

# High-Potassium Interlude Foods for Hypertensive Patients

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**Abstract:-** Hypertension is one of the main problems in developed and developing countries. Someone who has hypertension is often associated with high levels of sodium in the body, so the body needs minerals in the form of potassium which is able to complete the function of sodium. This study aims to develop high-potassium distilled food products in the form of mud cakes with the substitution of king banana flour for patients with hypertension. The design used in this study was a Completely Randomized Design (CRD) 4 treatment formulation of plantain flour with as many repetitions as many 5 times. Based on the results of the study, mud cakes with the proportion of king banana flour 25% and wheat flour 75% produced the best mud cakes product from the results of the organoleptic test. The results of the mud cake chemical test with the best treatment had 233.6 kcal of energy, protein content of 3.94%, fat 5.70%, carbohydrate 41.55%, ash 0.98%, water 47.83% and potassium 88.6 mg. The physical test results in the form of a mud cakes texture analyzer with the best treatment that is equal to 4.06 N. For one time consumption, patients are encouraged to consume 2 pieces of mud cakes with a content of 256.96 kcal, 4.3 grams of protein, 6.27 grams of fat, 45.71 grams of carbohydrates, and 97.46 mg of potassium. Within a day, the patient will be given 2 snack meals.

**Keywords:-** Hypertension; Mud Cakes; Potassium; King Banana Flour; Serving Size.

## I. INTRODUCTION

Hypertension is one of the diseases caused by an increase in blood pressure, namely where systolic blood pressure can be greater or equal to 140 mmHg and it can also be said that there is an increase in blood pressure if the diastolic blood pressure is greater than or equal to 90 mmHg [1]. Based on data from the Basic Health Research (RISKESDAS) survey of the Republic of Indonesia (2018) explained that the prevalence of hypertension based on measurement results in Indonesia in the population aged  $\geq 18$  years was 31.7% in 2007, 25.8% in 2013, and 34.1% in 2018. Where from this it can be known that the prevalence of hypertension in Indonesia is unstable [2].

A person who has hypertension is often associated with high levels of sodium in the body because excess sodium intake will cause the body to retain fluid so that blood volume

increases. This causes the heart to have to pump hard to push the increased blood volume through a narrow space so that hypertension occurs. In dealing with hypertension caused by high levels of sodium in the body, there is a mineral content in the form of potassium which is able to complete the function of sodium where potassium functions to remove fluid from the extracellular part and then lower blood pressure [3].

The mechanism of how potassium overcomes the occurrence of hypertension, namely potassium is able to lower blood pressure by vasodilation resulting in a decrease in total peripheral retention and increasing cardiac output, potassium has a function as a diuretic, namely removing excess salts, especially sodium and water through urine, potassium is able to change the activity of the renin-angiotensin system, potassium has the ability to regulate peripheral and central nerves that can affect blood pressure [4].

Potassium content is very easy to obtain in foodstuffs that we encounter daily, such as in staple foods, vegetables, and fruits but due to poor diet and lack of knowledge about the selection of types of food ingredients that contain potassium can be the cause of potassium deficiency in the body [4]. Some food sources, especially in fruits that contain high potassium, namely bananas. Banana fruit has a higher potassium content than other fruits Lone et al. [5]. In 100 grams of banana itself has a potassium content of 435 mg. Consuming bananas can meet 23% of daily potassium needs [6].

Bananas are a fruit that is widely available in the community. Bananas are one of the natural sources of minerals especially potassium Yuni et al. [7]. Some types of bananas have different potassium content. The type of banana that has the highest potassium content is plantain. Plantain has a potassium content of 831.42 mg per 100 grams [8].

Bananas can be processed into flour because they have a high carbohydrate content and are stored in the form of starch [9]. The benefits of processing bananas into flour can extend the durability of bananas without reducing the nutritional value of the fruit. The potassium mineral content in bananas after processing increases by 783 – 988 mg per 100 grams because the higher the drying temperature, the lower the moisture content in the ingredients [10]. Banana flour is usually a processed ingredient in the manufacture of cakes,

bread, biscuits, soufflé, pastries, and ice cream [11]. In this study, plantain flour was used as an ingredient in the processing of mud cakes, where mud cakes are wet cakes that are in great demand by the public. According to the Ministry of Finance [12] explained that in 2015 there were 64.918 wet cakes that have been consumed in a year [12].

Mud cakes are wet cakes that are usually round flat, yellowish in color, sweet and savory in taste and have a soft texture that is processed by the roasting process. Mud cakes are so popular with the public that they are often served at traditional events or traditional events. The nutritional content of mud cake consists of carbohydrates 44.1%, fat 11.1%, protein 3.6%, water 40.1% and energy 291 kcal [13]. Mud cakes are in great demand by the public with businesses that sell mud cakes with various flavors but the raw material used is still wheat flour [14].

Based on the description above, a study was conducted with the aim of determining the characteristics of high-potassium interlude food products in the form of mud cakes with the substitution of plantain fruit flour for people with hypertension.

**II. METHODS**

This study used the true experimental method. The research design used was a Complete Randomized Design (RAL). This study used 4 treatments and 6 tests. The research was conducted at the Food Processing Laboratory of the Department of Agricultural Technology and the Food Analysis Laboratory of the Department of Agricultural Technology from November to May 2021.

