Formulation of Functional Beverages Powder Based on Ambon Banana Flour (Musa Acuminata Colla) Enriched with Legume Flour

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In this paper, the formula for functional beverages made from Ambon banana flour, enriched with legume flour to increase protein levels is discussed. Functional beverage powder in this study was made using four formulas with different additional ingredients: formula 1 enriched with soybean flour (F1), formula 2 enriched with mung bean flour (F2), formula 3 enriched with red bean flour (F3), and formula 4 without additional ingredients (F4). The four formulas were tested using an organoleptic test, sedimentation rate, and sediment height. Formula 1, 2, and 3 were tested using a hedonic test, and the best formula was found through proximate analysis and testing the determination of potassium and sodium levels. The results showed that F2 was the best formula, and the results analysis of functional beverage powder F2 determined 2.32% moisture content, 1.48% ash content, 5.62% protein, 1.41% fat, 89.17% carbohydrate, potassium 452.41 mg / 100 g, and sodium 320.04 mg / 100 g.

Key words: *Ambon Banana Flour • Functional Beverage Powder • Protein • Potassium• Sodium.*

Introduction

Bananas are herbaceous plants originating from the Southeast Asian region (including Indonesia). Banana (Musa acuminata Colla) is one of the most beneficial plants in the world, especially in tropical regions such as Indonesia. Banana fruit has very good nutrition and nutritional value. Banana flesh is rich in potassium and is believed to reduce high blood pressure (Ghimire at al., 2019; Ebiowei, 2013; Suyanti and Supriyadi, 2008).

Ambon moss banana is the most preferred banana because of its sweet taste, better texture and sharper aroma compared with other bananas. The results analysis of potassium levels in 4 types of bananas (Alkatirie et al, 2012; Jacqueline and J.P. Paul, 2017) were that Ambon moss bananas had the highest potassium levels when compared with other types of bananas of 747.6 mg / 100g. The average amount of potassium in raja bulu banana was 688.11 mg / 100g, Ambon white banana was 622.12 mg / 100g, and jackfruit banana was 686.39 mg / 100g. In this study, the Ambon moss banana was transformed into banana flour. The reason for this is that flour is an alternative form of semi-finished product that is more resistant to being stored, easily mixed (made composite) and enriched with nutrients (Hassan et al., 2018; Okorie et al., 2015).

The results of the study conducted by Sarifudin et al, (2016) produced instant powder based banana flour drinks with a low protein content of 1.24-1.77%. According to (Kusumastuty et al, 2006) high protein intake can affect blood pressure by stimulating natriuresis in the body which results in a decrease in blood pressure. Natriuresis is a regulation of blood pressure by the kidneys where excretion of sodium and water occurs through urine and this is caused by increased blood volume. Recommended protein consumption in adult hypertensive patients is 50 g / day for women and 60 g / day for men (Karam et al., 2016; Kumar et al., 2012; Gröber et al., 2015).

The choice of protein additives such as soybean flour, mung bean flour, and red bean flour based on the protein content of each type of legume which is quite high: 100 g of soybeans containing 34.9 g of protein; 100 g of mung beans 22.2 g and the protein content in 100 g red beans is 22.1 g (Poedjiadi, 2005). In this study, the formulas were tested for functional beverages powder made from Ambon banana flour enriched with legume flour to increase protein levels. The testing on the functional powder of banana flour was conducted by quality testing which included the organoleptic test by measuring the parameters of color, taste, and aroma, and the flow rate test (Park et al., 2016; Gajera, 2008). The quality testing of the beverage powder was also carried out by a proximate test to determine the content of protein, fat and carbohydrates and through the testing of the water content, ash content and mineral content of potassium and sodium.

Material and Methods

This research was conducted for two months, from April to May 2018 at the Pharmacy Laboratory, Faculty of Mathematics and Natural Sciences, Pakuan University. Jl. Pakuan PO. BOX 452 Bogor - West Java and in the Laboratory of PT. Saraswanti Indo Genetech Bogor Jl. Rasamala No.20, Taman Yasmin, Bogor - West Java.

