions, which have significantly improved the quality of this article. Lastly, we would like to express our sincere appreciation to our families and friends for their continuous support and encouragement throughout this research project.

Author Contribution and Competing Interest

Teuku & Devita contributed to the conception and design of the study. Other's conducted the data collection, analysis, and interpretation. All authors have read and approved the final version of the manuscript.

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