The observation parameters are testing potassium levels, physical properties (hardness), organoleptic (hedonic quality test and hedonic test), determining the best treatment, nutritional composition (energy, protein, fat, and carbohydrates), comparing the nutritional composition of mud cakes from the results of the study with SNI wet cakes, and determining serving doses.

Organoleptic tests including hedonic quality tests and hedonic tests were conducted by 25 semi-trained panelists. The data obtained from this study there are 2 types of data, namely ordinals and ratios. The results of data analysis include analysis of potassium levels and physical properties (hardness) with ratio data types processed using Microsoft Excel 2010 and analyzed normality tests using SPSS v.24 to determine whether the data is normally distributed or not. If the data is normally distributed, it is continued using the One-Way Anova test, while if there is a significant difference, it is continued using the Tukey test with a 5% accuracy level ( $p < 0.05$ ). If the data is not normally distributed, it is continued using the Kruskal - Wallis's test. If there is a significant difference, continue using the Mann - Whitney test.

The ordinal data type, namely organoleptic tests (hedonic tests and hedonic quality) was processed using

Microsoft Excel 2010 and then analyzed with SPSS v. 24 using a type of non-parametric statistical test, namely Kruskal - Wallis. If there is a significant difference, continue using the Mann - Whitney test. The results obtained from the calculations.

**III. RESULTS**

*A. Chemical analysis of potassium content*

The results of the analysis of potassium content contained the highest value in the P4 treatment with a value of 317 mg while the lowest value in the P1 treatment with a value of 88.6 mg. Analysis of data on the potassium content of mud cakes with the substitution of plantain flour was carried out normality test and obtained results with a sig value of 0.023 ( $\text{sig} < 0.05$ ) showed that the data were not normally distributed so it was continued using the Kruskal - Wallis statistical test. The results of the Kruskal - Wallis's test are shown in Table 1 below.

TABLE I. KRUSKAL TEST RESULTS – WALLIS AND MANN WHITNEY TEST ANALYSIS OF POTASSIUM CONTENT

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	88,6 <sup>a</sup>	0,000*
P2 (50% Plantain Flour: 50% Flour)	161,8 <sup>b</sup>	
P3 (75% Plantain Flour: 25% Flour)	232,2 <sup>c</sup>	
P4 (100% Plantain Flour: 0% Flour)	317 <sup>d</sup>	

<sup>a</sup>The data is the result of a recapitulation of 5x replays and the same letter shows no real difference according to the Mann Whitney Test ( $\text{sig } P \leq 0.05$ ).

The results in the table above show that the four-plantain flour substitution mud cakes have significantly different potassium content values, this can be seen from the P value ( $0.000 < F_{\text{table}} (0.05)$ ). Based on the results of the Kruskal - Wallis's test, testing of the analysis data of the potassium content of mud cakes with the substitution of plantain flour can be continued using the Mann - Whitney test to determine the degree of difference in each treatment.

The results of the Mann - Whitney Test analyzed the potassium content in mud cakes with the substitution of plantain flour, namely that there was a significant difference between the four treatments with evidence of different letter notations in each treatment. The average value in the analysis of the potassium content of mud cakes with the substitution of plantain flour has increased along with the increasing proportion of plantains so that the more plantain flour that is added, the greater the value of the potassium content in it.

This has been explained in research conducted by Panjaitan [15] which mentions that the addition of composite flour aims to increase the nutritional content of a product. Especially the addition of banana flour turns out to make a great contribution to the potassium content of a product

produced. In the P1 to P4 treatment, plantain flour is added with different proportions so that the results obtained have a very far difference. The addition of plantain flour is carried out to increase the nutritional value in the form of potassium in mud cake products. Based on the data listed on the Indonesian Food Composition Table [8], Laboratory tests on potassium levels in plantains are 831.42 mg in 100 grams of plantain and when processed into banana flour can increase by 783 – 988 mg per 100 grams.

**B. Analysis of physical properties of texture hardness**

The results of the physical test in the form of texture hardness can be produced the highest value in the P1 treatment with a value of 4.06 N while the lowest value in the P2 treatment with a value of 2.15 N. Analysis of physical test data in the form of hardness of mud cake texture with the substitution of plantain flour was carried out using a normality test and obtained results with a sig value of 0.249 (sig > 0.05) indicates that the data is normally distributed so that it can be continued using the One Way Anova statistical test. In Table 2 there are results from the One Way Anova and Tukey Test statistical tests.

TABLE II. ONE WAY ANOVA TEST RESULTS AND TUKEY TEST OF PHYSICAL PROPERTIES (TEXTURE HARDNESS)

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	4,06 <sup>b</sup>	0,002*
P2 (50% Plantain Flour: 50% Flour)	2,15 <sup>a</sup>	
P3 (75% Plantain Flour: 25% Flour)	3,29 <sup>ab</sup>	
P4 (100% Plantain Flour: 0% Flour)	3,03 <sup>ab</sup>	

<sup>b</sup>The data is the result of 5x replays and the same letter shows no real difference according to the Tukey Test.

The results in the table above show that there is a significant or noticeable difference in each mud cake treatment with plantain flour substitution as evidenced by P value (0.002) < F<sub>table</sub> (0.05). This shows that there is an influence of the addition of the proportion of plantain flour on the physical properties (texture hardness) of the mud cake produced. The results of the physical properties (texture hardness) of mud cakes with the substitution of plantain flour can be continued using the Tukey test to determine the degree of difference in each treatment. The results of the Tukey test can prove that the existence of a different notation is real. The P1 treatment is no different from the P3 and P4 treatments. The treatment of P2 is significantly different from P3 and P4. The average value of the physical test (texture hardness) of mud cakes with plantain flour substitution was different in each treatment.

