Texture profile of the bread produced from composite flour
Bruguiera gymnorrhiza flour (BGF) and wheat flour

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Abstract. This research aims to know the texture profile of the bread produced from composite flour consisting of Bruguiera gymnorrhiza flour (BGF) and wheat flour. Two loaves of bread were prepared using 90% wheat flour and 10% substituted BGF. The dough had the following composition (Table 1). The fermentation of the dough took 15 minutes in a fermenter, and it was then kneaded twice, where each kneading was done until the dough did not stick to the side of the container. The dough was then put into the oven at 170-180°C for 45 min. A Hedonic test was carried out by 30 non-trained panelists. The texture profile was determined using a Strength measurement method and a Texture Analyzer (Imada, Japan). Bread containing 10% (w/w) BGF in this study had a higher customer preference than the control (white bread). Therefore, this substituted bread was more consumed by the people. In this study, substituted white bread had a higher textural profile value compared to white bread, although not significantly. This difference is due to the differences in the physicochemical properties of each flour used.

1. Introduction

Bruguiera gymnorrhiza is a mangrove plant species widely cultivated on the Asian continent. It produces fruit when the plant has aged two years. The Indonesian people call this species Lindur or Tanjang. The fruit has a green and brown color when the fruit shows appropriate maturity with a length and diameter of 15cm to 25cm and 2cm respectively.

According to previous studies, the Lindur fruit has good potential as an alternative food stock because it contains a high amount of carbohydrate such as starch and fiber. On the other hand, this fruit contains HCN and excess tannin which means that the fruit has a bitter taste and may cause adverse effects if consumed. However, a previous study has revealed the practice in reducing the amount of HCN and tannin by using a pretreatment of ash suspension. Through this treatment, the tannin concentration declines due to the absorbing activity of the used suspension. Furthermore, the flour produced becomes feasible to be eaten. Tannin is a water soluble phenol which can be beneficial in a sufficient amount but it is carcinogenic in a higher concentration and intensifies the bitterness [1].

Texture is one of crucial factors of food palatability where the ingredients used and the cooking method is another factor influencing the texture profile of food. So far, this flour has not been scientifically proven, although many people have already used this flour as food stock, especially people living in the coastal area.
2. Material and methods

2.1 Material
Lindur fruit (Bruguiera gymnorrhiza) were harvested in the Wonorejo Mangrove Conservation (Surabaya, East Java, Indonesia). The fruit was then carried to the food processing laboratory and stored in a freezer before use. Ash was purchased from a traditional market in Pucang, Surabaya, and Rattus norvegicus (Wistar) was obtained from the Laboratory of Biochemistry in the Faculty of Medicine, Universitas Airlangga.

2.2 Preparation of BGF
The whole Lindur fruit was thawed and quickly heated in water with a temperature of 90°C - 100°C for 2 minutes. The fruit was then cooled and peeled off. The peeled fruit was then chopped and soaked in an ash suspension of 10% (w/v) until the fruit had been fully soaked for 24h. The fruit was then washed using tap water to remove the remaining ash on the fruit. After that, the fruit was sun dried until fully dry. If the fruit was not dry, then the fruit was put into a refrigerator to prevent simultaneous microbial fermentation. The dry fruit was then milled and sieved through a membrane with a mesh number of 100.

2.3 Formulation of bread
The bread was prepared using Jailani’s method [2]. The dough had the following composition (Table 1). The fermentation of the dough took 15 min in a fermenter, and it was then kneaded twice, where each kneading was done until the dough did not stick to the sides of the container. The dough was then put into the oven at 170-180°C for 45 min.

Table 1. Formulasi roti tawar

| Ingredients    | F0     | F1     |
|----------------|--------|--------|
| Wheat flour (g)| 400.00 | 360.00 |
| Buahlindur (g) | 0.00   | 40.00  |
| Salt (g)       | 1.00   | 1.00   |
| Butter (g)     | 16.00  | 16.00  |
| Baker yeast (g)| 5.00   | 5.00   |
| Water (cc)     | 200.00 | 280.00 |
| Skim milk (g)  | 8.00   | 8.00   |
| Arabic gum (g) | 4.00   | 4.00   |

2.4 Hedonic test of bread
The hedonic test was carried out by 30 non-trained panelists recruited from the Faculty of Fisheries and Marine Universitas Airlangga. The four hedonic parameters of aroma, texture, taste color and overall were scored using 7 levels; 7 = extremely like; 6 = like; 5 = satisfactory; 4 = neutral; 3 = almost dislike; 2 = dislike; 1 = extremely dislike. The hedonic test was carried out at a room temperature of 24°C.

2.5 Profiling of the bread texture
The texture profile was determined using a strength measurement method using a Texture Analyzer tool (Imada, Japan).

3. Results and discussion

3.1 The effect of BGF substitution on the IG and texture profile of the bread
The bread containing 10% (w/w) BGF in this study had a higher customer preference than the control (white bread). Therefore, this substituted bread could be consumed by people.
The development level of the dough depends on the concentration of the gluten (protein) in the flour. Meanwhile, Lindur fruit flour can be said to have low protein content compared to wheat flour. In this study, the substituted white bread had a higher textural profile value compared to white bread, although not to the point where it was significant. This is due to the differences in the physicochemical properties of the flour types.

Table 2. Texture profile of substituted bread and control bread

| Texture parameter | Control            | Substituted Bread   |
|-------------------|--------------------|---------------------|
| Hardness          | 4153.61 ± 66.82    | 4708.76 ± 253.02    |
| Springiness       | 0.90 ± 0.04        | 0.82 ± 0.11         |
| Cohesiveness      | 0.55 ± 0.03        | 0.55 ± 0.07         |
| Gumminess         | 2281.34 ± 155.55   | 2576.32 ± 318.05    |
| Chewiness         | 2040.60 ± 93.00    | 2141.74 ± 525.17    |
| Resilience        | 0.22 ± 0.01        | 0.23 ± 0.03         |

As can be seen in the results, the addition of BGF in the formulation of the bread samples was significantly affected by the textural properties of the product. The hardness of the bread samples were increased by adding 10% BGF. Hardness was mainly attributed to the amylose and amylopectin matrix which contributes to the overall bread texture [3].

The springiness of the bread samples was significantly reduced by the addition of BGF in their formulation. According to a report by [4], the interaction between gelatinized starch and gluten dough can cause the dough to be more elastic, which can form a continuous sponge structure in the bread after heating. Therefore, the high springiness in the Control attribute could be attributed to the dilution of the gluten structure in the substituted bread. The lower amount of gluten causes a lower ability to hold in the gases which causes, in turn, an elasticity reduction in the bread [5].

The partial replacement BGF decreased the cohesiveness of the composite breads. These results indicate that composite breads have a low ability to resist to the bite-force between the teeth before the bread structure breaks. This was attributed to the substitution of BGF at a 10% level which interferes with the dough structure, and weakens the crumb structure [6]. Tannin did not have any effect on the textural properties [7]. According to Silva [8], they reported that the average value of WAI from flour is directly proportional to the value of its moisture content. Bread with the addition of 10% BOF tended to have lower moisture content, causing a higher hardness value.
4. Conclusion
This study revealed that the substitution of BGF affected customer preferences and texture profile of the final biscuit produced.

5. References
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