

**Innovation to Pisang Barlin (*Musa Acuminata* AA) as The Substitute Flour****Michael Ricky Sondak<sup>✉</sup>, Hari Minantyo, Prasetyon Sepsi Winarno****DOI 10.15294/jbat.v7i1.11415**

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**Abstract**

This research is used to explore local ingredients from *Musa Acuminata* AA. *Musa Acuminata* AA foodstuffs are usually used only as a raw fruit, not much processed into another food product. Food innovation that raise local potential is needed to increase local food value. This study is an experimentation research, which is uses laboratory experiments at the Food and Beverage Laboratory of Universitas Ciputra Surabaya. Data was collected from 20 respondents by using organoleptic test. There were 3 times of organoleptic test: 1). organoleptic test with whitewash immersion (code 001); 2). organoleptic test with Citroen water immersion (code 002) and 3). organoleptic test without any immersion process (code 003). *Musa Acuminata* AA flour tested in Research and Industry Standardization Laboratory to know about the moisture, protein, carbohydrate, fiber and potassium. The result: nutrition content code 001. Aw 0.351(25.7C); moisture 7.27%; protein 4.00%; carbohydrate 66.65%; fiber 2.79%; potassium 819.76 mg/100g. Nutrition content for code 002: Aw 0.347(25.6C); moisture 7.30%; protein 4.00%; carbohydrate 68.58%; fiber 2.00%; potassium 780.24 mg/100g. Nutrition content for code 003 Aw 0.536(25.5C); moisture 10.04%; protein 4.01%; Nutrition content for code 68.60%; fiber 1.61%; and potassium 990.18 mg/100g.

*\*This is a revised and extended version of an article which had been presented at SNTK UNNES 2017, Semarang, Indonesia, September 20<sup>th</sup>, 2017.*

**INTRODUCTION**

Banana is a tropical fruit which are easily produced and potentially to be developed. Banana is the most popular fruits among others tropical fruits. Banana is known from Asian, and also from African since 3000 years old and then produced in American. Francis (2015) stated that bananas are actually the most mysterious fruit in the world that they are found in almost every country in the. In the green stage, banana fruit are rich in vitamins (A, B1 and C), minerals (Potassium, Sodium, Chlorine, Magnesium and Phosphor) and consist of 25% of digestible carbohydrate (Nuryani & Soedjono, 1999). Every 100g of banana consists of 90 kkal of energy, carbohydrate 22.84 g, protein 1.09 g, fat 0.33 g, fiber 2.6 fg, calcium 5 mg, phosphor 22 mg,

iron 0.26 mg, copper 0.078 mg, potassium 358 mg, magnesium 27 mg, vitamin A 64 mg, vitamin B1 0,031 mg, vitamin C 8,7 mg, vitamin E 0,1 mg (Wardhany, 2014). Data from Dinas Pertanian (2006) stated that Indonesia is responsible for only 5% (3.6 million tons) of produces banana. An innovative approach has been taken to exploring bananas as functional and valuable ingredients, one of them are exploring banana flour (Kementerian Pertanian Badan Penelitian dan Pengembangan Pertanian, 2012). Many plants grown in Indonesia. This is a potential. Along with the increase in population, demand for food as a source of energy continues to increase. With so many groceries in Indonesia, too many opportunities to make innovative food creations thus increasing the diversity of the food by using local ingredients.

