Utilisation of Pineapple Waste in the Processing of Red Bean Jam

ABSTRACT

Indonesia is a country that produces fruit, including pineapples. They are the third highest produced fruit in Indonesia after bananas and mangoes. Pineapple waste in the form of eyes and weevel is still not widely utilized. The addition of pineapple waste is expected to add nutrition and increase organoleptic consumer acceptance of red bean jam. Jam is one of the processed foods that people like, various variants of jam have been produced to meet consumer needs. One of the jams made from non-fruit ingredients is peanut butter. Peanut butter is generally made from peanuts. Red beans can be used as an alternative to peanuts, considering that the amount of production in Indonesia is much higher than peanuts. From a nutritional perspective, red beans are the highest carbohydrate bean and have a fat content far below than peanuts. Red beans are said to be able to facilitate digestion and prevent cholesterol. The purpose of this study was to determine the effect of the proportion of red beans and pineapple waste on the chemical (water, ash, protein, fat, carbohydrate content) and organoleptic (color, aroma, taste, and spreadability) tests of jam. The study was conducted using a factorial randomized block design (RBD) method with two factors repeated 3 times on a laboratory scale. The treatment factors were Proportion of Red Beans: Pineapple Waste (P) with 3 levels (P1=25%:75%, P2=50%:50%, P3=75%:25%) and Type of Pineapple Waste (L) with 2 level (L1 = pineapple eye, L2 = pineapple weevel). Based on the alternative selection, the best jam was produced from the P3L1 treatment (Proportion of red beans : pineapple eyes = 25% : 75%). with protein 1.37%; fat 0.07%; water 48.24%; ash 0.64%; carbohydrate 58.67%; average liking score for taste 4.33; aroma 4.33; color 4 and spreadability 4.

Keywords: jam; pineapple waste; pineapple eyes, pineapple weevel, red bean

1. INTRODUCTION

Jam is a food product that is liked by all groups, from children to adults, so manufacturers are competing to create various kinds of flavor variants. Apart from taste, consumers also like nutritious food that is good for health. Jam is a product that has a soft texture so it is easy to spread. Jam is usually consumed as a complement to bread at breakfast. The habit of breakfast with bread and jam by foreigners is starting to be followed by many Indonesian

In general, many peanut butters on the market are made from peanuts. However, the level of demand for peanuts in Indonesia is very high for various processed products such as various kinds of snacks, and the need for peanut sauce for satay, gado-gado, pecel, etc. Meanwhile, the level of red bean production in Indonesia is very high, according to [1], total red bean production in 2020 reached 61,513 tons. Meanwhile according to [2], in the same year, peanut production only reached 721 tons. From a nutritional perspective, red beans are the highest carbohydrate bean and have a fat content far below that of peanuts. Therefore, red beans can be used as an alternative to new variants of peanut butter.

Red beans are a type of legume that has potential given its high protein content and is good for health, such as preventing cholesterol and improving digestion. However, red beans tend to be tasteless. To increase the taste of red bean butter, other ingredients need to be added. One ingredient that could potentially be added is pineapple.

Pineapples are the third highest produced fruit in Indonesia after bananas and mangoes. According to [3], total pineapple production will reach 3.2 tons. According to [4] 50% of pineapple fruit is pineapple waste consisting of 30-42% (w/w) peel, 9-10% (w/w) core, 2-5% (w/w) stem, and crown 2-4% (w/w). Pineapples have three parts that are not utilized optimally, namely the skin, eyes and weevil. According to [5] pineapple peel waste can be processed into jam. Meanwhile, pineapple waste in the form of eyes and weevil is still not widely used. The addition of pineapple waste is also expected to increase nutrition and increase organoleptic consumer acceptance of red bean butter. According to [6] Pineapple weevil.

contains active compounds of flavonoids and tannins has an antibacterial effect.