According to research conducted by Yasinta et al. [16] said that the higher the substitution of banana flour causes crispness in cookies because the moisture content contained in banana flour is lower than that of wheat flour. The hardness of mud cakes can also be influenced by the fiber content of

plantain flour, which is 30 grams per 100 grams. On research conducted by Jagat et al. [17] said that fiber is one of the foodstuffs formed from the hard cell walls of plants that affect the crispness of biscuits.

**C. Organoleptic test (hedonic and hedonic quality test)**

Organoleptic test is carried out by conducting hedonic quality tests and hedonic tests which include texture, color, taste, and aroma parameters. A hedonic quality test is a test carried out to determine the sensory characteristics of a sample. The test was carried out by 25 semi-trained panelists who aimed to provide a fairly good assessment of the characteristics of the sample. The value in each hedonic quality test has been determined. A hedonic test is a test performed to assess a panelist's liking for a sample. There are several predefined liking criteria in hedonic test assessments.

**D. Hedonic quality test**

The results of the recapitulation of hedonic quality tests on textures can be produced the highest value in the P2 treatment with a value of 3.91, namely the resulting criteria have a soft texture and the lowest treatment is found in P4 with a value of 2.8, namely the resulting criteria have a rather hard texture. The results of the assessment produced by the panelists on the hedonic quality of the texture of mud cakes with the substitution of plantain flour were tested using the Kruskal – Wallis statistical test. The results of the Kruskal - Wallis's test and the Mann Whitney test can be seen in Table 3.

TABLE III. TEST HEDONIC QUALITY OF MUD CAKE TEXTURE WITH PLANTAIN FLOUR SUBSTITUTION

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	3,84 <sup>c</sup>	0,001*
P2 (50% Plantain Flour: 50% Flour)	3,91 <sup>c</sup>	
P3 (75% Plantain Flour: 25% Flour)	3,32 <sup>b</sup>	
P4 (100% Plantain Flour: 0% Flour)	2,81 <sup>a</sup>	

<sup>c</sup>The data is the result of 5x replays and the same letter shows no noticeable difference according to the Mann Whitney Test (sig P ≤ 0.05).

The results of the analysis of hedonic quality test statistical data on textures using the Kruskal - Wallis's test found in Table 3. showed that there was a significant difference in the texture of mud cakes with the substitution of plantain flour as evidenced by P value (0.001) < F<sub>table</sub> (0.05). Based on the results of the Kruskal – Wallis's test, testing of hedonic quality data on the texture of mud cakes with plantain flour substitution can be continued using the Mann – Whitney test. The results of the Mann – Whitney test on the hedonic quality of mud cake texture with banana flour substitution showed a noticeable difference in the P3 and P4 treatments as evidenced by different notations. Then for P1 and P2 have the same notation so that the results obtained do not differ markedly. This is influenced by the addition of the proportion

of plantain flour used in making mud cakes. In P1 and P2 the flour used in making mud cakes is still dominant wheat flour so that the resulting texture is soft while in the P3 and P4 treatments it has used the addition of plantain flour in larger portions so that the resulting texture is much different, which is a bit hard.

According to research conducted by Ramadhani et al. [18] that the higher the concentration of banana flour used, the lower the average value on the texture. This is due to the water content contained in the mud cake raw materials, namely banana flour is lower than wheat flour, where in banana flour there is a moisture content of 8.66% while in wheat flour it is 14%. The hardness of mud cakes can also be influenced by the fiber content of plantain flour, which is 30 grams per 100 grams. On research conducted by Jagat et al. [17] said that fiber is one of the foodstuffs formed from the hard cell walls of plants that affect the crispness of biscuits. The results of the recapitulation of hedonic quality tests on color can be produced the highest value in the P2 treatment with a value of 3.75, namely the criteria produced are brown and the lowest treatment is found in P4 with a value of 3.34, namely the criteria produced are light brown. Color can affect the attractiveness of a product. The results of the Kruskal - Wallis's test and the Mann Whitney test can be seen in Table 4.

TABLE IV. TEST HEDONIC QUALITY OF MUD CAKE COLOR WITH PLANTAIN FLOUR SUBSTITUTION

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	3,49 <sup>b</sup>	0,005*
P2 (50% Plantain Flour: 50% Flour)	3,75 <sup>c</sup>	
P3 (75% Plantain Flour: 25% Flour)	3,46 <sup>b</sup>	
P4 (100% Plantain Flour: 0% Flour)	3,34 <sup>b</sup>	

<sup>d</sup>The data is the result of a recapitulation of 5x replays and the same letter shows no real difference according to the Mann Whitney Test (sig P ≤ 0.05).

The results of the analysis of hedonic quality test statistical data on colors contained in table 4 showed that there was a significant difference in the color of mud cakes with the substitution of plantain flour can be seen P value (0.005) < Ftable (0.05). The results showed that the use of plantain flour substitution in making mud cakes affected the color of the mud cakes. Based on the results of the Kruskal – Wallis's test, testing the hedonic quality data of mud cake color with plantain flour substitution can be continued using the Mann – Whitney test to determine the degree of difference in each treatment.