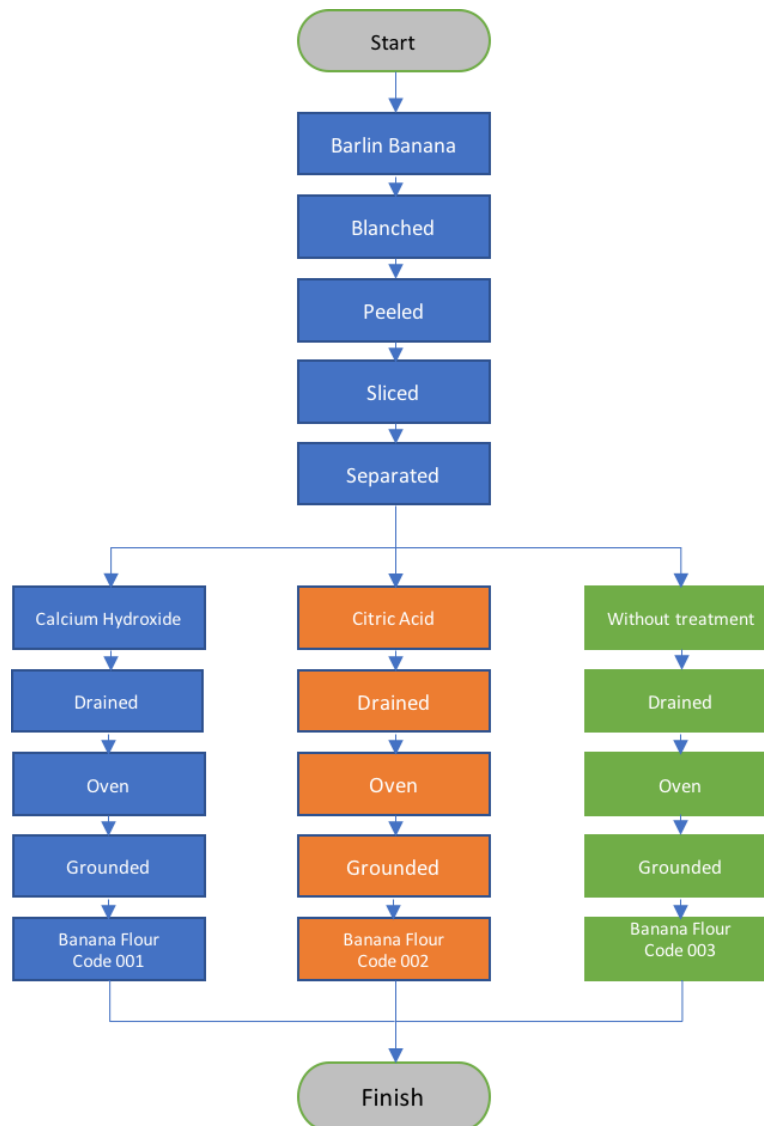
Table 1. Quality Standards Parameter of Banana Flour (SNI 01-3841-1995)

No	Criterias	Satuan	Requirements	
			Type A	Type B
1	Keadaan:	-	Normal	Normal
	a. Bau	-	Normal	Normal
	b. Rasa	-	Normal	Normal
	c. Warna	-	Normal	Normal
2	Benda asing	-	Tidak ada	Tidak ada
3	Serangga (dalam segala bentuk stadia dan potongan-potongan)	-	Tidak ada	Tidak ada
4	Jenis pati lain selain tepung pisang	-	Tidak ada	Tidak ada
5	Kehalusan lolos ayakan 60 mash	%b/b	Min 95	Min
6	Air	%b/b	Maks 5	Mak 12
7	Bahan tambahan pangan	-	SNI 01-0222-1987	
8	Sulfit (SO <sub>2</sub> )	mg/kg	Negatif	Mak 1.0
9	Cemaran logam :			
	a. Timbal (Pb)	mg/kg	Maks 1.0	Maks 1,0
	b. Tembaga (Cu)	mg/kg	Maks 10.0	Maks 10.0
	c. Seng (Zn)	mg/kg	Maks 40.0	Maks 40.0
	d. Raksa (Hg)	mg/kg	Maks 0.05	Maks 0.05
10	Cemaran arsen (As)	mg/kg	Maks 0.5	Maks 0.5
11	Cemaran mikroba:			
	a. Angka lempeng total	koloni /g	Maks 10 <sup>4</sup>	Maks 10 <sup>4</sup>
	b. Bakteri pembentuk coli	APM/g	0	0
	c. Escherichia coli	koloni/g	0	Maks 10 <sup>2</sup>
	d. Kapang dan kamir	koloni/g	Maks 10 <sup>2</sup>	Maks 10 <sup>4</sup>
	e. Salmonella/25gram	-	negatif	-
	f. Staphylococcus aureus	koloni/g	negatif	-

Astawan (2005) and BAPPENAS (2000) stated that banana (*Musa paradisiaca*) are classified into 4 groups: (1) *Musa Pardisiaca var. sapientum* (*Banana*) is classified into the edible banana or could be eaten as dessert, for example: banana which is called *susu, hijau, mas, raja, ambon kuning, barangan*, and so on; (2) *Musa Pardisiaca forma typiaca* (*Plantain*) is classified into plantain (banana for cooking), for example: banana which is called *tanduk, uli, bangkahulu, kapas*; (3) the edible banana (eaten as dessert) and/or plantain (banana for cooking), for example: banana which is called *kepok dan raja*; (4) *Musa Brachycarpa* is classified as a seed edible banana for example banana which is called *klutuk* or *biji*. East Java was the second largest contributor of banana production in Indonesia. One of type varieties of banana in East Java is Barlin. Barlin banana has many name, *pisang lilin, pisang empat puluh hari* (Malaysia), *Mama-on* (Philippines). Barlin banana has a smaller plant compare with others, but it could produce a lot (Admin, 2016). Barlin banana has a high economic value, but

nowadays are sold with cheap price and for consuming only. Major limitations to the utilization of banana is its limited shelf life. Bananas are highly perishable crop and one of the world's most important staple food after rice, wheat, and maize. Khasanah & Marsusi (2014) said that Barlin banana's storage life is less than five days. Based on exploration and interview at Desa Tambaksari, Kabupaten Pasuruan, the researchers will contribute to making creative designs and innovative products that use the seasoned flour ingredients of raw materials Barlin Banana to be banana flour that can be used in production of gluten-free products and other expanded products.

