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The Effect of Mocaf Flour and Yellow Pumpkin Flour (Cucurbita Moschata) Proportion on the Acceptability and Physicochemical Quality of Wet MI

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ABSTRACT

Overcoming dependence on wheat flour as raw material, researchers want to develop a wet noodle product by using mocaf flour to substitute wheat flour and adding pumpkin flour to increase the nutritional value of wet noodles, namely potassium minerals as an alternative main food that can help lower blood pressure in hypertension sufferers. To determine the effect of the proportion of mocaf flour and pumpkin flour on the physicochemical quality of wet noodles. This type of research uses an experimental study design with a Completely Randomized Design (CRD). The comparison of the proportions of mocaf flour and pumpkin flour is P0 (100g : 0g), P1 (95g : 5g), P2 (90g :10g), P3 (85 g :15g), P4 (80g :20g). Physical quality and chemical quality test data were analyzed using the Independent T-test. The research results show that the percent water absorption capacity; percent elongation; potassium levels; and sodium levels, namely P0 (58.5% ; 19.8% ; 16.5mg/100 g; 5.64 mg/100g), P2 (70.3% ; 8.8% ; 55.95 mg/100g ; 5.55 mg/100g). The best treatment P2 does not meet the adult RDA percentage and cannot be classified as high in potassium. Wet noodle products cannot yet be used as an alternative to foods high in potassium for preventing hypertension.

Keywords: Hypertension, wet noodles, mocaf flour, pumpkin flour.

1. INTRODUCTION

Wet noodles are a very popular food product in Indonesia, with demand continuing to increase along with population growth and urbanization. The quality of wet noodles is determined by various factors, including the composition of the flour used in the manufacturing process. Wheat flour, which is the main ingredient in making wet noodles, has several limitations, including a high gluten content which can cause health problems for some individuals as well as dependence on imports which has the potential to increase production costs. Therefore, the search for alternative flours that can replace some or all of wheat flour is important in efforts to develop wet noodle products that are healthier, more economical and environmentally friendly.

Mocaf flour (Modified Cassava Flour) and pumpkin flour (Cucurbita moschata) are two types of flour that have great potential to be used as a substitute or mixture in making wet noodles. Mocaf flour, which is made from cassava through a fermentation process, has a high fiber content and a lower glycemic index than wheat flour. Pumpkin flour, on the other hand, is rich in beta-carotene, vitamins and minerals which provide added nutritional value to wet noodle products. In addition, using pumpkin flour can also improve the color and taste of wet noodles, making them more attractive to consumers.

This research aims to evaluate the effect of the proportion of Mocaf flour and pumpkin flour on the acceptability and physicochemical quality of wet noodles. By studying the combination of these two types of flour, it is hoped that an optimal formulation can be found that not only meets quality standards and consumer preferences, but also provides health and economic benefits, especially in making wet noodles.

Consumption of wet noodles in Indonesia continues to increase, both as daily food and in the form of increasingly creative culinary variations. However, the high use of wheat flour in making wet noodles causes several problems. Apart from dependence on imports which can increase production costs, wheat flour also contains gluten which can cause digestive disorders in some people, such as people with celiac disease and non-celiac gluten sensitivity. Therefore, innovation is needed in making wet noodles using alternative ingredients that are healthier and more economical.

Mocaf flour is an innovation in the food industry that has attracted the attention of many researchers and food producers. Through a fermentation process, cassava flour is converted into Mocaf flour which has a texture and functional properties similar to wheat flour, but with a higher fiber content and a lower glycemic index. This makes Mocaf flour a potential substitute ingredient to reduce dependence on wheat flour while increasing the nutritional value of food products.

On the other hand, yellow pumpkin (Cucurbita moschata) is a local food source that is rich in nutrients, including beta-carotene, vitamin A and minerals. Pumpkin flour not only provides added nutritional value to wet noodle products, but can also improve organoleptic characteristics such as color and taste, making the product more attractive to consumers. Using pumpkin flour as a mixture in making wet noodles can diversify food products, support local food security, and reduce dependence on imported ingredients.