2. MATERIALS AND METHODS

The research was carried out using a factorial Randomized Block Design (RBD) method with two factors which were repeated 3 times on a laboratory scale. The treatment factor is Red Bean Proportion: Pineapple Waste (P) with 3 levels, namely

P1 = Red Beans : Pineapple Waste = 75% : 25%
P2 = Red Beans : Pineapple Waste = 50% : 50%
P3 = Red Beans : Pineapple Waste = 25% : 75%

And Types of Pineapple Waste (L) with 3 levels of treatment, namely:

L1 = Pineapple Eyes
L2 = Pineapple weevel

Parameters tested include water content, ash content, protein content, fat content, carbohydrate content, fiber content, and organoleptic parameters (aroma, taste, texture, color)

2.1 Processing of Red Bean Jam

a. Soaking Red Beans

Red beans are soaked for 12 hours. Soaking aims to soften the red beans and make the next process easier.

b. Boiling Red Beans

Boiling is carried out for 10 minutes at a temperature of 100 °C. Boiling is a process so that the unpleasant smell of red beans can be removed and to soften the texture.

c. Destruction

Crush the red beans and pineapple wasteby adding water 1:1 with a blender. The aim of crushing is to produce red bean pulp and pineapple waste.

d. Filtering

Filtering is done by filtering the crushed slurry to obtain a fine slurry

e. Cooking

Mix red bean pulp and pineapple waste with sugar and citric acid by heating on the stove for 10 minutes

f. Packaging

Packaging is done by pouring the jam into a cup and closing it after it has cooled

2.2 Analysis Method

2.2.1 Water content

Determination of water content used the distillation method [7]. A sample of 5 g put into a 250 mL Erlenmeyer, then 50 mL of toluene was added. The sample is boiled at 100°C on a hot plate and waits for ± 10 min after boiling, then the volume of water is read with a measuring cup. The determining of moisture content by Equation 1

$$Water\ Content\ (\%) = \frac{Water\ Volume\ (ml)}{Material\ Weight\ (g)}\ X\ 100\%\ (1)$$

2.2.2 Ash content

Ash content testing was carried out using the kiln method [7]. The porcelain dish was washed and heated in an oven at 105°C to constant weight, then cooled in a desiccator for 15 minutes and weighed (A). 3 g of the sample is put into a porcelain dish and then weighed (B). Then put in a furnace at a temperature of 550°C for 3 hours or until the sample turns grey. The porcelain cup was put into the oven, then cooled in a desiccator for 15 minutes and weighed (C). Ash content was calculated by the Equation 2.

$$\text{Ash Content } (\%) = \frac{(C-A)}{(B-A)} \text{ x } 100\% \qquad (2)$$

Note: A = weight of empty cup (g)
B = weight of the cup and sample (g) C = weight of cup and ash (g)

2.2.3 Protein content

Protein content was determined by the Kjeldahl method [7]. The material was weighed as much as 0.5 g and then put into a 100 ml Kjeldahl flask. Approximately 1 g of a mixture of selenium and 10 mL of concentrated H_2SO_4 (98%) was added and then homogenized. Digested in fume hood until clear. The material allowed to cool, then discarded into a 100 mL volumetric flask while rinsing with distilled water. Allowed to cool then added aquadest to the mark. Prepare a container consisting of 10 mL of 2% H_2BO_3 and add 4 drops of indicator solution in a 100 mL Erlenmeyer. Pipette 5 mL of 30% NaOH and 100 mL of distilled water, distilled until the volume of the reservoir becomes approximately 50 mL. The end of the distiller was rinsed with distilled water and then collected with its contents. Titrated with 0.02 N HCl or H_2SO_4 solution, the calculation of protein content Was carried out equation 3.