Many research have already conducted to substitute wheat flour with banana flour. In the green stage, banana fruit are rich in dietary fiber and indigestible carbohydrates, proteins, essential amino acids, cellulose, hemicelluloses, lignin, starch, resistant starch, polyunsaturated fatty acids and potassium (Yalingar, 2015). The starch which is contained in banana almost equivalent to the starch content of endosperm of corn and pulp of



Picture 1. The Making of Barlin Banana Flour

white potato (Anyasi et al., 2017). It is widely used in infant feeding as a source of energy and it can be used as functional flour (Bezera et al., 2013). The benefit of banana flour are: extending shelf life, able to package and distributed, easily to be used for products, giving added value, increasing nutrition content and prospect to develop as a business (Prabawati et al, 2008). Previous research is made of banana flour and measuring its chemical composition and nutritional value of unripe banana (*Musa acuminata*, var. Nanicão) (Menezes et al., 2011), then, research about quality techniques with Spray Drying System of banana flour for biscuit (Nurhayati & Andayani, 2014) and also research about histories of banana by Francis (2015). Francis (2015) stated about the primary history of banana in Asia. Menezes et al. (2011) stated that the unripe banana flour (UBF) presented a high amount of total dietary fiber (DF) (56.24 g/100 g), which

consisted of resistant starch (RS) (48.99 g/100 g), fructans (0.05 g/100 g) and DF without RS or fructans (7.2 g/100 g). Nurhayati & Andayani (2014) stated that drying system with spray dryer presented: water 3.62% for kepok banana flour and 3.73% for gedah banana flour, and also using all parameter standards from SNI 01-3841-1995 (Type A). Previous studies about the utilization of banana flour (Batu banana = *Musa Balbisiana Colla*) as a brownies is expressed that code B3 (30% Batu banana flour: 70% wheat flour) is the best formula. This study is presented of 25.26% water content, mineral 1.33%, fat 19.63%, protein 6,04%, carbohydrate 49.07%, soluble food fiber 0.65%, insoluble fiber 23.08%, dan glycemic index (GI) 21.06% (Musita, 2014). Testing the quality standards parameter of banana flour according to SNI 01-3841-1995 for physical characteristics (color, texture, aroma, and taste). The standard

quality of banana flour is shown in Table 1. In this research, it is essential to measure the water content, protein, carbohydrate, crude fiber and potassium.

## RESEARCH METHODOLOGY

This research design is an experimental research. Experimentation is executed at the Food & Beverage Laboratory, School of Tourism Universitas Ciputra Surabaya. Nutritious content test was done in Biochem Technology Surabaya. Independent variable in this research is the quantity of banana flour, while the dependent variables are the acceptance of organoleptic test of Barlin banana flour (color, texture, aroma and taste), water content (Aw), moisture, protein, carbohydrate, crude fiber, potassium (K). Three versions were made in Barlin banana flour experiments are as follows: soaked in solution of Calcium Hydroxide, soaked in solution of Citric Acid and without treatment.

Ingredients used in this research are: Barlin banana, water, Calcium Hydroxide, and Citric Acid. Equipment used in this research are: oven, knife, shredded, cutting board, bowls, wooden spatula, scale, sieve flour and plastic packaging. Green Barlin banana was purchased from a local farmer at Desa Tambaksari, Kabupaten Pasuruan. The bananas were prepared using some method in order to make a banana flour. Banana were blanched in 80°C for 3 minutes, peeled, sliced 2 mm and separated for 3 pre-treatments: soaked in solution of Calcium Hydroxide (3 g/L), solution of Citric Acid (3 g/L) for 8 minutes and without treatment. Sliced treated banana was dried on 70°C for 6 hours by dried cabinet oven SINMAG SM-705G and grounded using FCT-Z100, and passed through an 80-mesh sieve. Powdered material for each sample was stored in room temperature for one night before laboratory analysis.

