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Proximate analysis of fresh Banana Blossoms and Banana Blossoms Flours in two cultivars of Kepok Banana *(Musa Acuminata×Balbisiana)* and Janten Banana *(Musa Paradisiaca Sapientum)*

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Abstract

Banana blossom has good nutritional content and can be processed into flour, which can be used as an alternative to local food (indigenous food). This study analyzed the proximate content of fresh banana blossom and banana blossom flour in two cultivars of banana. The design used in this study was experimental and had a completely randomized design (CRD). This study consisted of 6 levels of treatment with two replications, including fresh kepok blossom, fresh janten blossom, unblanching kepok blossom flour, unblanching janten blossom flour, blanching kepok blossom flour, blanching janten blossom flour. The statistical analysis used was the variance test (ANOVA) with an error of 5. This study concludes that the nutrient content of fresh banana blossoms is the lowest among other banana blossom flours. Making banana blossom into flour has the advantage of increasing the nutritional content, but the effectiveness should be considered from the low yield.

Keywords: Proximate analysis, Banana blossom, Banana blossom flour, Indigenous food.

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1. Introduction

In 2021, 11 (eleven) banana production center provinces in Indonesia will contribute up to 88.07%. These provinces are East Java, West Java, Lampung, Central Java, North Sumatra, Banten, Bali, South Sumatra, South Sulawesi, East Nusa Tenggara and West Sumatra. East Java Province is the province that provides the highest contribution, namely 21.87%. In second place is West Java Province (19.22%), followed in third place by Lampung Province (18.20%). In 2021, banana production in Lampung Province became 1,123,240 tons [1]. Bananas are one of the cheap foods consumed by most of the population in many countries. Most people only eat the banana fruit, and most banana blossoms are cut and thrown away. However, many people do not understand that banana blossoms have many benefits [2]. Banana blossoms have good nutritional content, such as fiber-rich, and are a good protein source since they balance amino acid content [3-4]. Apart from that, banana blossoms also contain lots of vitamins A, C, and E as well as minerals such as phosphorus, potassium, calcium, iron, magnesium, and cuprum [3,5]. Besides that, banana blossoms are also a good source of phytochemicals that act as antioxidants, especially flavonoids [2,6–8]. Banana blossoms have many functional benefits [3,9]. The benefits of banana blossoms include being lactogenic, increasing breast milk production, easing bleeding during menstruation, good for digestive tract health, and reducing weight [2,10-11]. The results of research conducted in Indonesia show that banana blossoms can potentially increase breast milk production in breastfeeding mice [7,12-13]. The aglycone content in banana blossoms can significantly increase breast milk production in breastfeeding mice [14]. A study in Indonesia shows that banana blossom extract significantly increases breast milk production and the hormone prolactin [15]. Utilizing banana blossoms can provide additional benefits to reduce banana waste and increase their use in food development [12]. Banana blossoms can be processed into banana blossom flour to extend the shelf life and increase the nutritional content per 100 g.

Making banana blossoms into flour will make it easier to use in product formulations [16–18]. Processing banana blossoms into flour can be used as an alternative to local food (indigenous food) to reduce the use of wheat flour, which is not food sourced from Indonesia. Previous research that has been carried out regarding the use of banana blossoms has focused more on developing them into products. Research to look at the proximate content and analysis of food fiber from fresh banana blossoms and banana blossom flour has not been widely carried out in Indonesia. A comparison of proximate and dietary Fiber between fresh banana blossoms and banana blossom flour is important as a basis for nutritional value when formulating various kinds of banana blossom-based products. Based on this, the researchers were interested in examining fresh banana blossom proximate and banana blossom flour on two cultivars of Kepok banana *(Musa acuminata × balbisiana)* and Janten banana *(Musa paradisiaca sapientum)*. The specific objectives of this research include: 1) knowing the proximate content (protein, fat, dietary Fiber, water, and carbohydrates) in fresh banana blossoms and banana blossom flour, 2) analyzing the comparison of the proximate contents of fresh banana blossoms and banana blossom flour. This research's urgency (priority) is the use of local food (indigenous food) in food diversification efforts. Later, this research can provide information for the community to increase the use of abundant banana blossoms in Lampung Province by making flour using simple technology. The innovation targeted by this research is patenting banana blossom flour, processing banana blossom flour into various snacks, and formulating banana blossom flour into food intended for special groups to improve health status in society.