Tools and Materials

The tools used in this study include analytical scales (And®), ovens (Memmer®), blenders, furnaces, crucibles, 40 mesh sieves, plastic basins, glass utensils, water baths, porcelain cup, kjeldahl squash, and an atomic absorption spectrophotometer.

The ingredients used include ambon moss banana at ¾ maturity, other additives of soybean flour, mung bean flour, red bean flour, sucrose, skim milk, and salt. The chemicals for analysis as solvents and reagents used in this study include aquades, hydrochloric acid, concentrated sulfuric acid, HNO_3, hexane solution, concentrated nitric acid, aquabides.

Method
Banana Flour Making

In the process of making the banana flour, the Ambon banana used is at ¾ of maturity level. Then the banana is blanched for 5 minutes. After it is cooled, the banana is peeled and then sliced with a thickness of 1-2 cm. The banana slices are then roasted (temperature 60ºC for 6 hours), mashed and sieved using a mesh size of 80-100.

Legumes Flour Making

In this process, soybeans, mung beans, and red beans are prepared with clean flowing water, soaked beans with clean water for about 5 hours. Wash the beans again while squeezing to separate the beans from the peel, drained, followed by the blanching process at 90ºC for about 10 minutes, drained again, then dry using an oven at 60ºC for 8 hours, milled (mashed) and sieved with 80-100 mesh sizes.

Characterization of banana flour and legumes flour

The rendement of banana flour and legume flour made was then calculated and the total ash content and water content determined to ensure the quality of flour to be used in the powder formulation of this functional beverage.

The making of Functional Beverage Powder

To make functional beverage powder based on Ambon banana flour, banana flour was mixed with additives for each test formula. The mixture was stirred, and the sucrose added until all ingredients were mixed. Then, it was sieved using 40 meshes and dried in an oven at 50ºC for 15 minutes.

The mixture was weighed at 30 g, of packaged and sealed in airtight plastic. The functional beverage powder formulas are as follows: F1 (soybean flour) 20%, F2 (mung bean flour) 20%, F3 (red bean flour) 20%, F4 (without addition) using banana flour 30%, further for formula 1, 2, and 3 banana flour was 10%. All formulas, 1-4, used sucrose, skim milk and salt with the same concentration of 40%, 29.5%, and 0.5%.

The Quality Test of Functional Beverage Powder Preparation

The quality test of functional beverage powder included an organoleptic test, sediment rate test and sediment height test. Organoleptic tests carried out were based on the parameters of color, aroma, and taste for sediment rate and sediment height tests were carried out using a measuring cup by dissolving 5 g of powdered beverage with 25 mL of warm water. The mixture was stirred until homogeneous and left still until it settled perfectly and notes were made regarding how long the deposition process took and the height of the sediments measured (Mahawan et al., 2015).

Hedonic Test

The hedonic test in this study aimed to determine the level of acceptance of the panelists on the product so that the best formula could be obtained. This hedonic test included observing the color, aroma, and taste of functional beverage powder based on Ambon banana flour. Hedonic testing was conducted by 20 panelists consisting of males and females aged 19-24 years. The presentation of functional beverage powder was made by adding hot water (± 80 ° C) to the beverage powder, as much as ± 150 ml, then stirring until homogeneous. The panelists were asked to sample and assess the color, aroma, and taste and rate each factor using a 5 point Likert scale: a score of 5 = very like, 4 = like, 3 = normal, 2 = rather like, and 1 = dislike. The data obtained was analyzed using SPSS 24 Completely Randomized Design (CRD).

Proximate Analysis

After obtaining the best formula, the next step was that the functional beverage powders were tested using proximate analysis which included water content, ash content, protein, fat, and carbohydrate to determine the nutrient content contained in each formula.

Determination of Potassium and Sodium Levels

Determination of mineral levels of potassium and sodium were carried out with ICP OES by weighing 0.5 ml of the sample and adding to it 10 ml of HNO3 (p) after which it was destined for 15 minutes at 150º C and then placed in a 50 ml volumetric flask, added with aquabides to the boundary mark and filtered - the mineral level by ICP OES at each wavelength was measured. Next, a calibration curve was made and the levels of metals or minerals calculated.

