# Improve the texture of white bread from cassava flour (gluten free)

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**Abstract.** The production of white bread made from cassava has a hard texture, is easily crushed and is not elastic, so that new innovations are needed to have a soft and elastic texture. The research objective was to improve the texture of bakery products (white bread) made from cassava flour. Data analysis used ANOVA analysis of variance at the 5% level and further testing using the LSD (Least Significant Difference) method. The design was carried out using RAL, carried out three times with the variable treatment of 3 types of flour (**Dioscorea esculenta**, **Pachyrhizus erosus** and **Dahlia sp**), and variable fermentation time (0, 24, 48, 72 hours). The variables observed included physical, chemical and functional properties. The research was conducted in three stages (production of cassava flour, **Dioscorea esculenta**, **Pachyrhizus erosus** and **Dahlia sp** characterization, and making bread made from cassava). Based on its characteristics, the addition of improver flour (B1) **pachyrhizus erosus** 3% in making white bread made from cassava can improve the resulting bread with a soft texture (119.18 ± 1.09 g / 10 mm), expand power (126.67 ± 0.24%). Based on the effectiveness test, treatment B1 has the highest effectiveness with a value of 1.

## 1. Introduction

Cassava is a starch-only carbohydrate source consisting of amylose and amylopectin. The production of white bread with cassava raw materials has not been accepted by the community, especially in texture and elasticity, therefore it is necessary to do an innovation so that white bread made from cassava (gluten free) can be accepted in the community. In making white bread with cassava raw materials, if the amount of water is added a little, it makes the bread produced easy to shape, has high expansion power, hard texture, crumbles easily and has low elasticity. White bread made from cassava added with too much water causes the white bread does not expand. White bread is made from wheat flour with added sugar, butter or margarine, powdered milk, salt, yeast, and water. Wheat flour which is good for bread is wheat flour which has high protein. The criteria for good white bread is bread that has a soft and elastic texture.

In the process of making white bread, protein (gluten) plays an important role in expansion and elasticity. The protein matrix formed can provide resistance to tensile forces. The protein content greatly affects the stretch value of the dough. The stretch value of the dough can increase with increasing protein content [1].

Water-soluble polysaccharides contained in gembili can be used as food additives that function as emulsion stabilizers, gels, foam formers and as fillers [2]. Water Soluble Polysaccharide (PLA) is a water soluble food fiber, which is currently widely used in the food industry to achieve the expected viscosity, stability, texture, and appearance [3].
2. Material and Methods

2.1 Material
Kaspro cassava, Dioscorea esculenta, Pachyrhizus erosus and Dahlia sp. Other research materials used are local sugar from the gulaku brand, cap kapal brand salt, master brand blue band, eggs, dancow brand milk powder, instant yeast, chemicals used include NaOH, HCl, amilosa, etanol, folin ciocalteu, DPPH.

2.2 Production Flour Cassava Dioscorea esculenta, Pachyrhizus erosus and Dahlia sp
Cassava is removed from its skin, washed thoroughly to remove dirt and mucus. Then blended and weighed as much as 10 kg and added water with a ratio (1: 2), then added a starter of 500 ppm. Before use, a starter containing LAB is developed by weighing 0.1 g of starter, 20 g of sugar, 100 g of dry cassava chips and 2000 ml of water put in a 2000 ml beaker, left for 24 hours until ready to use. Furthermore, fermentation is carried out for 0, 24, 36 and 72 hours. After the desired fermentation time is reached, the cassava flour is harvested by draining it with a filter cloth, then the fermentation water is removed and the cassava flour is dried in the sun.

Production of flour Dioscorea esculenta, Pachyrhizus erosus and Dahlia sp is removed from the skin, washed thoroughly to remove dirt and mucus. Then cut 0.5 cm thin and 2 cm time and weighed as much as 10 kg and added water with a ratio (1: 2), then added a starter of 500 ppm. Before use, a starter containing LAB is developed by weighing 0.1 g of starter, 20 g of sugar, 100 g of chips of Dioscorea esculenta, Pachyrhizus erosus and Dahlia sp and 2000 ml of water put into a 2000 ml beaker, left for 24 hours until ready will be used. Furthermore, fermentation is carried out for 0, 24, 48 and 72 hours. After the desired fermentation time is reached, the additional chips are harvested by draining them with a filter cloth, then the fermentation water is removed and the chips are dried using sunlight.