2. Materials and Methods

2.1. Research Design, Place and Time

This type of research was experimental research, conducted from January – August 2021. This research was conducted in several laboratories: formulation activities, organoleptic tests, and determination of the selected formula were conducted in the Universitas Aisyah Pringsewu (UAP) laboratory. Proximate analysis was determined at the Chemical Analysis Laboratory at the Lampung State Polytechnic (Polinela). The design used in this research was experimental with a Completely Randomized Design (CRD). This research consisted of 4 treatment levels with two repetitions. The experimental unit was the cultivars of bananas and the processing method. The six treatments in this study were fresh kepok banana blossom (KS), fresh janten banana blossom (JS), unblanching kepok banana blossom flour (KM1), unblanching janten banana blossom flour (JM1), blanching kepok banana blossom flour (KM2), blanching janten banana blossom flour (JM2).

2.2. Materials and tools

The tools used to make flour are knives, slicers, baking sheets, cabinet dryers, boilers, disk mills, and scales. The tools used for analysis include glass equipment (Kjeldahl flask, Soxhlet flask, filter paper, dropper pipette, volumetric pipette, measuring cup, test tube, beaker, measuring flask, shaker glass, Erlenmeyer flask), oven, desiccator, furnace, analytical balance, tweezers, porcelain cup, aluminum cup, electric heater (hot plate), whiteness test equipment. The main ingredients used in this research were kepok banana blossoms and janten banana blossoms. The quality standard for banana blossom flour used the wheat flour quality standard approach. The quality standards for wheat flour as a food ingredient, according to Indonesia National Standart (SNI) 3751:2009, include 1) in powder form, normal odor (free from foreign odors), white color; 2) no insects and foreign objects; 3) pass through a 70 mesh sieve; 4) maximum water content 14.5%; 5) ash content 0.7%; 6) protein content of at least 7% [19]. Other ingredients used in making banana blossom flour include citric acid, water, and plastic. The chemicals used include concentrated HNO_3, ion-free water, distilled water, hexane, NaOH solution, HCl solution, H_3BO_3 solution, Na Phosphate buffer pH 6, thermamyl enzyme, MM: MB indicator, alpha-amylase, pepsin, pancreatin bile, acetone, selenium mix, 96% ethanol, NaCl, formic acid, and acetonitrile.

2.3. Procedure Analysis

Chemical property analysis carried out includes analysis of water content, ash content using the gravimetric method, ash content using the gravimetric method, protein content using the Kjeldahl micro method, fat content, carbohydrate content by difference, and crude Fiber [20]. The first stage of this research was to make banana blossom flour. The next stage was to conduct proximate and dietary fiber tests between fresh banana blossoms and banana blossom flour. The proximate analysis included energy content analysis, water content, ash content by gravimetric method, protein content by Kjeldal micro method, fat content, and carbohydrate content by difference. The third stage was to compare the differences in proximate values of each treatment.

2.4. Analysis Statistics

The independent variables in this research were the cultivar of banana blossom and the processing method. The dependent variables of this research were water content, ash content, protein content, fat content, crude fiber content, and carbohydrate content. Data processing was carried out using Microsoft Excel and SPSS programs. The statistical analysis used was Analysis of Variance (ANOVA) to analyze the effect of formula type on proximate composition and food fiber. The error used was 5%. If the analysis results were significant, a further contrast test was carried out to determine which treatment was more significant.

3. Results and Discussion

Mothers are parents who play a greater role in childcare. The characteristics of mothers in this study include age, education, occupation, total number of family, total number of toddlers and household income per capita. Table 1 shows that the average age of mothers of toddlers was 31 years old, more than half of the mothers had a high school education (56.5%) and most of them did not work or were housewives (81.9%). The type of occupation of parents represents the amount of income received each month, while education is the basic capital in getting a better job [11-12]. The average household income in this study was IDR 2,595,564, which is below the minimum wage of Aceh Province.