Mann Test Results – Whitney hedonic color quality in mud cakes with banana flour substitution, namely P2, there is a noticeable difference with P1, P3, and P4. Then on P1, P3, and P4 no noticeable difference can be seen from the same notation. P1 to P4 treatment contains the addition of plantain

fruit flour which is different for each treatment. The resulting color is like light brown on P1, P3, and P4, while the brown color resulting from the P2 treatment is evidenced in writing results that are not much different.

The brown color results from the enzymatic browning reaction by banana fruit and the non-enzymatic produced by sugar. The enzymatic browning reaction is caused by the presence of the polyphenol oxidase enzyme which produces a yellow color pigment and then turns brown. This can happen to fruits such as apples, bananas, pears, and grapes. Meanwhile, non-enzymatic browning reactions occur when food processing takes place, which can occur in sugar and plain bread [19].

The results of the recapitulation of hedonic quality tests on taste can be produced the highest value in the P1 treatment with a value of 3.44, namely the criteria produced have a slightly sweet taste and the lowest treatment is found in P4 with a value of 2.85, namely the resulting criterion has a slightly sweet taste. A hedonic quality test of the taste was carried out to obtain an assessment of the taste characteristics of mud cakes by substituting plantain flour per treatment. The results of the assessment produced by the panelists on the hedonic quality of mud cake flavor with the substitution of plantain flour were tested using the Kruskal – Wallis statistical test. In Table 5 are the results of the Kruskal Wallis and Mann – Whitney Tests.

TABLE V. TEST HEDONIC QUALITY OF MUD CAKE FLAVOR WITH PLANTAIN FLOUR SUBSTITUTION

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	3,44 <sup>c</sup>	0,001*
P2 (50% Plantain Flour: 50% Flour)	3,43 <sup>c</sup>	
P3 (75% Plantain Flour: 25% Flour)	3,11 <sup>b</sup>	
P4 (100% Plantain Flour: 0% Flour)	2,85 <sup>a</sup>	

<sup>e</sup>The data is the result of 5x replays and the same letter shows no real difference according to the Mann - Whitney Test.

Based on the results of the Kruskal - Wallis's test, it was shown that there was a significant or noticeable difference in each mud cake treatment with the substitution of plantain flour as evidenced by P value (0.001) < Ftable (0.05). This shows that there is an effect of increasing the proportion of plantain flour on the taste of the mud cake produced, so that hedonic quality tests on the taste of mud cakes with the substitution of plantain flour can be continued using the Mann - Whitney test to determine the degree of difference in each treatment.

The results of the Mann - Whitney test can be known that the presence of different notations is noticeable. The treatment of P3 and P4 is significantly different as evidenced by different notations. The treatment of P1, and P2 has no real difference is evidenced by the same notation.

Assessment of the hedonic quality of the taste of the mud cake with the substitution of plantain flour resulted in a slightly sweet taste criterion. The assessment of the hedonic quality of taste in the four treatments was not much different. This is explained in a study conducted by Yasinta et al. [16] that the raw material of banana flour comes from banana fruit with a maturity level of three-quarters of ripe has not been reduced to sugar so there is no sweetness in banana flour just as there is no sweetness in wheat flour due to the relatively low sugar content. However, in the research conducted by Rangkuti [20] There is a statement that the addition of the proportion of plantain flour affects the taste of mud cakes because the more proportion of banana flour added, the more pronounced the banana flavor will be in a product.

The results of the recapitulation of hedonic quality tests on aromas can be produced the highest value in the P1 treatment with a value of 3.17, namely the criteria produced are slightly fragrant and the lowest treatment is found in P4 with a value of 2.60, namely the criteria produced with a slightly fragrant aroma. The results of the assessment produced by the panelists on the hedonic quality of the aroma of mud cakes with the substitution of plantain flour were tested using the Kruskal – Wallis statistical test. The results of the Kruskal – Wallis and Mann Whitney tests can be seen in Table 6.

TABLE VI. TEST HEDONIC QUALITY OF MUD CAKE AROMA WITH PLANTAIN FLOUR SUBSTITUTION

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	3,17 <sup>c</sup>	0,009*
P2 (50% Plantain Flour: 50% Flour)	3,10 <sup>c</sup>	
P3 (75% Plantain Flour: 25% Flour)	3,03 <sup>b</sup>	
P4 (100% Plantain Flour: 0% Flour)	2,60 <sup>a</sup>	

<sup>f</sup>The data is the result of 5x replays and the same letter shows no real difference according to the Mann Whitney Test (sig P ≤ 0.05).

The results of the analysis of hedonic quality test statistical data on the aroma contained in table 6 showed that there was a significant difference in the aroma of mud cake with the substitution of plantain flour as evidenced by P value (0.009) < Ftable (0.05). Based on the results of the Kruskal – Wallis’s test, testing of hedonic quality data on the aroma of mud cakes with the substitution of plantain flour can be continued using the Mann – Whitney test. The results of the Mann – Whitney test on the hedonic quality of the aroma of mud cakes with the substitution of plantain flour showed a noticeable difference in P4. It is characterized by P4 having a different notation than all treatments. Then P1, P2, and P3 have the same notation so that the results obtained do not differ markedly.