Results and Discussion

The characteristics of Ambon moss banana flour are a light brown color, a distinctive aroma of bananas, and a bland taste. The rendement flour of ambon moss banana flesh obtained was 48.6%. The results of the moisture content of Ambon moss banana obtained an average of 8.68% and the ash content obtained an average of 1.78%. Soybean flour, mung beans, and red beans have different characteristics. The characteristics of soybean flour are a yellow color, strong aroma and distinctive taste. The rendement of soybean flour obtained was 51.62%. Water content and ash content of soybean flour obtained were an average of 6.41% for moisture content and 4.14% for ash content. Mung bean flour has the characteristics of faded green color, strong aroma and distinctive taste. The rendement of mung bean flour obtained was 59.15% with an average moisture content of 7.97% and an average ash content of 4.59%. The red bean flour has the characteristics of reddish brown color, distinctive aroma and distinctive taste. The rendement of red bean flour obtained of 61.23%, the average water content of 7.52%, and the average ash content of 4.0%.

Organoleptic Test Result of Beverage Powder

Organoleptic test results for functional beverage powder can be seen in Table 1 below.

Table 1. Organoleptic test results for functional beverage powder

Formula	Colour	Flavor	Taste
F1	Yellowish Brown	typical soybeans	Sweet
F2	Greenish brown	Typical mung beans	Sweet
F3	Reddish brown	Typical red beans	Sweet
F4	Brown	Typical banana	Sweet

Sediment Rate and Sediment Height Test Results of Beverage Powder

Based on the findings presented in Table 2 below, testing sediment rate and sediment height for each beverage powder formula with a variety of additives, resulted in different sedimentation rates and sediment height. The difference in additives produced the best formulas, 2 and 3, with a longer sedimentation rate. These results differ significantly from the research conducted by Dewi, (2016) which returned a sedimentation rate of 21 minutes which means that the longer the sedimentation rate in beverage powder, the better the quality. From Table 2 it can further be seen that the deposit height in formula 4 differs markedly from the other three formulas because formula 4 does not use additives in the form of legumes and as such deposits are only slightly formed. The results of sediment rate and sediment height can be seen in Table 2 below.

Table 2: Sediment Rate and Sediment Height Test Results of Beverage Powder

F	Iteration	Sediment Rate	Sediment Height
1	1	33" to 6'	2.8 cm
	2	32" to 6'	2.8 cm
2	1	18" to 7'	2.9 cm
	2	18" to 7'	2.8 cm
3	1	16" to 7'	2.3 cm
	2	17" to7'	2.2 cm
4	1	13" to 5'	0.9 cm
	2	13" to 5'	0.9 cm

Hedonic Test Results

The numbers followed by the same letter and the same column present that they are not significantly different. In the table above, the results analysis of variance F2 gave the highest results in the parameters of color, aroma, and taste. In the color parameters, the results were 3.50 (usual-like), for the aroma parameter, the results were 3.60 (normal-like), and for the taste parameter, the result was 4.05 (like). The result mean that formula 2 is the best formula because panelists liked it most.

In the color parameters, aroma and taste when viewed from the results of the Levene test have a significance value of ≥ 0.05 indicating that all formulas have the same effect on the powder of functional beverages. In the ANOVA test, the aroma and flavor parameters yielded a sig value of ≥ 0.05 indicating that there was one formula that had a significantly different effect on the functional beverage powder. The Hedonic test results are shown in Table 3 below.

Table 3: Results Analysis of Functional Beverage Powder Variations

Formula	Average		
	Colour	Flavor	Taste
F1	3.10^a	2.95^a	3.20^a
F2	3.50^a	3.60^b	4.05^b
F3	3.25^a	3.05^a	3.30^a

Results of Proximate Test
Testing Result of Moisture Content

Testing for moisture content found 2.32% and this result shows that functional beverage powder (F2) meets the requirements as the value of water content for cereal is no more than 3% based on SNI. Testing the moisture content of the beverage powder aims to determine the water content of the functional beverage powder because water can affect the length of storage of the beverage powder.

Testing Result of Ash Content

The test results of ash content in the functional beverage powder showed the Ambon banana flour (F2) at 1.48% and this was deemed the best formula. The value of this ash content meets the standards set by (SNI, 1995) in that the maximum value for ash content in cereal beverage is 4%. Determination of ash content is related to the mineral content contained in the material.