The education of parents is usually related to knowledge, which will affect the selection of food ingredients and the fulfillment of the nutritional needs of family members. The total family in this research consists of parents, children, and relatives who live in the same house from the same source of food acquisition. Family size can be used to illustrate the amount of food received by family members. Based on the research results, the treatment had a significant effect ($p<0.05$) on water, ash, protein, fat, crude Fiber, and carbohydrate content, as seen in Table 1. The water content analysis showed that the treatment had a significant effect ($p<0.05$) on the water content of fresh banana blossoms and banana blossom flour for the two banana blossoms. Further test results showed that the highest ash content was in fresh banana blossoms, while the water content in banana blossom flour was not significantly different. The proximate analysis results of the water content in fresh janten (JS) and fresh kepok (KS) banana blossoms were 89.16% and 88.17%. The water content in JM1 and JM2 was 7.46% and 6.02%. Meanwhile, the water content in KM1 and KM2 was 9.14% and 8.85%. The results of research on water content are in line with research by Sheng et al., (2010) which showed the results of analysis of the water content of two cultivars of fresh banana blossoms, Baxijao and Paradisiaca bananas, of 90.58% and 89.42% [21]. The results of other research on banana blossoms by Krishnan and Sinija (2016) show that the water content in 2 cultivars of banana blossoms in India, namely Poovan and Monthan bananas, is 90.1% and 90.23%. Meanwhile, the water content in Poovan and Monthan banana blossom flour is 1.76% and 1.89% [16]. Proximate analysis research on banana blossoms and other banana blossom flour by Elevaniya & Jayamuthunagai (2014) showed that the water content in fresh banana blossoms and banana blossom flour was 89% and 10%. The research results in Bangladesh by Tasnim et al., (2020) show that the water content in banana blossom flour is 8% [22]. The analysis of ash content showed that the treatment had a significant effect ($p<0.05$) on the ash content of fresh banana blossoms and banana blossom flour for the two banana cultivars. Further test results showed that the lowest ash content was in fresh banana blossoms, followed by banana blossom flour for the blanching method and banana blossom flour for the direct/fresh method. The cultivar of banana did not have a significant effect on ash content. The proximate analysis results of the ash content in fresh janten (JS) and fresh kepok (KS) banana blossoms were 1.26% and 1.44%. The ash content in JM1 and JM2 was 13.79% and 10.29%. Meanwhile, the ash content in KM1 and KM2 was 13.72% and 11.75%. This is in line with research by Sheng et al. (2010) which showed the results of analysis of the ash content in two cultivars of fresh banana blossoms, Baxijao and Paradisiaca bananas, of 1.19% and 1.24% [21]. The results of other research on banana blossoms by Krishnan and Sinija (2016) show that the ash content in 2 cultivars of banana blossoms in India, Poovan and Monthan bananas, is 3.21% and 2.42%. Meanwhile, the ash content in Poovan and Monthan banana blossom flour is 4.19% and 3.08% [16]. Proximate analysis research on banana blossoms and other banana blossom flour by Elevaniya & Jayamuthunagai (2014) showed that the ash content in fresh banana blossoms and banana blossom flour was 2% and 3.5%. The research results in Bangladesh by Tasnim et al. (2020) show that the ash content in banana blossom flour is 4.5% [22]. The analysis of protein content showed that the treatment had a significant effect ($p<0.05$) on the protein content of fresh banana blossoms and banana blossom flour for the two cultivars of banana. Further test results showed that the lowest protein content was in fresh banana blossoms, followed by janten blossom flour without blanching, janten blossom flour with blanching, kepok blossom flour without blanching, and kepok blossom flour with blanching. The protein content in kepok blossom flour without blanching, kepok blossom flour with blanching, and janten blossom flour with blanching did not differ significantly ($p>0.05$). The proximate analysis results of the protein content in fresh janten banana blossoms (JS) and fresh kepok (KS) were 2.91% and 3.03%. The protein content in JM1 and JM2 was 13.39% and 14.15%. Meanwhile, the protein content in KM1 and KM2 was 15.32% and 15.56%. This is in line with research by Sheng et al., (2010), which showed the results of analysis of the protein content in two cultivars of banana blossoms, Baxijao and Paradisiaca bananas, of 2.07% and 1.62% [21]. The results of other research on banana blossoms by Krishnan and Sinija (2016) show that the protein content in 2 cultivars of banana blossoms in India, Poovan and Monthan bananas, is 1.99% and 1.43% [16]. Meanwhile, the protein content in Poovan and Monthan banana blossom flour is 1.98% and 1.29%. The research results in Bangladesh by Tasnim et al., (2020) show that the water content in banana blossom flour is 14.2% [22]. The results of the fat content analysis showed that the treatment had a significant effect ($p<0.05$) on fat from fresh banana blossoms and banana blossom flour for the two cultivars of banana. Further test results showed that the lowest fat content was in fresh banana blossoms, followed by Janten banana blossom flour and Kepok banana flour. Fat content was significantly different ($p<0.05$) between treatments, except between the fresh janten blossom and fresh kepok blossom, and also janten banana blossom flour using the fresh method and kepok using the blanching method. The proximate analysis results of the fat content in fresh janten banana blossoms (JS) and fresh kepok banana blossoms (KS) were 0.63% and 0.85%. The fat content in JM1 and JM2 was 6.59% and 6.14%. Meanwhile, the fat content in KM1 and KM2 was 7.50% and 6.60%. This is in line with research by Sheng et al., (2010), which showed the results of analysis of the fat content in two cultivars of fresh banana blossoms, Baxijao and Paradisiaca bananas, of 0.4% and 0.6% [21]. The results of other research on banana blossoms by Krishnan and Sinija (2016) show that the fat content in 2 cultivars of banana blossoms in India, Poovan and Monthan bananas, is 0.43% and 0.54% [16]. Meanwhile, the fat content in Poovan and Monthan banana blossom flour is 0.41% and 0.46%. Proximate analysis research on banana blossoms and other banana blossom flour by Elevaniya and Jayamuthunagai (2014) shows that the fat content in banana blossom flour is 0.6%. The analysis of crude fiber content showed that the treatment had a significant effect ($p<0.05$) on crude Fiber from fresh banana blossoms and banana blossom flour for the two cultivars of banana blossoms. Further test results showed fresh banana blossoms had the lowest crude fiber content, followed by kepok banana blossom flour and janten banana flour. The proximate analysis results of crude fiber content in fresh kepok banana blossoms (KS) and fresh janten banana blossoms (JS) were 3.12% and 3.14%. The crude fiber content in KM1 and KM2 was 26.02% and 17.70%, while the crude fiber content in JM1 and JM2 was 28.90% and 26.42%. The research results of Krishnan and Sinija (2016) show that the crude fiber content in 2 cultivars of banana blossoms in India, Poovan and Monthan bananas, is 12.82% and 12.42 %. Meanwhile, the crude fiber content in Poovan and Monthan banana blossom flour is 15.48% and 15.32%.