## RESULT AND DISCUSSION

### **The Discussion Result: Barlin Banana Flour Soaked in Solution of Calcium Hydroxide (code 001)**

In terms of **color** (visual appearance) there are significant acceptance differences between Barlin banana flour which has a white color and the opposite. Based on data most respondents state that the color of Barlin banana flour is brownish white

(75% from 20 respondents state clearly disagree of white color) and only has 25% from respondents (10% state strongly agree and 15% agree that Barlin banana flour has a white color). In terms of **texture**, from data result, it is known that in average the respondents answer the texture of Barlin banana flour is soft. Basic material of banana which is processed until soft and grounded using FCT-Z100, and passed through an 80-mesh sieve. Based on data, 10% respondents state strongly agree that Barlin banana flour is soft, 60% state agree and only 30% state disagree. In terms of **aroma** or flavor, are criticised by many respondents (>55% and cause a significant overall acceptance of aroma). Only 10% respondents state strongly agree that the aroma of Barlin banana flour is fragrant, and another 35% respondents state agree. Product attributes that are not meeting the respondents because of soaked in solution of Calcium Hydroxide. Based on data, respondents disagree that the **taste** of the flour is sweet. Based on 20 respondents, 70% state disagree of the sweet taste of Barlin banana flour and only 10% respondents state strongly agree and 15% state agree. The fit and balance composition causes the taste of flour is less sweet.

### **The Discussion Result: Barlin Banana Flour Soaked in Solution of Citric Acid (code 002)**

In terms of **color** (visual appearance) there are significant acceptance differences between Barlin banana flour has a white color and the opposite. Based on data most respondents state that the color of Barlin banana flour is brownish white (10% from 20 respondents state strongly agree and also 55% state agree) and only has 35% from respondents' state disagree that Barlin banana flour has a white color. In terms of **texture**, from data result, it is known that in average the respondents answer the texture of Barlin banana flour is soft. Basic material of banana which is processed until soft and grounded using FCT-Z100, and passed through an 80-mesh sieve. Based on data, 10% respondents state strongly agree that Barlin banana flour is soft, 75% state agree and only 15% state disagree. In terms of **aroma** or flavor, are accepted by many respondents (60% and cause a significant overall acceptance of aroma). 5% respondents state strongly agree that the aroma of Barlin banana flour is fragrant, and another 35% respondents state disagree. Product attributes that are meeting the respondents because of soaked in solution of Citric Acid. Based on data, respondents disagree that the

Table 2. Respondents Acceptance of Barlin Banana Flour

No	Code	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)
1	001/ Soaked in Solution of Calcium Hydroxide	20	55	25	0
2	002/ Soaked in Solution of Citric Acid	30	65	5	0
3	003/without treatment	25	55	20	0

**taste** of the flour is sweet. Based on 20 respondents, 50% state disagree of the sweet taste of Barlin banana flour, 5% state strongly disagree and the other side, 5% respondents state strongly agree and 40% state agree. The fit and balance composition causes the taste of flour is less sweet.

#### The Discussion Result: Barlin Banana Flour without Treatment (code 003)

In terms of **color** (visual appearance) there are significant acceptance differences between Barlin banana flour has a white color and the opposite. Based on data most respondents state that the color of Barlin banana flour is brownish white (10% from 20 respondents state strongly agree and also 50% state agree) and another 40% from respondents' state disagree that Barlin banana flour has a white color. In terms of **texture**, from data result, it is known that in average the respondents answer the texture of Barlin banana flour is soft. Basic material of banana which is processed until soft and grounded using FCT-Z100, and passed through an 80-mesh sieve. Based on data, 5% respondents state strongly agree that Barlin banana flour is soft, 60% state agree and only 35% state disagree. In terms of **aroma** or flavor, are criticised by many respondents (55% and cause a significant overall acceptance of aroma). On the other hand, there are 45% respondents state strongly agree that the aroma of Barlin banana flour is fragrant. Product attributes that are not meeting the respondents because of no treatment of banana. Based on data, respondents disagree that the **taste** of the flour is sweet. Based on 20 respondents, 60% state disagree of the sweet taste of Barlin banana flour, and the other side, 10% respondents state strongly agree and 30% state agree. The fit and balance composition causes the taste of flour is less sweet. From data result, it is found that in average the respondents answer the creation of Barlin banana flour can be developed for further creation.