% Proteins = Va − Vb HCl x N HCl x 14.007 x 6.25 W x 100%

Where: Va = mL HCl for sample titration

Vb = mL HCl for blank titration
N = normality of the standard HCl
W = sample weight, g

2.2.4 Fat content

Fat content testing is done based on the method of [7]. The distilled flask used is dried in an oven at 100 - 110°C for 30 min, cooled in a desiccator and weighed. The sample was weighed as much as 5 g and put into a Soxhlet extractor that had contained hexane solvent. Reflux carried out for 5 h (minimum), and hexane solvents are in the distilled fat flask. Then the fat flask containing extracted fat is heated in an oven at 100°C until the weight is constant, cooled in a desiccator and weighed. The calculation of protein content is carried out Equation 4.

% Fats = fat weight g / sample weight g x 100% (4)

2.2.5 Carbohydrate content

Carbohydrates content used by different method Winarno,1986 in [8].

2.2.6 Sensory test

The sensory test of red bean jam was evaluated using thirty non-trained panelists consisting students Agricultural Industrial Technology of the Engineering Department, Universitas Wijaya Kusuma Surabaya. Red bean jam was evaluated for taste, flavour, and texture, spreadbility using five point Hedonic scale (where 1 = very disliked and 5 =very liked Iwe, M.O in [9]. Red bean jam from each treatment was presented to panelists. Jam is spread on bread to test its spreadability

2.3 Data Analysis

Parametric data obtained from the results of the study, then analyzed using analysis of variance to determine the effect of each treatment. If the results obtained through analysis of variance show that there is a significant difference between treatments, the analysis was continued with Duncan's test. with a 95% confidence level to determine which treatment has a different effect. Organoleptic test data is non-parametric data, so using non-parametric analysis, namely Friedman test.

2.4 Alternative Selection

Alternative selection aimed to determine the selected treatment alternative. The basis for selecting alternatives is the quality parameter for each product. Parameters used for the selection of alternative were protein, fiber, texture, taste, and aroma. The determination of the weight of importance for each parameter uses the Analytical Hierarchy Process (AHP) method [10], while the determination of the chosen alternative uses the expectation value method[11]

3. RESULTS AND DISCUSSION

3.1 Protein Content

The protein content produced ranges from 0.98%-2.35%. Based on the results of analysis of variance, it shows that there is no interaction between the proportion of nuts and pineapple waste and the treatment factor of the type of pineapple waste. The treatment of the proportion of red beans and pineapple waste had a significant effect on the protein content of the jam, while the treatment of the type of pineapple waste had no effect on the protein content. The protein content in red beans was higher than the protein content in pineapple, so that increasing the proportion of pineapple will cause the protein content to decrease. Red beans contain 14,36% protein [12], while Pinneaple is 0,54% [13]

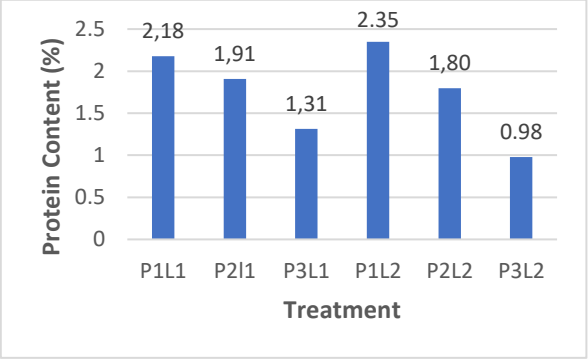

Figure 1. Histogram of Protein Content of Jam with Various Treatments

3.2 Fat Content

The resulting fat content ranges from 0.06%-0.13%. This shows that this jam contains low fat, this was becaused the raw material contains low fat. It is known that the fat content of red beans is 6,5 % [12] and pineapple is 0,12 g [13] Low-fat foods are good for health and suitable for diets. According to [14]Currently there is an increase in consumer demand for low fat/calorie products because consumption patterns are oriented towards healthy food.Based on the results of analysis of variance, it showed that there is no interaction between the proportion of red beans and pineapple waste and the treatment factor of the type of pineapple waste. The treatment of the proportion of red beans and pineapple waste had a significant effect on the fat content of the jam, while the treatment of the type of pineapple waste had no effect on the fat content. The results of the fat content in various jam treatments can be seen in Fig 2

