Combination of Pineapple and Okra on Chemical and Sensory Characteristics of Fruit Leather

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Abstract. The purpose of this research was to get the best combination of pineapple and okra on chemical and sensory characteristics of fruit leather. This research was conducted experimentally by using a complete randomized design (CRD) which consist of four treatments and four replicates. The treatments were ratios of pineapple and okra pulp, such as NO1 (50:50), NO2 (60:40), NO3 (70:30), and NO4 (80:20). Data obtained were statistically analyzed by using Analysis of Variance and continued with Duncan’s New Multiple Range test at 5% level. The results showed that the ratio of pineapple and okra pulp significantly affected moisture content, ash content, pH, fiber content, dissolved total solid, sensory test on color, flavor, taste, and texture of the fruit leather. The best treatment in this research was NO4 (80:20) with 6.07% moisture content, 0.70% ash content, 4.4 pH, 4.75% fiber content, and 56.04 °brix total solid. The results of descriptive test showed that the fruit leather had brown color (3.1), pineapple scented (3.67), pineapple taste (3.57), little chewy texture (2.67) and overall assessment hedonically was favored by panelists (3.78).

Keywords: Fruit Leather, Pineapple, Okra

1. Introduction

Pineapple is a tropical fruit that has a high economic value. For the people in Indonesia, pineapple is a part of their lives, because all parts of the plant can be utilized. Pineapple is not only popular for the consumption of fresh fruit, but also an industrial raw material for canned and processed fruits such as jam, syrup, and others. The content of minerals and vitamins in pineapple is very good for the body, especially the content of vitamins A and C. In addition, the water content in pineapple is quite high.

Foods in general are not always consumed directly but most are processed into various types of other processed foods. Pineapple has a sweet and sour taste so it is delicious to be consumed either directly as a fruit or processed food. Currently, there are many processed products from pineapple such as jam, dodol, pineapple chips, and one of the products that being developed namely fruit leather. Fruit leather is a natural healthy food that is rich in vitamin, fiber and mineral, and can be used as an alternative processed food made from fruit, vegetable, and flower that have been crushed and dried, so that thin sheets can be rolled up [1]. The fruit leather has a shelf life of up to 12 months when it stored in a good packing at 25-30 °C.

The pineapple fruit leather processing has been done so it is necessary to do new innovations by mixing pineapple fruit leather with vegetables to increase its nutritional value. The vegetable that are currently being developed in Indonesia is okra (Abelmoschus esculentus). Okra is widely consumed...
because it contains carbohydrates, fats, proteins, vitamins, and minerals. According to [2], the benefits of consuming okra are reducing the risk of heart disease, smoothing digestion, counteracting free radicals, lowering cholesterol, and balancing blood sugar and cancer. Some types of okra that exist are red and green okra, but the okra that is consumed mostly is green okra. The purpose of this research was to get the best combination of pineapple and okra pulp on chemical and sensory characteristics of fruit leather.

2. Methods

2.1 Materials
Material used were pineapple which obtained from pineapple plantation in Rimbo Panjang Village, Tambang Subdistrict, Kampar District, Riau Province and okra from Brastagi, North Sumatera. Chemical for analysis used were aquades, alcohol, HCl, fenolftalein, NaOH, KI, Na-thiosulfate, luff schoorll, H$_2$SO$_4$, K$_2$SO$_4$, and (NH$_4$)$_2$HPO$_4$.

2.2 Research Methodology
The research was conducted using a complete randomized design, which consist of 4 treatments and each treatment was repeated 4 times. The treatments were combination of pineapple and okra pulp at temperature of 60 °C such as NO1 (50% pineapple: 50% okra), NO2 (60% pineapple: 40% okra), NO3 (70% pineapple: 30% okra), and NO4 (80% pineapple: 20% okra).

2.3 Processing of Pulp Pineapple and Pulp Okra
Materials preparation was done by visually sorting pineapple and okra on same colour of yellow and green flesh fruit. The pineapple and okra weren’t mushy. The pineapple and okra were cut into small pieces and milled by using blender.

2.4 Processing of Fruit Leather
Processing of fruit leather was done by mixing pineapple and okra pulp according to the treatment. The mixture was added 40% sugar, 0.3% arabic gum, and 0.3% carrageenan, then blanched to a temperature of 70 °C. The mixture was dried in an oven at 60 °C until 11-12 h. The mixture that has been dried was cut to size of 4x4 cm and rolled up.