Banana, consisting of numerous well-known varieties and cultivars, has been explored

and the by-products such as pseudostem, rhizome, leaves, fruit stalks, and peels from the common varieties to some extent are potential raw materials in areas of food and non-food industries, providing each different application. Different types of banana will produce different number of several aspects, such as water content, protein, rude fiber and also the physical test. Table 3 showed water activity value and moisture, protein, and carbohydrate contents of different pretreatments were not significantly different ( $P>0.05$ ). Water activity is the ratio between water vapor pressure of the food to that of pure water at the same temperature. Water activity has strong connection to microbiological safety of the food. Water activity for flour is 0.72 (Lisa et al., 2015). Moisture content is important index of quality for flour. Bakare et al. (2016) state that if moisture content above 14%, it will affect the storage quality of flour and more than that, it may increase the microbial content. Water activity in Ambon banana is the highest mark which is soaked in solution natrium metabisulfit ( $\text{NaS}_2\text{O}_5$ ) but has a lowest mark for Kepok banana flour which has only 3.82%, while according to SNI, the standard quality is 5%. All pretreatments of Barlin banana flour were enough to make safety limit of water activity and moisture content.

The results showed that carbohydrate, protein and potassium were the three of the most important factors of banana flour. Therefore, blanching was the best pretreatment for Barlin banana flour. Protein in Barlin banana flour is higher (4%) than Kepok banana flour (3.76%), Gedah banana flour (3.82%), based on research by Nurhayati & Andayani (2014).

Banana starch can be modified to resistant starch with heating treatment, fermentation or chemical. Citric acid could modify the starch and increase total starch resistant. Soaked with calcium hydroxide or citric acid increased crude fiber and decrease the carbohydrate of Barlin banana flour. Banana starch which is soaked with calcium hydroxide or citric acid has higher than soaked with

Table 3. Nutritious Content of Barlin Banana Flour

No	Nutritious Content	Code: 001	Code: 002	Code: 003	Methods	
		Soaked in Solution of Calcium Hydroxide	Soaked in Solution of Citric Acid	Without Treatment		
		Result/ (Unit)	Result/ (Unit)	Result/ (Unit)		
1	Water content (Aw)	0.351(25.7C)	0.347(25.6C)	0.536(25.5C)	IK	A2-LL06 (Aw meter)
2	Moisture	7.27%	7.30%	10.04%	SNI	01-2891-1992 point 5.1. (Gravimetric)
3	Protein	4.00%	4.00%	4.01%	SNI	01-2891-1992 point 7.1 (Kjealdahl)
4	Carbohydrate	66.65%	68.58%	68.60%	SNI	01-2891-1992 point 9 (Luff school)
5	Crude fiber	2.79%	2.00%	1.61%	SNI	01-2891-1992 point 11 (Gravimetric)
6	Potassium (K)	819.76 mg/100g	780.24 mg/100g	potassium 990.18 mg/100g	AOAC	985.35 (18th Ed., 2005) (AAS)

sodium metabisulfite ( $\text{Na}_2\text{S}_2\text{O}_5$ ), with only 1.34%-1.55% (Palupi, 2012). Pre-treatment with calcium hydroxide increased crude fiber significantly ( $P < 0.05$ ). Potassium of soaked Barlin banana flour in citric acid or calcium hydroxide was lower significantly than blanched only. It showed that potassium was reacted to calcium hydroxide or citric acid and released it to the solution.

## CONCLUSION

Based on pretreatments by soaked in solution of Calcium Hydroxide (code 001) is presented by 75% respondents disagree that Barlin banana flour is brownish white. It is known that in average the respondents answer the texture of Barlin banana flour is soft. Barlin banana flour are criticised by many respondents, stated the banana flour is not fragrant. Based on data, respondents disagree that the taste of the flour is sweet.

Based on pre-treatments by soaked in solution of Citric Acid (code 002) is presented by 65% respondents agree that Barlin banana flour is brownish white. It is known that in 75% of respondents answer the texture of Barlin banana flour is soft. Barlin banana flour are accepted by

many respondents (>65% stated the banana flour is fragrant). Based on data, respondents disagree that the taste of the flour is sweet.

Based on the third research without treatment (code 003) is presented by 60% respondents agree that Barlin banana flour is brownish white. It is known that in average the respondents answer the texture of Barlin banana flour is soft. Barlin banana flour are criticised by many respondents (>55% stated the banana flour is not fragrant). Based on data, respondents disagree that the taste of the flour is sweet.

The best pre-treatment for Barlin banana flour was blanching without chemical addition, since carbohydrate, protein and potassium was decreased after soaking in calcium hydroxide solution or citric acid. Since Barlin banana flour contains starch, it could be used to substitute wheat flour for some amount. Therefore, it can be concluded that Barlin banana flour have the potential as alternative flour in production of gluten-free products, fruit filling and jellies, and crispy expanded products. Furthermore, it was suggested to further study the physicochemical properties of Barlin banana flour and its effect on using it in food products.

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