Hypertension is one of the most dangerous health problems in the world, because hypertension is the main risk factor that leads to cardiovascular disease such as heart attack, heart failure, stroke and kidney disease, where in 2016 ischemic heart disease and stroke became the two main causes of death in world. Nationally, the prevalence of hypertension sufferers in Indonesia has reached 34.1% with an estimated number of cases of 63,309,630 people. Based on 2018 Basic Health Research data, the highest prevalence of hypertension was in South Kalimantan Province at 44.1%. According to Fitria et al., [23] modification of daily food intake patterns is one component of lifestyle change that has the biggest role in reducing blood pressure.

In observational studies, clinical trials, and several meta-analyses by [5] stated that potassium intake has been proven to significantly reduce blood pressure responsively in hypertensive patients. Increasing potassium consumption by 4.7 g per day can reduce blood pressure by an average of 8.0/4.1 mmHg.Mocaf is a product derived from cassava flour using the principle of cassava cell modification by fermentation. The fermentation stage in the process of making mocaf flour influences the increase in nutrients, one of which is the mineral potassium. Yellow pumpkin is high in potassium minerals, based on the Indonesian Food Composition Table (2019) yellow pumpkin contains 356.2 mg of potassium. According to Hamdi*et al*., [8] The shelf life of pumpkin is around 6 months or more depending on storage. Therefore, to extend the shelf life of pumpkin and make it easier to use, it is necessary to starch the pumpkin.

Sihmawati et al., [9] stated that one of the alternative foods to replace rice in Indonesia made from wheat flour is noodles. Noodles are one of the most popular high-carbohydrate staple food products in Indonesia with total consumption of 14.2 billion packs in 2022 [10]. With increasing noodle consumption, the raw material for making noodles also increases, namely wheat flour, which is a processed wheat product. Therefore, there is a need for potential materials to be developed as substitutes or substitutes for wheat.Based on this background, to overcome dependence on wheat flour as raw materials, researchers want to develop wet noodle products by using mocaf flour to substitute wheat flour and adding pumpkin flour to increase the nutritional value of wet noodles, namely potassium minerals as an alternative main food that can help reduce blood pressure in hypertension sufferers, which are named wet noodles "Cafla" (Yellow Pumpkin Mocaf).

It is hoped that this research can make a significant contribution to the development of healthier and better quality wet noodle products by utilizing Mocaf flour and pumpkin flour. By understanding the influence of the proportions of these two flours on the acceptability and physicochemical quality of wet noodles, the food industry can adopt optimal formulations to produce products that meet the needs and preferences of modern consumers.

2. METHOD

This type of research uses an experimental study design with a completely randomized design (RAL). The treatment carried out in the experimental unit was the ratio of mocaf flour to pumpkin flour P0 (100:0), P1 (95:5), P2 (90:10), P3 (85:15), P4 (80:20). Each treatment was repeated three times. The making of "Cafla" wet noodles was carried out at the Food Technology Science Laboratory, Nutrition Department, Health Polytechnic, Ministry of Health, Banjarmasin. The organoleptic test assessment was carried out by 30 somewhat trained panelists, nutrition students from the Banjarmasin Ministry of Health Polytechnic, and research on potassium and sodium content was carried out at the Banjarbaru Industrial Research and Standardization Center Laboratory. This research was conducted in August 2023 – March 2024. This research has been approved by the Research Ethics Committee of the Muhammadiyah University of Banjarmasin and

has obtained an ethical certificate with No. 633/UMB/KE/X/2023. The main ingredients for wet noodles used are mocaf flour and pumpkin flour. The complementary ingredients used are eggs, water, salt and oil. The materials used for organoleptic tests are drinking water and samples. The materials used to test the potassium and sodium content are Aqua DM (Demineralization), distilled water, HNO3 65%, "Cafla" wet noodle samples, MERCK potassium solution (1000 ppm), MERCK sodium solution (1000 ppm), water of irrigation.