2.3 Methods
Data analysis used ANOVA analysis of variance at the 5% level and further testing using the LSD (Least Significant Difference) method. Design is done using RAL. Determination of the best treatment is determined based on the effectiveness index method [4]. Multiple linear regression test is recommended to determine the parameters that affect texture.

3. Results and Discussion
Based on the multiple linear regression test, R2 (R Square) is 0.984. This shows that the percentage of contribution of water, ash, fat, protein, amylose, carbohydrates, pH, total acid, polyphenols, inhibitors, PLA, OHC, WHC, cold and hot viscosity has a significant effect on texture by 98.4%. The highest protein content was in pachyrhizus erosus with a value of 10.47(%) ±0.05. Therefore, the elasticity formed in white bread from cassava flour with added Pachyrhizus erosus is more elastic than those added, Dioscorea esculenta and Dahlia sp. This can be seen in Table 1 Characterization of physical, chemical and functional properties of Dioscorea esculenta, Pachyrhizus erosus and Dahlia sp fermented on time (0, 24, 48 and 72 hours). The PLA content of pachyrhizus erosus was lower with a value of 12.22(%) ±0.21 compared to Dioscorea esculenta and Dahlia sp with a value of 12.34(%) ±0.49 and 28.18(%) ± 0.86. The presence of PLA significantly affects the texture of white cassava bread. Although the PLA content of Dahlia sp is high, its expand power is low due to the small amylose content of 2.44 (%) ± 0.27.

High polyphenol content at 0 hour fermentation time, the high polyphenol content as an additive in making white bread from cassava is undesirable because it causes brown bread. The presence of fermentation causes the polyphenol content to decrease, so that the color of white bread from the inside of the cassava is yellow. This can be seen in Figure 2. Cross section of cassava white bread with the addition of 3% pachyrhizus erosus flour at fermeted 24 hours.

The form of the granules in cassava and pachyrhizus erosus is same and the size of the Pachyrhizus erosus granules is smaller in SEM observations. Pachyrhizus erosus have granules 0.7-11.7 µm and
the cassava granules which have a size of 5 to 40µm. The form of Dioscorea esculenta and Pachyrhizus erosus granules is different from cassava.

Figure 1. Application of Dioscorea esculenta (G1), pachyrhizus erosus (B1) and Dahlia sp (U1) on cassava whitebread

Table 1. Characterization physical, chemical and functional properties of Dioscorea esculenta, Pachyrhizus erosus and Dahlia sp fermentation time (0, 24, 48 and 72 hours)