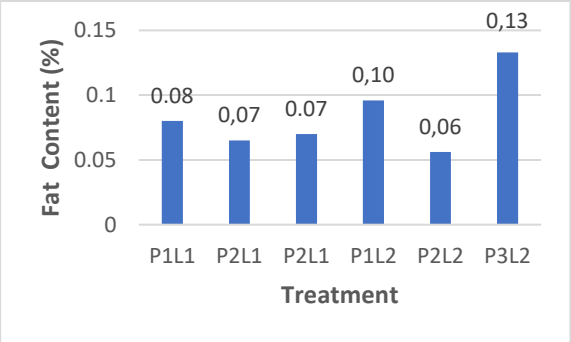

Figure 2. Histogram of Fat Content of Jam with Various Treatments

3.3 Water Content

The water content of the jam produced ranges from 39.82% - 48.24%. Based on the results of analysis of variance, it showed that there was an interaction between the proportion of red beans and pineapple waste and the treatment factor of the type of pineapple waste. Apart from that, each treatment also had a significant effect on the water content of the jam. The higher the proportion of pineapple waste in the jam, the more the water content of the jam increases. It was caused the water content in pineapple higher than the water content in red beans. The water content in red beans was 17% [15] while in pineapple it is 85.66% - 87.24% [4]

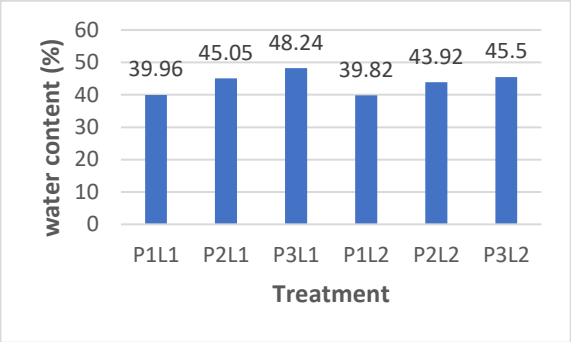

Figure 3, Histogram of Water Content of Jam with Various Treatments

3.4 Ash Content

The ash content of the jam produced ranges from 0.31%-0.62%. Based on the results of analysis of variance, it shows that there is an interaction between the proportion of red beans and pineapple waste and the type of pineapple waste. Apart from that, each treatment also had a significant effect on the ash content of the jam. According to[16]The ash content in pineapple is 0.68%. The ash content in jam is influenced by the mineral content of the raw materials used.

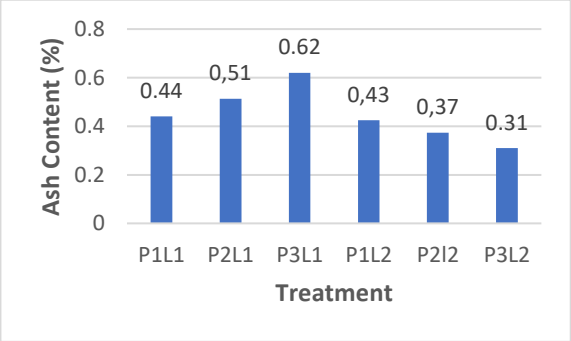

Figure 4. Histogram of Ash Content of Jam with Various Treatments

3.5 Carbohydrate

The carbohydrate content of the jam produced ranges from 48.79% - 58.21%. Based on the results of analysis of variance, it shows that there is no interaction between the proportion of red beans and pineapple waste and the treatment factor of the type of pineapple waste. Apart from that, each treatment also had a significant effect on the carbohydrate content of the jam. The higher the proportion of pineapple waste, the lower the carbohydrate content. Carbohydrates were obtained from the results of calculations by difference so they are influenced by the results of other chemical tests. According to research conducted by [17] shows that the average nutritional content of boiled red beans is 18.77% protein, 4.03% fat, 27.40% carbohydrates and 18.25% fiber.