Tools used for making wet noodles include basins, bowls, spoons, analytical scales, measuring cups, sieves, apnci, micers, roll presses. The tools used for organoleptic testing are organoleptic test forms and writing instruments. The tool used to test the nutritional content of potassium and sodium isstir bar, blender, erlenmeyer, measuring cup, electric bath, analytical balance, furnace, Whatman No.42 filter paper, porcelain crucible, spatula, glass bottle and Atomic Absorption Spectrophotometer (SSA) device. The tool used to analyze water absorption capacity is an analytical scale. The tool used to analyze the elongation of wet noodles is a ruler.

In this research, wet noodles refer to research by Helen et. al. (2020) and modified with the addition of pumpkin flour from research by Khasanah and Astuti (2019). The method for making wet noodles refers to [11]. Research on wet noodles refers to (SNI 0102987-2015). The research was carried out twice, namely testing water absorption and elongation, then testing potassium and sodium levels using the Attomic Absorption Spectrophotometry (AAS) method. Then the data was statistically analyzed for nutritional content using the Independent T-test. Organoleptic test analysis used the Friedman test and continued with the Independent T-Test.

At the final stage, pDetermination of the selected formulation using the best treatment selection procedure using the De Garmo (1984) method. The best treatment is selected from the highest number of products. The best treatment results will be compared with the control. The control used was wet noodles made from mocaf flour without the addition of pumpkin flour. So that positive differences can be seen between the best treatment and the control. In this study, wet noodles P2 were the best food with a proportion of 90 g mocaf flour and 10 g pumpkin flour.

3. RESEARCH RESULTS AND DISCUSSION

RESULTS

Organoleptic Test

The panelists' acceptance of the wet noodle color hedonic test was highest in treatment P3 with an average value of 13.3 (liked it very much) while the lowest was P0 with an average value of 16.6 (disliked). The panelists' acceptance of the hedonic test for the aroma of wet noodles was highest in treatment P2 with an average value of 13.3 (very like) while the lowest was P4 with an average value of 13.3 (dislike). The panelists' acceptance of the wet noodle texture hedonic test was highest at P0 with an average value of 13.3 (very like) while the lowest was P4 with an average value of 23.3 (dislike). The panelists' acceptance of the hedonic wet noodle taste test was P2 with an average value of 10 (very like) while the lowest was P4 with an average value of 26.6 (dislike). The results of the Friedman statistical test show a p value <0.05, so there are significant differences between each hedonic test treatment (Table 1).

Table 1. Hedonic Test Results for Wet Noodles Proportion of Mocaf Flour and Yellow Pumpkin Flour

	Proportion				*p-value*
	P1	**P2**	**P3**	**P4**	
Color	3.3 (like very much)	13.3 (like very much)	13.3 (like very much)	3.3 (dislike)	0.00
Aroma	3.3 (like very much)	13.3 (like very much)	3.3 (dislike)	13.3 (dislike)	0.00
Texture	6.6 (like very much)	6.6 (dislike)	3.3 (dislike)	23.3 (dislike)	0.00
Flavor	10 (like very much)	10 (like very much)	10 (dislike)	26.6 (dislike)	0.00

**Friedman*

Best Treatment

The best treatment has been determined by de Garmo's (1984) effectiveness test. Determining the best treatment is carried out by testing the effectiveness of color, aroma, texture and taste parameters. The effectiveness test is carried out by calculating the weight and effectiveness value for each parameter to obtain a productivity value which is used to determine the best treatment. The highest average for "Cafla" wet noodles based on aroma and taste parameters is P2. Thus, P2 was chosen as the best treatment to continue with the main research stage, namely physical and chemical quality testing.

Table 3. Results of Best Treatment Analysis with Effectiveness Test

Physical Quality Test		
Treatment	**Treatment Variables (Proportion of Mocaf Flour and Yellow Pumpkin Flour)**	**Productivity Value**
P0	100g	0.59
P1	95:5 g	0.92
P2	90:10 g	0.93
P3	85:15 g	0.80
P4	80:20 g	0.11

Physical Quality Test

Research on making wet noodles with the proportion of mocaf flour and pumpkin flour has been carried out and the results obtained are presented in Table 2.