The assessment of the hedonic quality of the aroma of the mud cake with the substitution of plantain flour produces

a scent criterion that is not much different, that is, it is slightly fragrant. According to research conducted by Rangkuti [20] The use of the percentage of banana flour in the manufacture of a product affects the aroma produced but banana flour has the disadvantage that the banana aroma is not strong enough. So, the resulting criteria are almost the same, which is a bit fragrant. But in the research conducted by Sutedja et al. [21] said that the aroma of bananas is increasingly noticeable along with the addition of banana flour in a food product, this is because bananas have a volatile compound, namely isoamil acetate which affects the aroma of mud cakes with banana flour raw materials. Isoamil acetate is a compound found in banana fruit and has a function as an aroma-forming. The results of the hedonic test recapitulation of textures can be produced the highest value in the P1 treatment with a value of 3.78, namely the criteria produced by likes and the lowest treatment is found in P4 with a value of 2.93, which is the usual resulting criterion. The results of the assessment produced by the panelists on the hedonic texture of mud cakes with banana flour substitution were tested using the Kruskal – Wallis statistical test. The results of the Kruskal - Wallis’s test and the Mann Whitney test can be seen in Table 7.

TABLE VII. HEDONIC TEST OF MUD CAKE TEXTURE WITH PLANTAIN FLOUR SUBSTITUTION

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	3,78 <sup>c</sup>	0,002*
P2 (50% Plantain Flour: 50% Flour)	3,43 <sup>b</sup>	
P3 (75% Plantain Flour: 25% Flour)	3,15 <sup>a</sup>	
P4 (100% Plantain Flour: 0% Flour)	2,93 <sup>a</sup>	

<sup>g</sup>The data is the result of 5x replays and the same letter shows no noticeable difference according to the Mann Whitney Test (sig P ≤ 0.05).

The results of the analysis of hedonic test statistical data on the texture contained in table 7 showed that there was a significant difference in panelists' liking for mud cake texture with the substitution of plantain flour which can be proven by P value (0.002) < Ftable (0.05). The results showed that the use of plantain flour substitution in making mud cakes influenced panelists' liking for the texture of each treatment mud cake. Based on the results of the Kruskal – Wallis’s test, testing of hedonic data on mud cake texture with plantain flour substitution can be continued using the Mann – Whitney test to determine the degree of difference in panelists' liking for the texture of mud cakes in each treatment.

Mann Test Results – Whitney hedonic mud cake texture with plantain flour substitution, namely P1 and P2, there is a real difference with P3 and P4 as evidenced by different notations. Then P3 is not significantly different from P4 can be seen from the same notation. A hedonic assessment of the texture of mud cakes with the substitution of plantain flour yielded an average value of 2.93 to 3.78 with the criterion of liking the resulting texture, which is ordinary to like.

Panelists prefer mud cakes that have a soft texture, but it turns out that with each addition of plantain flour, the resulting texture gets harder / tighter. This is because banana flour has a lower moisture content than wheat flour, where banana flour has a moisture content of 8% while in wheat flour it is 14% Yasinta et al. [16]. The hardness of mud cakes can also be influenced by the fiber content of plantain flour, which is 30 grams per 100 grams. In a study conducted by Jagat et al. [17] said that fiber is one of the foodstuffs formed from the hard cell walls of plants that affect the crispness of biscuits.

The results of the recapitulation of hedonic tests on color can be produced the highest value in the P1 treatment with a value of 3.73, namely the criteria produced by likes and the lowest treatment is found in P4 with a value of 2.70, which is the usual resulting criterion. The results of the assessment produced by the panelists on the hedonic color of mud cakes with the substitution of banana flour were tested using the Kruskal – Wallis statistical test. The results of the Kruskal - Wallis’s test and the Mann Whitney test can be seen in Table 8.

TABLE VIII. TEST HEDONIC MUD CAKE COLOR WITH PLANTAIN FLOUR SUBSTITUTION

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	3,73 <sup>cd</sup>	0,001*
P2 (50% Plantain Flour: 50% Flour)	3,62 <sup>c</sup>	
P3 (75% Plantain Flour: 25% Flour)	3,08 <sup>b</sup>	
P4 (100% Plantain Flour: 0% Flour)	2,70 <sup>a</sup>	

<sup>a</sup>The data is the result of 5x replays and the same letter shows no noticeable difference according to the Mann Whitney Test (sig P ≤ 0.05).

The results of the analysis of hedonic test statistical data on colors contained in table 8 showed that there was a significant difference in panelists' liking for mud cake colors with the substitution of plantain flour which can be proven by P value (0.001) < Ftable (0.05). The results showed that the use of plantain flour substitution in making mud cakes influenced the panelists' liking for the color of the mud cakes of each treatment. Based on the results of the Kruskal – Wallis’s test, testing of hedonic data on mud cake color with plantain flour substitution can be continued using the Mann – Whitney test to determine the degree of difference in panelists' liking on the color of mud cakes in each treatment. Mann Test Results – Whitney hedonic mud cake color with plantain flour substitution namely P3 and P4 there are real differences as evidenced by different notations. Then on P1 and P2 no noticeable difference can be seen from the same notation. A hedonic assessment of the color in mud cakes with the substitution of plantain flour yielded an average value of 2.70 to 3.73 with the criteria of liking the resulting color, which is ordinary to like.

The average level of panelists' liking for the color of mud cakes was in the P1 treatment, where the proportion of plantain flour added was still small with the resulting light brown color. But in fact, the more plantain flour is added, the browner the color will be. The brown color results from the enzymatic browning reaction by banana fruit and the non-enzymatic produced by sugar. The enzymatic browning reaction is caused by the presence of the polyphenol oxidase enzyme which produces a yellow color pigment and then turns brown. This can happen to fruits such as apples, bananas, pears, and grapes. Meanwhile, non-enzymatic browning reactions occur when food processing takes place, which can occur in sugar and plain bread [19].