2.5 Analysis Data
Data obtained were statistically analyzed using Analysis of Variance (ANOVA). If the obtained data showed that $F_{\text{count}} \geq F_{\text{table}}$, the data were proceed with Duncan's New Multiple Range Test (DNMRT) at 5% level.

3. Results and Discussion

3.1. Moisture content
Water content is one of the characteristics that is very important for food. The water content in food can affect the appearance and texture of the food. The results of the fruit leather moisture content can be seen in Table 1. The moisture content ranged 6.06-9.65%. The highest water content in the fruit leather was NO1. The water content increased with more okra and less pineapple pulp used. This was because of the differences in water content in the raw materials used. Based on the analysis, pineapple had moisture content of 83.81%, while okra of 88.69%.

| Treatment                  | Moisture content (%) |
|----------------------------|----------------------|
| NO1 (50% pineapple:50% okra) | 9.65$^d$            |
| NO2 (60% pineapple:40% okra)  | 8.03$^c$            |
| NO3 (70% pineapple:30% okra)  | 6.81$^b$            |
Water content of the fruit leather was also influenced by fiber content that found in these raw materials, especially water soluble fibers. The fiber content in okra pulp was 3.2% while pineapple was 1.4%. The more pineapple pulp added into the fruit leather, the lower resulting fiber content of the fruit leather (Table 1). According to [3], the fiber content can affect the moisture content of fruit leather produced, because the fiber is able to absorb and retain water. Water-soluble food fibers have large polymer-shaped molecules complex, large water-binding capacity, and many free hydroxyl groups. The many free hydroxyl groups which are polar in fiber have multiple matrix structures that provide an opportunity for the binding of water through hydrogen bonds. This was what caused the water content tends to be high in the high content of fiber in the materials. The dried process for 12 hours at 60°C in the making of fruit leather also affected the water content of fruit leather. According to Winarno [4], the higher temperature of drying process, the faster evaporation occurs which can reduce the water content of the food. But, in this research, there wasn’t temperature treatment on the processing of fruit leather.

3.2. Ash Content
The results of the fruit leather ash content can be seen in Table 2. The ash content of fruit ranged 1.05 to 0.70%, the highest ash content is NO1. The ash content increased with more okra and less pineapple pulp used. This was caused by differences in mineral content in the raw materials used. Based on the analysis of raw materials, pineapple had ash content of 0.3% while okra of 0.7%.

| Treatment                  | Ash Content (%) |
|----------------------------|-----------------|
| NO1 (50% pineapple:50% okra) | 1.05<sup>a</sup> |
| NO2 (60% pineapple:40% okra) | 0.94<sup>c</sup>  |
| NO3 (70% pineapple:30% okra) | 0.81<sup>b</sup>  |
| NO4 (80% pineapple:20% okra) | 0.70<sup>a</sup>  |

Winarno [5] stated that determination of ash content is closely related to the mineral contained in an ingredient such as iron, calcium, potassium manganese, and magnesium. According to [6], minerals content in 100 g of okra are 56 mg phosphate, 6.9 mg sodium, 30 mg sulfur, 66 mg calcium, 0.35 mg iron, 103 mg potassium, 53 mg magnesium, and 0.19 mg copper. While [7] stated that the mineral content of pineapple are 9 mg phosphorus and 0.2 mg iron.

3.3. pH Value
The results of the fruit leather ph values can be seen in Table 3. The ph values of fruit leather ranged 4.70 to 4.37. The highest ph value was shown in NO1. The pH value increased with more okra and less pineapple pulp used. This was because the pineapple pulp had a higher pH value than the okra pulp. Based on the analysis of raw materials, pineapple had ph value of 3.5 while okra of 5.7

| Treatment                  | pH Value (%) |
|----------------------------|--------------|
| NO1 (50% pineapple:50% okra) | 4.70<sup>c</sup> |
| NO2 (60% pineapple:40% okra) | 4.70<sup>c</sup> |
| NO3 (70% pineapple:30% okra) | 4.53<sup>b</sup> |
| NO4 (80% pineapple:20% okra) | 4.37<sup>a</sup> |

The results of this study was similar with [8], that stated the addition of pineapple pulp in fruit leather can caused pH getting lower. According to [9], the pH or acidity of food is influenced by naturally acids that found in food ingredients. The pH value was also closely related to the water content. As shown in Tables 1 and 3, the lower water content can cause lower pH value of the fruit
leather. This was because the concentration of $H^+$ ions in solution, if the pH value is higher, the more $H^+$ ions in the solution [10].