Table 1: Results of Proximate Analysis of Banana Blossom Flour.

Variable	Treatment						*p-value*
	KS	JS	KM1	JM1	KM2	JM2	
Water (%)	88.16[a]	89.16[a]	9.14[b]	7.46[b]	8.85[b]	6.03[b]	0.000
Ash (%)	1.44[a]	1.27 [a]	13.73[c]	13.79[c]	11.75[bc]	10.29[b]	0.000
Protein (%)	2.91[a]	3.03[a]	15.32[c]	13.39[b]	15.56 [c]	14.14 [bc]	0.000
Fat (%)	0.85 [a]	0.63 [a]	7.50[d]	6.59[c]	6.60[c]	6.15[b]	0.000
Crude Fiber (%)	3.12[a]	3.14[a]	26.03[c]	28.90[d]	17.70[b]	26.42[c]	0.000
Carbohydrates (%)	2.89[a]	3.39[a]	28.29[b]	29.87[b]	39.54[c]	36.97[c]	0.000

Note= The p-value <0.05 indicates a significant influence. Different letters in different columns indicate a significant effect. KS: Fresh kepok banana blossom, JS: fresh janten banana blossom, KM1: unblanching kepok banana blossom flour, JM1: unblanching janten banana blossom flour, KM2: blanching kepok banana blossom flour, JM2: blanching janten banana blossom flour.