The results of the hedonic test recapitulation of taste can be produced the highest value in the P1 treatment with a value of 3.61, namely the criteria produced by likes and the lowest treatment is found in P4 with a value of 2.96, which is the usual resulting criterion. The results of the assessment produced by the panelists on the hedonic taste of mud cakes with banana flour substitution were tested using the Kruskal – Wallis statistical test. The results of the Kruskal - Wallis’s test and the Mann Whitney test can be seen in Table 9.

TABLE IX. TEST HEDONIC MUD CAKE FLAVOR WITH PLANTAIN FLOUR SUBSTITUTION

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	3,61 <sup>c</sup>	0,001*
P2 (50% Plantain Flour: 50% Flour)	3,34 <sup>b</sup>	
P3 (75% Plantain Flour: 25% Flour)	3,33 <sup>b</sup>	
P4 (100% Plantain Flour: 0% Flour)	2,96 <sup>a</sup>	

<sup>a</sup>The data is the result of 5x replays and the same letter shows no real difference according to the Mann Whitney Test (sig P ≤ 0.05).

The results of the analysis of hedonic test statistical data on taste found in table 9 showed that there was a significant difference in panelists' liking for mud cake flavor with the substitution of plantain flour which can be proven by P value (0.000) < Ftable (0.05). The results showed that the use of plantain flour substitution in making mud cakes influenced the panelists' liking for the taste of each treatment mud cake. Based on the results of the Kruskal – Wallis’s test, testing of hedonic data on mud cake flavors with plantain flour substitution can be continued using the Mann – Whitney test to determine the degree of difference in panelists' liking for the taste of mud cakes in each treatment.

Mann Test Results – Whitney hedonic mud cake flavor with plantain flour substitution namely P1 and P4 there are real differences as evidenced by different notations. Then on P2 and P3 no real difference can be seen from the same notation. The P1 and P4 treatments included the addition of plantain flour, which was significantly different in proportion so that the panelists' level of liking for mud cakes was

different. This is because the more the proportion of plantain flour, the lower the panelist's favorability level but this is still acceptable to panelists because it is still in the ordinary/neutral category. The P2 and P3 treatments have almost similar flavors because the proportion of plantain flour is not much different so that the panelists' favorability level is almost the same. A hedonic assessment of the taste in mud cakes with the substitution of plantain flour yielded an average value of 2.96 to 3.61 with the criteria of liking the resulting taste, which is ordinary to like.

The panelists' liking level for the five treatments based on hedonic quality assessment of the taste of mud cakes was slightly sweet. This is explained in a study conducted by Yasinta et al. [16] that the raw material of banana flour comes from banana fruit with a maturity level of three-quarters of ripe has not been reduced to sugar so there is no sweetness in banana flour just as there is no sweetness in wheat flour due to the relatively low sugar content. However, the more proportion of banana flour added, the more pronounced the banana flavor produced [20].

The results of the hedonic test recapitulation of aromas can be produced the highest value in the P2 treatment with a value of 3.30, namely the usual resulting criteria and the lowest treatment is found in P4 with a value of 3.02, which is the usual resulting criterion. The results of the assessment produced by the panelists on the hedonic aroma of mud cakes with banana flour substitution were tested using the Kruskal – Wallis statistical test. The results of the Kruskal - Wallis's test and the Mann Whitney test can be seen in Table 10.

TABLE X. TEST HEDONIC AROMA OF MUD CAKES WITH PLANTAIN FLOUR SUBSTITUTION

Treatment	Average (mg)	P value
P1 (25% Plantain Flour: 75% Flour)	3,28 <sup>b</sup>	0,038*
P2 (50% Plantain Flour: 50% Flour)	3,30 <sup>b</sup>	
P3 (75% Plantain Flour: 25% Flour)	3,23 <sup>b</sup>	
P4 (100% Plantain Flour: 0% Flour)	3,02 <sup>a</sup>	

The data is the result of 5x replays and the same letter shows no noticeable difference according to the Mann Whitney Test (sig P ≤ 0.05).

The results of the analysis of hedonic test statistical data on aromas contained in table 10 showed that there was a significant difference in panelists' liking for the aroma of mud cakes with the substitution of plantain flour which can be proven by P value (0.002) < Ftable (0.05). The results showed that the use of plantain flour substitution in making mud cakes influenced the panelists' liking for the aroma of mud cakes in each treatment. Based on the results of the Kruskal – Wallis's test, testing of hedonic data on mud cake aromas with plantain flour substitution can be continued using the Mann – Whitney test to determine the degree of difference in panelists' liking for the aroma of mud cakes in each treatment.

Mann Test Results – Whitney hedonic aroma of mud cake with plantain flour substitution, namely P4, there is a noticeable difference with P1, P2, and P3 as evidenced by different notations. Then on P1, P2 and P3 no noticeable difference can be seen from the same notation. The difference in aroma is obtained from the increasing proportion of plantain fruit flour in each treatment. A hedonic assessment of the aroma in mud cakes with the substitution of plantain flour yielded an average value of 3.02 to 3.30 with the usual criteria for liking the resulting aroma.