### 3.4 Total Dissolved Solids

The results of the fruit leather total dissolved solids can be seen in Table 4. The total dissolved solids ranged 42.87 to 56.04, the highest was NO4. The total dissolved solids increased due to more pineapple and lower okra pulp added. This was related to the total sugar content in the food. The higher total sugar content of fruit leather, the higher total dissolved solids produced. The total sugar content and carbohydrates of pineapple were 2 g and 13 g, while okra were 1.2 g and 7.03 g, respectively. [11] stated that the total dissolved solids included reducing sugars, non-reducing sugars, organic acids, and proteins.

| Treatment                  | Total Dissolved Solids (brix) |
|---------------------------|-------------------------------|
| NO1 (50% pineapple:50% okra) | 42.87a                       |
| NO2 (60% pineapple:40% okra)  | 48.65b                       |
| NO3 (70% pineapple:30% okra)  | 51.59c                       |
| NO4 (80% pineapple:20% okra)  | 56.04d                       |

Pectin content in the pineapple can also affect the total dissolved solids of the fruit leather. According to[12], pectin in fruit that undergoes a ripening process will be hydrolyzed into soluble components causing an increase in the water-soluble component. The pineapple used in this study was a ripe pineapple so that the pectin in it had been hydrolyzed and the soluble component was high. This caused the total dissolved solids in fruit leather increased with the increasing number of pineapple pulp used.

### 3.5 Crude Fiber Content

The results of the fruit leather crude fiber content can be seen in Table 5. The value of crude fiber ranged 6.98 to 4.75, the highest was NO1. The more pineapple and the lower okra pulp added can caused the crude fiber content of fruit leather getting lower. This was due to the amount of crude fiber content in the raw materials, pineapple had 1.46% crude fiber content while okra had 3.01% crude fiber content.

| Treatment                  | Crude Fiber Content (%) |
|---------------------------|-------------------------|
| NO1 (50% pineapple:50% okra) | 6.98d                   |
| NO2 (60% pineapple:40% okra)  | 6.22c                   |
| NO3 (70% pineapple:30% okra)  | 5.58b                   |
| NO4 (80% pineapple:20% okra)  | 4.75a                   |

The crude fiber content was related to the water content of the fruit leather. [8] stated that the higher water content of the fruit leather, the higher crude fiber content of the fruit leather. The crude fiber in food materials has high water absorption due to its large polymer size, complex structure, large water-binding capacity, and many free hydroxyl groups [13].

### 3.6 Sensory Assement Fruit Leather

Sensory descriptive assessment was done on color, aroma, taste, and texture of the fruit leather. Sensory assessment had fulfilled SNI 01-3746-2008 which was normal. The average panelist's assessment of the color of fruit leather ranged 2.27-3.1 (brownish green to brown). The average panelist's assessment of the taste of fruit leather ranged 2.27-3.57 (okra taste to pineapple taste). The average panelist's assessment of the aroma of fruit leather ranged 2.63-3.67 (pineapple and okra scented to pineapple scented). The average panelist's assessment of the texture of fruit leather ranged 2.33-2.67 (chewy to rather chewy). The average panelist's assessment of the overall assessment of fruit leather ranged 3.28-3.78 (rather like to like). Based on the proximate analysis and sensory assessment,
the best treatment of fruit leather was NO4. The NO4 treatment had fulfilled SNI 01-3746-2008 and can be accepted and favored by panelists.