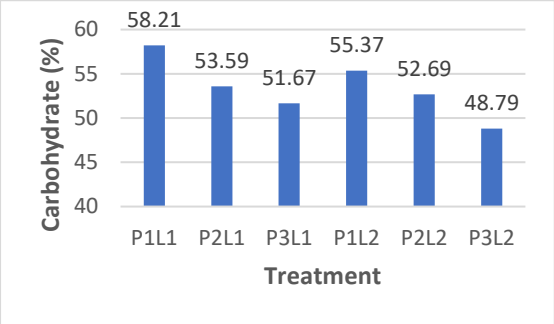

Figure 5. Histogram of Carbohydrate of Jam with various treatments

3.6 Sensory Test

3.6.1 Taste

Taste was a determining factor in making a decision to accept or reject a food product. The average taste preference score ranged from 3.5 – 4.47 with the highest preference score in the P3L2 treatment (Proportion of red beans : pineapple weevel = 25% : 75%) The picture showed that the more the proportion of pineapple waste added, the more increase preferred the taste. It was caused pineapple waste gave the jam product a sweet and sour taste, while red beans have a taste that tends to be bland, so the more pineapple waste added, the more it will give the jam a spesific taste.

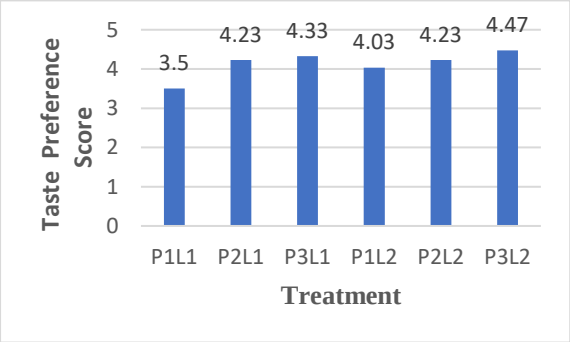

Figure 6. Histogram of Taste Preference Score

3.6.2 Aroma

Aroma was one of the determining factors that influence panelist preferences for food products, a delicious aroma can cause panelists to like food products. According to aroma, it was produced by volatile substances which are captured by nasal receptors which are interpreted by the brain. The average aroma preference score for the various jam treatments ranged from 3.28-4.33 with the highest score in the P3L1 treatment (Proportion of red beans : pineapple eyes = 25% : 75%). The aroma of red beans tends to be odorless so it was less liked by panelists, while the fresh and spesific aroma of pineapple means that the greater the proportion of pineapple, the more panelists will like it. According to [18] the addition of pineapple juice, it has quite an effect on the aroma of the drink, but it is not that strong. The main volatile components of pineapple juice that produce a distinctive aroma are ethyl ester with a content of 2092 µg/L and methyl ester with a content of 9043 µg/L 9 [19]

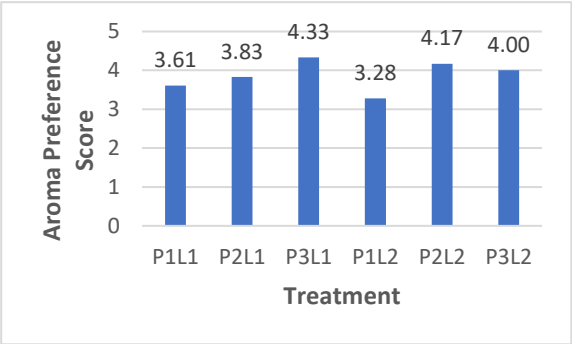

Figure 7. Histogram of Aroma Preference Score

3.6.3 Color

Color was the first thing consumers see in a product, unattractive colors can cause consumers not to buy the food product. The average score for color preference in the various jam treatments ranged from 2.83 to 4.33 with the highest score in the P3L2 treatment (Proportion of red beans : pineapple weevel = 25% : 75%). Red beans give a brownish color while pineapple gives a yellowish color to the jam. The increasing proportion of pineapple causes the color of the jam to become yellower, making it more attractive and liked by panelists. According to [20] the pineapple core, it can give the syrup a yellow color. Apart from that, [21] stated that caratenoid and xanthophyll pigments can be used as a dye food