Based on the panelists' assessment of the hedonic quality of the aroma in the five mud cake treatments, the resulting criteria were the same, namely that it was slightly fragrant. This is because the use of the percentage of banana flour in the manufacture of a product affects the aroma produced but banana flour has the disadvantage that the banana aroma is not strong enough [20]. So, the resulting criteria are almost the same, which is a bit fragrant. But in the research conducted by Sutedja et al. [21] There is a statement that the aroma of bananas is increasingly evident along with the addition of banana flour in a food product, this is because bananas have a volatile compound, namely isoamil acetate which affects the aroma of mud cakes with banana flour raw materials.

E. Best Treatment

The determination of the best treatment in this study was carried out using the effectiveness index of the sequence of variables that have the most important value for mud cake products with the substitution of plantain flour, namely those with the highest value of variable potassium content (I) with an average value of 3.84, then continued with the taste variable (II) with an average value of 3.64, aroma variable (III) with an average value of 2.88, color variable (IV) with an average value of 2.68, and the unimportant thing is the texture variable with an average value of 2.08 (V). After determining the ranking of the five variables, the next step is to calculate the EV (Effectiveness Value) and YV (Yield Value) in each mud cake treatment with the substitution of plantain flour based on the variables that have been calculated. From the calculation of the determination of YV obtained the results seen in Table 11.

TABLE XI. RESULTS OF DETERMINING THE BEST TREATMENT OF MUD CAKES WITH PLANTAIN FLOUR SUBSTITUTION

Treatment	Number of values YV
P1 (25% Plantain Flour: 75% Flour)	0,63
P2 (50% Plantain Flour: 50% Flour)	0,55
P3 (75% Plantain Flour: 25% Flour)	0,46
P4 (100% Plantain Flour: 0% Flour)	0,25

Based on table 11, it is known that the best treatment results with the calculation of the effectiveness index show that P1 is the best treatment of mud cake products with the substitution of plantain flour. This is in line with the results of research conducted by Sappu et al. [22] which says that the ratings are tempered by the level of consumer acceptance. The ranking value decreases as more and more flour is substituted. This is because the addition of substitution flour can reduce the level of consumer acceptance of the intensity of the assessed properties (color, taste, aroma, and texture). The results of the best treatment test can be seen in Table 12.

TABLE XII. BEST TREATMENT TEST RESULTS

Charateristic	Result
Potassium levels	88,6 mg/100 gram
Physical properties	4,06 N
(Texture Hardness)	Brownish yellow / Like
Color	Kind a Sweet / Like
Taste	Fragrant / Ordinary
Aroma	Soft / Like
Texture	4,06 N

F. Nutritional Composition

After obtaining the best treatment, laboratory tests were carried out to determine the nutritional composition of the best treatment (P1). Laboratory tests serve to determine the composition consisting of energy, proteins, fats, and carbohydrates contained in mud cakes per 100 grams. The results of laboratory tests of nutritional composition can be seen in Table 13.

TABLE XIII. NUTRITIONAL COMPOSITION OF MUD CAKES PER 100 GRAMS

No	Nutrition composition	Value
1.	Energy (kcal)	233,6
2.	Protein (%)	3,94
3.	Fat (%)	5,70
4.	Carbohydrate (%)	41,55
5.	Ash (%)	0,98
6.	Water (%)	47,83
7.	Potassium (mg)	88,6

The best treatment results compared to SNI quality standards for wet cakes. The results of determining the best treatment obtained from P1 with a proportion of 25% plantain flour and 75% wheat flour. The results of the comparison of the nutritional composition of mud cakes with SNI wet cakes can be seen in Table 14.

TABLE XIV. COMPARISON OF NUTRITIONAL COMPOSITION OF MUD CAKES BASED ON SNI WET CAKES NO. 01-4309 - 1996 AND RESEARCH RESULTS

Nutrition composition	Nutrition standard	Result	Information
Energy	-	233,6 kcal	-
Protein	-	3,94%	-
Fat	Max. 3%	5,70%	More
Carbohydrate	-	41,55%	-
Ash Content	Max. 3%	0,98%	Appropriate
Water Content	Max. 40%	47,83%	More
Potassium	-	88,6 mg	-
Color	Normal	Brownish yellow / Like	Appropriate
Taste	Distinctive	Kind a Sweet / Like	Appropriate
Aroma	Distinctive	Fragrant / Ordinary	Appropriate
Texture	Normal	Soft / Like	Appropriate

SNI is a standard set by the government for various production products made by the Indonesian people, be it produced individually or produced by an agency or company. This has been regulated in the Regulation of the Minister of Trade No.72/M-DAG/PER/9/2015 which requires goods in certain categories to be produced in accordance with SNI. Mud cakes belong to the category of wet cakes so that the nutritional composition in them can be compared with the provisions of wet cakes listed in SNI.

The fat contained in 100 grams of mud cake amounted to 5.70%. The fat content in mud cakes exceeds the maximum fat requirement stated in the wet cake quality requirements according to the Indonesian National Standard (1996) because the standard fat content in it should be 3%. This is influenced by the ingredients used in making mud cakes such as egg yolks and margarine while in SNI the provisions are not intended for one type of wet cake so that the fat content produced can be higher than the SNI provisions. The high fat content can affect the texture in the mud cake, the higher the fat contained in the mud cake, the higher the level of softness of the texture of the mud cake produced [23].