Table 2. Results of Average Physical Quality of Wet Noodles Proportion of Mocaf Flour and Yellow Pumpkin Flour

Physical Quality Test		
Variable	**Mean**	***p****
Water Absorption Capacity		
P0	58.5% a	0.002
P2	70.3% b	
Elongation		
P0	19.8% a	0.001
P2	8.8% b	

*Note: *based on Independent T-test (p<0.05)*

The highest percent water absorption capacity of wet noodles was in treatment P2 with an average value of 70.3%, while the lowest was in treatment P0 with an average value of 58.5%. Based on the Independent T-test statistical test, the p value <0.05 means that the water absorption capacity of wet noodles in each treatment is significantly different. The highest percent elongation of wet noodles was in the P0 treatment with an average value of 19.8%, while the lowest was in the P2 treatment with an average value of 8.8%. Based on the Independent T-test statistical test, the p value <0.05 means that the elongation of wet noodles in each treatment is significantly different.

Chemical Quality Test

Research on making wet noodles with the proportion of mocaf flour and pumpkin flour has been carried out and the results obtained are presented in Table 1.

Table 1. Average Results of Wet Noodle Chemical Quality Test Proportion of Mocaf Flour and Yellow Pumpkin Flour

Chemical Quality Test Per 100 grams		
Variable	**Mean±SD (%)**	***p****
Potassium Levels		
P0	16.52 ± 0.016	0.017
P2	55.95 ± 0.056	
Sodium Levels		
P0	5.64 ± 0.006	0.388
P2	5.55 ± 0.005	

*Note: *based on Independent T-test (p<0.05)*

The highest potassium content in wet noodles was found in treatment P2 with an average value of 55.95. Based on the Independent T-test statistical test, the p value <0.05 means that the potassium content of wet noodles in each treatment is significantly different. The highest sodium content in wet noodles was found in treatment P0 with an average value of 5.64. Based on the Independent T-test statistical test, the value of p>0.05 means that the sodium content of wet noodles in each treatment is not significantly different.

DISCUSSION

Organoleptic Test

Based on the results of the hedonic color test, it is known that the highest preferred result is P3, namely 13.3 with a bright yellow color. This yellow color is caused by the high content of carotenoid pigments in pumpkin so that it can be used as a natural coloring in a product. The greater the proportion of pumpkin flour, the more intense the yellow color produced. This is in line with research by Dewi [12] which states that the level of panelist acceptance of the color of wet noodles with the addition of yellow pumpkin received the highest score by the panelists. Meanwhile, the results of the hedonic test for the color of wet noodles which had the highest average dislike was treatment P4 with a yellowish white color. This color is less attractive according to panenlis compared to wet noodles with other treatments.

Based on the results of the hedonic aroma test, it is known that the highest preferred result is P2, namely 13.3 with a typical fragrant aroma of pumpkin. Nurjannah et al., [13] stated that pumpkin contains aromatic compounds in the tarpenid group, namely monoterpe hydrocarbons, sesquiterpene hydrocarbons and esters, which give the resulting wet noodles a distinctive pumpkin aroma. Meanwhile, the hedonic aroma test result with the highest unfavorable result was P4, namely 13.3, which has a strong yellow pumpkin aroma. Basically, yellow pumpkin has a pleasant aroma, so adding large amounts of pumpkin to a product can give a pleasant aroma. According to Berger [14], pumpkin produces a pleasant aroma because it contains too strong flavonoids.