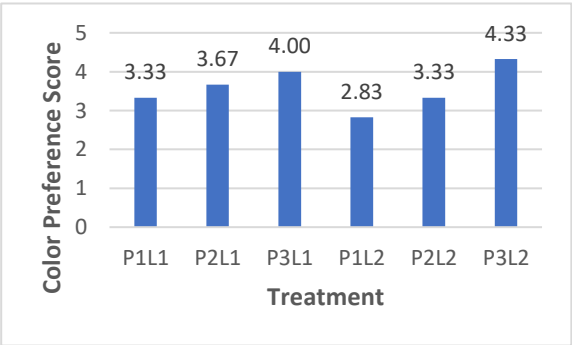

Figure 8. Histogram of Taste Preference Score

3.6.4 Spreadability

Spreadability was a measure of how easy it was for jam to spread on bread. The average spreadability preference score for various jam treatments ranged

from 3.00-4.33 with the highest score in treatment P2L1 (Proportion of red beans : pineapple eyes = 50% : 50%). Spreadability was influenced by the density of the jam, jam with a higher proportion of pineapple had a higher water content so it was easier to spread.

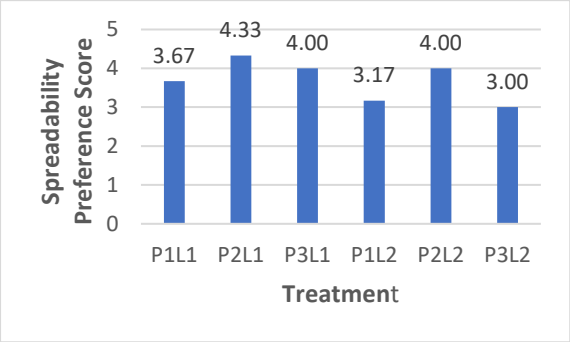

Figure 9. Histogram of Taste Preference Score

3.7 Alternative Selection

Determining the selection of the best alternative is based on the effectiveness index method, namely determining the weight for each parameter, determining the effectiveness value and product value, then the product value for each parameter is added up to get the best treatment. The assessment of these parameters is the result of organoleptic test assessments carried out by several panelists

Based on the results of the AHP test, the taste parameter has the highest importance weight of 0.381 when compared to other parameters. Meanwhile, the parameter with the lowest weight is water content with a score of 0.035.

The expected value is the sum of the values that are expected to occur regarding a possibility. The basis for calculating the best treatment is the product quality results for each parameter and the importance weight of each parameter. When making decisions, efforts should always be made to choose treatment with the maximum expected value. The results of the expected value score calculation show that the P3L1 treatment (Proportion of red beans : pineapple eyes = 25% : 75%) has the highest expected value, namely 8.02. so P3L1 was chosen as the best treatment

4. Conclusion

From the research results the following conclusions can be drawn:

1. Treatment of the proportion of red beans has a significant effect on protein content, fat content, water content, ash content and carbohydrate content. Meanwhile, the type of pineapple waste treatment had a significant effect on the water content and ash content. There was an interaction between the proportion of red beans and the type of pineapple waste on water content and ash content
2. Organoleptic test results show that the average taste preference score for various treatments ranges from 3.5 – 4.47 (neutral – like); The average aroma preference score for various jam treatments ranged from 3.28 to 4.33 (neutral-liked); The average color preference score in various jam treatments ranged between 2.83-4.33 (unliked-liked) and the average spreadability preference score in various jam treatments ranged from 3.00-4.33 (neutral-liked)
3. The best treatment for jam is the P3L1 treatment (proportion of 25% red beans and 75% pineapple eyes) with a protein content of 1.37%; fat 0.07%; water content 48.24%; ash content 0.64%; carbohydrate content 58.67%; average liking score for taste 4.33; preference score for aroma 4.33; color preference score 4 and spreadability preference score 4.

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