The ash content contained in 100 grams of mud cake is 0.98%. This value is in accordance with the Indonesian National Standard (1996) which is a maximum of 3%. However, the moisture content contained in the mud cake is 47.83%. This value exceeds the maximum limit of wet cake quality requirements according to the Indonesian National Standard (1996) because the standard water content in it should be 40%. The high water content is caused by the ingredients used in making mud cakes such as sugar and margarine which can produce moisture content when experiencing a heating reaction Ferga et al. [24]. Wheat flour as a raw material in making mud cakes also contributes a

fairly high moisture content of 14% and plantain flour by 8.66% [16].

According BPOM [25] potassium is said to be high in food products if it has a potassium content of 30% ALG per 100 grams (1,410 mg) and can be said to be a source of potassium if it has a potassium content of 15% ALG per 100 g (705 mg). The best-treated mud cake product (P1) has a potassium content of 88.6 mg, so it does not include food products high in potassium or potassium sources. This is because the selected treatment is the treatment with the lowest proportion of plantain flour. Potassium has an important role in controlling blood pressure. Potassium is able to help kidney function to filter sodium and remove sodium from the blood, so indirectly it is a potassium process in lowering blood pressure in people with hypertension [26].

In addition, there are also several nutritional compositions that are in accordance with the quality requirements of mud cakes based on Indonesian National Standards which include color, taste, aroma and texture. The color produced by the mud cake with the best treatment is a brownish-yellow color with a degree of liking. The taste produced by the mud cake with the best treatment is a bit sweet with a degree of liking. The aroma produced by the best-treated mud cakes is a bit fragrant with an ordinary degree of liking. And the texture produced by the mud cake is soft with a degree of liking.

*G. Serving Dose*

Serving dose is the amount of product that can be consumed in one meal expressed in the appropriate household size in the food product. The portion dose is obtained by referring to the nutritional needs of adults according to the Nutritional Adequacy Figure 2019 for interlude food, which is 10% of the total need for one consumption of interlude food. The nutritional needs of adults in a day are 2650 kcal of energy, 65 grams of protein, 75 grams of fat, 430 grams of carbohydrates, and 4700 mg of potassium. In the best treatment, namely P0, energy results were obtained in 100 grams of 233.6 kcal, protein 3.94%, fat 5.70%, carbohydrates 41.55%, and potassium 88.6 mg. Information on nutritional value can be seen in Table 15.

TABLE XV. INFORMATION ON THE NUTRITIONAL VALUE OF SERVING MUD CAKES

Nutrition fact		
Serving size	2 pcs (110 grams)	
Number of serving per package	2	
Amount per serving		
Total energy	256,96 kcal	
Energy from fats	56,43 kcal	
		%AKG
Protein	4.3 gram	6.62%
Fat	6.27 gram	8.36%

Nutrition fact		
Carbohydrate	45.71 gram	10.63%
Potassium	97.46 mg	2.1%

The recommended mud cake in one consumption is 2 mud cakes with an energy content of 256.96 kcal, protein 4.3 grams, fat 6.27 grams, carbohydrates 45.71 grams, and potassium 97.46 mg. A day the patient will be given 2 interlude meals, so that in a day the patient can consume 4 pieces (220 grams).

The contribution of 2 pieces of mud cake (110 grams) can meet the total energy needs of 9.69% of the nutritional adequacy figure, protein needs 6.62% of the nutritional adequacy figure, total fat needs 8.36% of the nutritional adequacy figure, carbohydrate needs 10.63% of the nutritional adequacy figure, and potassium 2.1% from the nutritional adequacy figure. Percent of AKG (Nutritional Adequacy Number) is calculated based on general needs, namely 2650 kcal, in accordance with the PERMENKES RI Number 28 of 2019. Patients in a day get two interlude meals, namely 2 mud cakes (±110 grams) in 1 meal time which contains 97.46 mg potassium. Consuming plantain flour substitution mud cakes has not been able to meet the needs of potassium in a day in hypertensive patients who need potassium intake of 4700 mg per day. The lack of potassium needs in interlude foods can be met from the staple foods consumed by patients such as potatoes, sweet potatoes, seafood, and tomatoes.

**IV. CONCLUSION**

Based on the results and discussion of research entitled making mud cakes with the substitution of plantain flour as a high-potassium interlude food for people with hypertension, it can be concluded that each mud cake treatment affects the difference in organoleptic properties of both hedonic and hedonic qualities (texture, color, taste, and aroma). The four mud cake treatments made a difference in the results of the potassium content analysis. The treatment that has the highest potassium content is P4 at 317 mg per 100 grams while the treatment that has the lowest potassium level is P1 of 88.6 mg / 100 grams. The greater the number of substitutions of plantain flour in making mud cakes, the greater the content of potassium levels in the mud cakes. The P1 treatment is the best treatment with potassium content of 88.6 mg / 100 grams, physical test (hardness) of 4.06 N, light brown color / like, slightly sweet / like taste, slightly fragrant / ordinary aroma, and soft / like texture. The nutritional composition of the best treatment of mud cakes contains energy of 233.26 kcal, protein 3.94%, fat 5.70%, carbohydrates 41.55%, water content 47.83%, and 0.98% ash content. The serving dose of mud cakes for adults is 2 times the interlude food (2 pieces per consumption). For further research, it is expected to use banana flour with a type of banana that has a better organoleptic character than plantain so as to improve the panelists' assessment.

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