Based on the results of the hedonic texture test, it is known that the highest preferred result is P0, namely 13.3 with a chewy texture. This elasticity is influenced by the use of 100% mocaf flour which has an amylose content of 19% and amylopectin of 81%. This is in line with the statement by Charles (2005, in Umri, 2016) that the low amylose and high amylopectin content in mocaf can form a gel from starch properties through the gelatinization process and the formation of strong stickiness so that it can form elastic properties. Meanwhile, the texture of wet noodles with P4 treatment had the highest average dislike. This is because the texture of the noodles feels stiff and less chewy. Pumpkin flour has a high amylose content and low amylopectin content. Amylose plays a role in reducing the stickiness of noodles and increasing the hardness of noodles, while amylopectin plays a role in increasing the elasticity of noodles and as a binding agent for flour components.

Based on the results of the hedonic taste test, it is known that the highest preferred result is P2, namely 10with a typical sweet pumpkin taste. The sweet taste of pumpkin comes from carbohydrates, most of which are fructose, which is the sweetest type of monosaccharide. Meanwhile, the taste of wet noodles with P4 treatment had the highest average dislike because it had a sweet, tending to bitter taste. This is in line with research by Cahyaningtyas [19] which states that a high proportion of pumpkin flour has a significant effect on taste parameters because the typical taste of pumpkin is very strong. This distinctive taste comes from the content of flavonoid compounds.

Physical Quality Test

Based on the results of the physical quality test of wet noodles, it is known that P2 has the highest water absorption capacity, namely 70.3%.The wet noodles in the P2 treatment not only contain mocaf flour but there is also the addition of 10 g of pumpkin flour which is high in fiber. The increased water absorption capacity of noodles given pumpkin flour is due to the fact that pumpkin contains pectin which can bind water better than the starch in mocaf flour. Even though it has been made into flour, the pectin in pumpkin is not damaged, and can even bind water well when used to make noodles. Apart from that, the fiber contained in pumpkin is thought to bind water better than the starch found in wheat flour. The increase in water content in noodles given pumpkin flour is also influenced by the high fiber content in pumpkin flour. The higher the addition of pumpkin flour, the higher the fiber content in the noodles, which causes the water content of the noodles to also increase. Fiber has the ability to absorb water so it can increase the water content of wet noodles. The very high water content in noodles, especially after boiling, is caused by the starch gelatinization occurring during the boiling process. The number of hydroxyl groups in starch molecules is very large, causing its ability to absorb water very large.

The percent water absorption capacity of the P0 control wet noodles was lower than the P2 treatment wet noodles. This is because the P0 control wet noodles only contain 100% mocaf flour. The ability to bind water is only influenced by the starch content in mocaf. Starch contains amylose and amylopectin with hydroxyl groups which have hydrophilic properties and function to bind water. Mocaf flour contains 85.6% starch which consists of amylose and amylopectin. This is reinforced by the statement according to Rahman and Mardesci [22] that the greater the number of hudroxyl groups contained in amylose and amylopectin, the more interactions will occur with hydrogen and cause more water to be bound.

The percent elongation of P0 wet noodles has the highest value because P0 wet noodles contain 100% mocaf and have lower water absorption compared to P2. Elongation can be influenced by the gluten content of the ingredients, the proportion of amylose and amylopectin and the dough process. Apart from these factors, elongation is also influenced by the composition of the dough. Protein functions as a binding agent which can influence the elasticity of the dough. Based on analysis, mocaf has high protein levels. However, the protein contained in other ingredients is not gluten which gives rise to elastic properties. It is suspected that the high elongation due to the increased use of mocaf is caused by the starch content in mocaf.

Wet noodles with P2 treatment experienced a decrease in percent elongation. This can be influenced by the high water absorption capacity of wet noodles, causing the texture of wet noodles to become softer and break easily when pulled. The relationship between water absorption capacity and elongation is inversely proportional, meaning that the higher the water absorption capacity will cause a decrease in elongation. This is because the more water that is absorbed, the softer the texture of the noodles will be. The softness of wet noodles comes from the large amount of water that is absorbed or bound, causing hydrogen bonds to form and the bonds between starch-gluten to be fewer or less dense, so that the resulting noodles will be softer if the water content is high.