Table 2: Results of analysis of the degree of whiteness and yield of banana blossom flour.

Variable	Parameter	
	White Degree (%)	Yield (%)
KM1	6.80[ab]	9.1[a]
KM2	7.70[a]	8.5[a]
JM1	5.20[b]	8.7[a]
JM2	5.28[b]	8.0[a]
p-value	0.047	0.834

Note=The p-value <0.05 indicates a significant influence. Different letters in different columns indicate a significant effect. KM1: unblanching kepok banana blossom flour, JM1: unblanching janten banana blossom flour, KM2: blanching kepok banana blossom flour, JM2: blanching janten banana blossom flour.

Proximate analysis research on banana blossoms and other banana blossom flour by Elevaniya and Jayamuthunagai (2014) showed that the crude fiber content in banana blossom flour is 16%. The research results in Bangladesh by Tasnim et al. (2020) show that the crude fiber content in banana blossom flour is 16.2% [22]. The analysis of carbohydrate content showed that the treatment had a significant effect ($p<0.05$) on the carbohydrate content of fresh banana blossoms and banana blossom flour for the two cultivars of banana blossoms. Further test results showed that the lowest carbohydrate content was in fresh banana blossoms, followed by banana blossom flour using the direct/fresh method and banana blossom flour using the blanching method. The cultivar of banana does not affect the carbohydrate levels in each processing method. Based on the research results, it was known that the cultivar of treatment had a significant effect ($p<0.05$) on the whiteness of the flour but did not have a significant effect on the yield of the flour produced. The complete analysis results are presented in Table 2. Table 2 shows that the highest whiteness value of banana blossom flour was in the blanched kepok blossom flour. Meanwhile, the unblanching kepok blossom, unblanching janten blossom, and blanching janten blossom did not differ in degree of whiteness. However, overall, the whiteness value of all treatments was still relatively low, ranging from 5-8%.

The degree of whiteness is an important parameter in determining flour quality. When compared with wheat flour, banana blossom flour in this study had a very low value. The banana blossom flour produced has a dark color. The flour's dark color can reduce the product's nutritional content and consumer acceptability [23]. Three main enzymes play a role in the browning reaction in plant tissue, including polyphenol oxidase (PPO), peroxidase (POD), and phenylalanine ammonia-lyase (PAL) [24-25]. In this research, before drying using both the fresh and blanching methods, the banana blossom was soaked in an ascorbic acid solution (50mg of ascorbic acid in 1000 ml of water). However, this does not significantly reduce the browning reaction in banana blossoms. According to Chomkitichai (2018), factors that can reduce the browning reaction include enzyme concentration, phenolic components, temperature, degree of acidity, and oxygen exposure to plant tissue. Tamarind juice and sodium metabisulfite are used as anti-browning components that suppress the browning reaction in fresh banana blossoms [26]. Another study conducted by Kaewjumpol (2021) showed that treating banana blossoms with 3% oxalic acid was effective in substituting the use of sodium metabisulfite to prevent the browning of banana blossoms [27]. The yield of banana blossom flour is the ratio of the dry weight of the flour produced to the weight of fresh banana blossom before peeling. This study showed that banana blossom flour yield value in all treatments was very small, <10%. This means that to make 1 kg of banana flour, 10 kg of fresh banana blossom is needed.

4. Conclusions

The cultivar of banana blossom and processing method significantly affect the water, ash, protein, fat, crude fiber, and carbohydrate content in banana blossom flour. Banana blossom flour has a higher nutritional content per 100 g than fresh banana blossoms. The low water content and fat content of banana blossom flour are beneficial in increasing the shelf life of banana blossom flour. Making banana blossoms into flour has the advantage of increasing the nutritional content, but it is necessary to pay attention to the right anti-browning agent to reduce the browning reaction in the flour. Besides that, the effectiveness of making flour must consider the low yield.

Conflict of Interest

The authors state that there are no potential conflicts of interest associated with the research, authorship, or publication of this article.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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