| Parameter (%) | 0 | 24 | 48 | 72 |
|---------------|---|----|----|----|
| **BO**        |   |    |    |    |
| Water         | 16.43 ± 0.33 | 10.71 ± 0.02 | 12.14 ± 0.07 | 10.25 ± 0.04 | 11.05 ± 0.03 | 10.86 ± 0.06 | 10.56 ± 0.05 | 11.34 ± 0.00 | 12.67 ± 0.02 | 10.93 ± 0.03 | 12.47 ± 0.03 | 12.24 ± 0.05 |
| Ash           | 2.93 ± 0.04 | 3.18 ± 0.04 | 3.84 ± 0.1 | 2.49 ± 0.02 | 2.97 ± 0.02 | 5.08 ± 0.1 | 2.39 ± 0.04 | 2.41 ± 0.05 | 5.29 ± 0.05 | 2.17 ± 0.05 | 1.91 ± 0.02 | 5.68 ± 0.04 |
| Fat           | 0.65 ± 0.04 | 0.09 ± 0.00 | 0.67 ± 0.00 | 0.41 ± 0.02 | 0.07 ± 0.00 | 1.15 ± 0.00 | 0.35 ± 0.02 | 0.13 ± 0.00 | 1.88 ± 0.06 | 0.32 ± 0.00 | 0.09 ± 0.00 | 0.55 ± 0.05 |
| Protein       | 13.19 ± 0.03 | 6.05 ± 0.00 | 6.12 ± 0.06 | 10.47 ± 0.05 | 5.78 ± 0.03 | 7.07 ± 0.07 | 7.89 ± 0.02 | 5.66 ± 0.17 | 6.26 ± 0.05 | 7.59 ± 0.04 | 5.04 ± 0.18 | 6.38 ± 0.13 |
| Polyphenols   | 1.02 ± 0.02 | 0.14 ± 0.05 | 0.16 ± 0.00 | 0.046 ± 0.07 | 0.13 ± 0.13 | 0.39 ± 0.24 | 0.08 ± 0.08 | 0.061 ± 0.02 | 0.42 ± 0.05 | 0.07 ± 0.05 | 0.05 ± 0.05 | 0.34 ± 0.02 |
| Antioxidant activity | 33.51 ± 2.04 | 13.13 ± 1.12 | 12.12 ± 1.25 | 1.67 ± 0.08 | 9.36 ± 0.65 | 14.67 ± 0.82 | 1.62 ± 0.04 | 5.10 ± 0.32 | 11.42 ± 0.11 | 0.93 ± 0.02 | 4.58 ± 0.58 | 11.12 ± 0.11 |
| PLA           | 6.37 ± 0.22 | 8.58 ± 0.35 | 29.49 ± 0.40 | 12.22 ± 0.21 | 12.34 ± 0.49 | 28.18 ± 0.86 | 6.38 ± 0.21 | 10.72 ± 0.49 | 17.81 ± 0.22 | 3.62 ± 0.20 | 13.08 ± 0.78 | 13.30 ± 0.30 |
| Amilosa       | 7.56 ± 0.11 | 18.50 ± 0.01 | 0.48 ± 0.01 | 10.99 ± 0.07 | 20.03 ± 0.78 | 2.43 ± 0.27 | 13.47 ± 0.25 | 20.06 ± 1.7 | 6.19 ± 0.18 | 12.47 ± 1.02 | 19.90 ± 4.60 |
| pH            | 4.07 ± 0.10 | 6.90 ± 0.03 | 6.83 ± 0.09 | 5.92 ± 0.01 | 6.64 ± 0.00 | 6.73 ± 0.03 | 6.02 ± 0.01 | 6.98 ± 0.05 | 5.51 ± 0.05 | 5.95 ± 0.11 | 7.14 ± 0.05 | 4.70 ± 0.08 |
| WHC           | 161.99 ± 0.86 | 123.40 ± 0.86 | 120.71 ± 4.66 | 191.86 ± 0.70 | 156.14 ± 3.55 | 139.06 ± 2.58 | 194.64 ± 1.66 | 464.22 ± 3.32 | 183.82 ± 2.55 | 263.35 ± 2.96 | 157.04 ± 3.12 | 196.93 ± 5.88 |
| OHC           | 205.81 ± 3.73 | 110.89 ± 1.88 | 183.82 ± 2.13 | 137.71 ± 1.74 | 546.16 ± 5.17 | 164.58 ± 5.20 | 156.10 ± 1.08 | 132.27 ± 1.05 | 229.52 ± 1.05 | 155.39 ± 2.16 | 128.14 ± 0.40 | 183.62 ± 1.30 |
| Total Acid   | 53.85 ± 3.35 | 10.08 ± 0.66 | 10.62 ± 0.13 | 36.03 ± 0.65 | 7.12 ± 0.65 | 14.96 ± 0.65 | 12.67 ± 0.65 | 5.83 ± 0.32 | 22.52 ± 1.32 | 14.97 ± 0.65 | 7.43 ± 0.58 | 31.52 ± 0.65 |

The amylograph forms of cassava and Pachyrhizus erosus are the same as being with different Dioscorea esculenta and Dahlia sp. The peak viscosity and breakdown in cassava was 4896.67 and 2037.00 [5]; Pachyrhizus erosus is at 3667.00 and 1395.00, while for Dioscorea esculenta and Dahlia sp it was lower.
4. Conclusion

With multiple linear regression test (R Square) is 0.984, water, ash, fat, protein, amyllose, carbohydrates, pH, total acid, polyphenols, inhibitors, PLA, OHC, WHC, cold and hot viscosity has a significant effect on texture by 98.4%. The addition of *Pachyrhizus erosus* flour up to 3% can improve white bread made from cassava, the texture of the bread is softer, and more elastic. The presence of high protein content in *Pachyrhizus erosus* flour affects the expand power on white bread made from cassava. The presence of PLA content in *Pachyrhizus erosus* is able to maintain the stability of the texture in white bread made from cassava. The fermentation process causes the polyphenols to degrade. The shape of the pachyrhizus erosus granules and cassava was the same, and the size of the pachyrhizus erosus granules was smaller from cassava and amylographs *Pachyrhizus erosus* are same with cassava, have same peak viscosity and break down in fermented 24 hours.

5. Reference

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