Chemical Quality Test

The potassium content of wet noodles in the P2 treatment was higher than the potassium content of the control P0 wet noodles. This shows that the potassium content of "Cafla" wet noodles increases with the difference in the proportion of mocaf flour and pumpkin flour. This proves that mocaf and pumpkin flour have a potassium content that is large enough to affect the potassium content of the "Cafla" wet noodles.

However, "Cafla" wet noodles cannot be said to be a functional food source of potassium or high in potassium. The potassium content in wet noodles is 559.5 mg per serving, less than the potassium requirement per day as a main food if it is said to be a source of potassium, namely 940 mg per serving. Wet noodles can be used as a main food by meeting 20-25% of energy needs. This refers to BPOM RI regulation No. 9 of 2016 concerning Nutrition Label Reference for the public, energy requirements are 2,150 kcal, protein 60 grams, fat 67 grams, carbohydrates 324 grams, dietary fiber 30 grams, potassium 4700 mg.

The source of potassium in "Cafla" wet noodles is different for each treatment. This can be seen from the different amounts of increase in potassium levels between treatments P0 and P2. The potassium level in the P0 treatment was around 165.2 mg/kg, so it can be concluded that the source of potassium in the P0 treatment was only mocaf flour. Based on information on the nutritional value of the Ladang Lima mocaf flour used, it contains 235 mg/100 g of mocaf flour. Suiraoka I (2012, in [28]) said that the process of cooking food can cause a loss of potassium in food ingredients. The potassium levels in the P2 treatment increased to around 394.3 mg/kgd from the control treatment, where this amount was greater than the potassium content of 100% mocaf wet noodles. Thus, it can be seen that the increase in potassium levels comes from increasing the proportion of pumpkin flour.

The research results showed that there was no real difference between the sodium content of "Cafla" wet noodles and the proportion of mocaf flour and pumpkin flour with a confidence level of 5%. The sodium content of the P0 control wet noodles was higher because the sodium content in mocaf flour was quite high, namely 14 mg compared to the sodium content in yellow pumpkin. Thus, treatment P2 contained lower sodium levels because the proportion of mocaf was reduced and the proportion of yellow pumpkin increased but with low sodium levels.

The boiling process can cause a decrease in the sodium content of "Cafla" wet noodles. This is thought to be caused by the release of sodium ions from the wet "Cafla" noodles with the release of water due to the influence of heating. Sodium is distributed in extracellular and intracellular fluids so it is very sensitive to high temperatures. Salts dissolved in water may be hydrated or hydrolyzed. Sodium intervenes more optimally so

that the transfer of sodium ions out of the cells is greater, this causes more sodium to be lost than potassium when in the aquatic environment during boiling. However, the sodium content in "Cafla" wet noodles is relatively low or less than the daily sodium requirement. This refers to BPOM RI regulation no. 9 of 2016 concerning Nutrition Label Reference for the public, with a sodium mineral requirement of 1500 mg/day.

For hypertensive patients, sodium intake is limited to 1.5 g/day or 3.5 – 4 g/day. The sodium content in "Cafla" wet noodles with the best treatment is 55.5 mg/kg or 0.05 g. This shows that the "Cafla" wet noodle product is safe to consume for hypertension sufferers because its sodium content is below the daily sodium consumption limit for hypertension sufferers. Although not all hypertensive patients are sensitive to sodium, limiting sodium intake can form a pharmacological therapy to reduce blood pressure and reduce the risk of cardiovascular disease.

4. CONCLUSION

The proportion of mocaf flour and pumpkin flour influences the percent water absorption capacity, elongation and potassium content of wet noodles. However, the proportion of mocaf flour and pumpkin flour did not significantly affect the sodium content of wet noodles. However, treatment P2 was the best treatment with a proportion of 90 g mocaf flour and 10 g pumpkin flour which had a potassium content of 55.95 mg/100 g and a sodium content of 5.55 mg/100 g. The P2 wet noodle product does not meet the adult RDA% and cannot be claimed as an alternative to high potassium foods for preventing hypertension.

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