Testing Result of Protein Content

Protein content testing was conducted to determine the protein content in functional beverage powder because a functional beverage powder is a beverage that has benefits for body health. Protein has a function as an energy source if the supply of energy from carbohydrates and fat is insufficient. Further, the shared protein minerals play a role in maintaining water balance by sustaining the amount of fluid in each part of the body's fluids, namely fluid in the blood vessels, space between cells, and in cells. Testing of protein content was carried out on all four formulas to determine protein content in each formula. The test results for the functional beverage powder formula are shown in Table 4 below.

Table 4: Test Results of Protein Content of Functional Beverage Powder.

Parameter	F1 (%)	F2 (%)	F3 (%)	F4 (%)
Protein	8.21	5.62	4.72	1.09

From Table 4 above it can be seen that formulas which fulfill the requirements for cereal beverage are formulas 1 and 2, according to SNI that cereal milk must have a protein content of at least 5%. In the hedonic test, the best formula was obtained in formula 2 even though the highest protein content found in formula 1, this is because formula 1 used a soybean flour additive which had an aroma and taste that the panelists do not like.

Formula 2 contains 5.62% of protein, which means that the banana flour-based functional beverage powder made in 1 package (30 g) only suffices protein requirements 2.72-3% for male (62 g) and female (56 g) respectively according to the percentage calculations of RDA. This means that one package of functional beverage powder cannot meet the daily protein needs and further protein intake will still be needed from other sources such as eggs, meat, and fish.

Testing Result of Fat Content

The test results of the fat content were 1.41% and according to SNI, that cereal milk must have a minimum fat content of 7%. The fat content of functional beverage based on Ambon banana flour did not met the standards set by SNI and the functional beverage powder fat content in 1 package (30 g) just sufficed at 0.46-0.56% of the fat requirements for men (91 g) and women (75 g) respectively according to the calculation of RDA. This is because in making powder functional beverage powder based on ambon banana flour, legume flour and other ingredients used have low-fat content (not a source of fat).

Testing Result of Carbohydrate Content

The yield of carbohydrate obtained in functional beverage powder (F2) is 89.17%. This carbohydrate level value meets the standards set by SNI that cereal milk has a carbohydrate level of at least 60%. The carbohydrate content of functional beverage powder in 1 new package (30g) sufficed 7.13-8.77% of carbohydrate requirements in men (375 g) and women (305 g) according to the calculation of RDA.

Testing result for the Determination of Potassium and Sodium for Functional Beverages Powder

The test results for the determination of potassium and sodium content in formula 2 are shown in Table 5 below.

Table 5: Testing result for the Determination of Potassium and Sodium

Parameter	Unit	Yield
Potassium	mg / 100 g	320.04
Sodium	mg / 100 g	452.41

Table 5 above shows that sodium content in functional beverage powder is 320.04 mg / 100 g, and thus the results are fairly good and indicate safety for consumption because the recommended sodium intake is less than 2300 mg per day (Janah et al, 2013). The results of potassium contents in functional beverage powder are 452.41 mg / 100 g, these results are still lacking in terms of meeting the daily potassium intake recommended to produce the beneficial effects on hypertension in the range of 3,500-4,500 mg / day (Grober, 2013).

Information of Nutritional Value for Functional Beverage powder

Amount for 1 serving (30 grams)
Number of servings per package: 30 grams

Amount per Serving

Total Energy   117.98kcal
Energy of fat   12.6 kcal

		%RDA
Fat*	0.42 g	0.46-0.56%
Protein*	1.69 g	2.72-3%
Carbohydrate*	26.86 g	7.13-8.77%

*Can be seen based on age and sex

Conclusion

The panelists responded that the best formula of functional beverage powder based on Ambon banana flour is formula 2 which is enriched with mung bean flour. The Formula of functional beverage powder based on Ambon banana flour preferred by panelists contains 2.32% of moisture, 1.48% of ash, 5.62% of protein, 1.41% of fat, 89.17% of carbohydrate, 452.41mg/100g of potassium, and 320.04 mg/100g of sodium.

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