Tabel 6 Sensory Assessment Fruit Leather

| Sensory Assessment | SNI | Treatment | NO1 | NO2 | NO3 | NO4 |
|-------------------|-----|-----------|-----|-----|-----|-----|
| Colour            | Normal | 2.27<sup>a</sup> | 2.43<sup>a</sup> | 2.63<sup>a</sup> | 3.10<sup>b</sup> |
| Taste             | Normal | 2.27<sup>a</sup> | 2.73<sup>b</sup> | 3.07<sup>b</sup> | 3.57<sup>c</sup> |
| Aroma             | Normal | 2.63<sup>a</sup> | 2.70<sup>a</sup> | 3.17<sup>b</sup> | 3.67<sup>c</sup> |
| Texture           | Normal | 2.33<sup>a</sup> | 2.47<sup>a</sup> | 2.57<sup>a</sup> | 2.67<sup>a</sup> |
| Overall Assessment| Normal | 3.28<sup>a</sup> | 3.41<sup>b</sup> | 3.66<sup>b</sup> | 3.78<sup>b</sup> |

Note: the number followed a different lowercase indicates significantly different according to DNMRT test at 5% level.

Number in color 1= very green; 2=brownish green; 3=brown; 4=brownish yellow; 5= yellow.
Number in taste 1= very okra taste; 2= okra taste; 3= okra and pineapple taste; 4= pineapple taste; 5= very pineapple taste
Number in aroma 1= very okra scented; 2: okra scented; 3= okra and pineapple scented; 4= pineapple scented; 5= very pineapple scented.
Number in texture 1= very chewy; 2= chewy; 3= rather chewy; 4= hard; 5= very hard.
Number in overall assessment 1= very dislike; 2= dislike; 3= rather like; 4= like; 5= very like

4. Conclusion
Ratio of pineapple and okra pulp in fruit leather significantly affected moisture, ash, pH, fiber, and total dissolved solid content, as well as sensory test on color, taste, aroma, and texture of the fruit leather. The best treatment in this research was NO4 (80% pineapple: 20% okra) which had 6.07% moisture content, 0.70% ash content, 4.4 pH, 4.75% crude fiber content, and 56.04 °brix total dissolved solid. The fruit leather had brown color (3.1), pineapple taste (3.57), pineapple scented (3.67), rather chewy texture (2.67), and was hedonically favored by panelist (3.78).

References
[1] Puspasari K, Rusli F, and Mileiva S 2005 *Formulasi campuran flower leather dari bunga mawar dengan ekstrak rempah-rempah (cengkeh dan kayu manis) sebagai pangan fungsional kaya antioksidan [PKMP-2-5-1]* Bogor
[2] Gemede H F, Ratta N R, Haki G D, Woidegiorgis A Z, and Beyene F 2014 Nutritional Quality and Health Benefits Okra (*Abelmoschus esculentus*): A Review *Jurnal Food Science and Quality Management* **33**
[3] Darojat D 2010 Benefits of Adding Food Fiber to Processed Meat *Jurnal Food Review* **5**(7) 52-53
[4] Winarno F G 2004 *Food chemistry and nutrition* Jakarta: Gramedia Pustaka Utama
[5] Winarno F G, Fardiaz S, and Fardiaz D 2008 *Introduction to food technology* Jakarta: PT. Sarana Perkasa
[6] Gopalan C, Rama, Sastri B V, and Balasubramanian S 2007 *Nutritive Value of Indian Foods*. National Institute of Nutrition (NIN): ICMR
[7] Barus A 2008 *Agrotechnology of fruit plant* Medan: Universitas Sumatra Utara-Press
[8] Zulfarina T 2018 *Kombinasi buah nipah dan buah nanas dengan penambahan gum arab terhadap mutu fruit leather [Skripsi]* Pekanbaru: Fakultas Pertanian Universitas Riau
[9] Fardiaz S 1992 *Food Processing Microbiology* Bogor: Departement Pendidikan dan Kebudayaan. Direktorat Jenderal Pendidikan Tinggi, Pusat Antar Universitas Pangan dan Gizi, Institut Pertanian bogor
[10] Safitri A A 2012 *Studi on making mangga-rosella fruit leather* [Skripsi] Makasar: Universitas Hasanudin
[11] Buckle K A, Edward R A, Fleet G H, and Wootton M 2007 Food Science Penerjemah Hari P and Adiono Jakarta: Universitas Indonesia

[12] Farikha I N, Anam C, and Widowati E 2013 Effect of type and concentration of natural stabilizers on the physicochemical characteristics of red dragon fruit (Hylocereus polyrhizus) Jurnal Teknologi Pangan 2(1)

[13] Tala. Z Z 2009 Fiber benefits for health Medan: Universitas Sumatera Utara Press