The effect of the ratio of wheat flour with fermentation orange sweet potato flour and addition of baking powder on the quality of dried choux pastry

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Abstract. The research aims were to find out the nutritional value of wheat flour and fermented orange sweet potato flour and the addition of baking powder and to identify the best formulation of dried choux pastry making. The research was using completely randomized design with two factors. i.e., the ratio of wheat flour with fermented orange sweet potato flour (T): T1 = 50:50, T2 = 60:40, T3 = 70:30, T4 = 80:30. The second factors is baking powder (B): B1 = 1%, B2 = 2%, B3 = 3%. The ratio of wheat flour with fermented orange sweet potato flour had a highly significant effect on moisture content, cake volume specific, colour hedonic values, texture hedonic values, and texture score values. The addition of baking powder had a highly significant effect on moisture content, cake volume specific, texture hedonic values, and texture score values. The interaction of the ratio of wheat flour with fermented orange sweet potato flour and the addition of baking powder had a highly effect on cake volume specific. The best-dried choux pastry composition is treatment T4B3 which the ratio of wheat flour with fermented orange sweet potato of 80:20 and 3% baking powder addition.

1. Introduction
Dried choux pastry is one type of choux paste product that is well known in Indonesia. This brownish snack is small in size with a crunchy, hollow texture and a distinctive savoury taste. Dried choux pastry is made from wheat flour, margarine, water, eggs, baking powder and salt. The process of making the dough is done by boiling techniques and is finished by baking. One of the ingredients commonly used in food processing which is very familiar to Indonesian society is wheat flour.

Wheat flour is an ingredient used to make pastry products. However, the high use of wheat flour as a raw material for food products has caused imports in Indonesia to increase. To reduce dependence on imported products, it is necessary to look for other alternative ingredients as a substitute for wheat flour, which is easily available around us, and has the potential for making flour. Substitution of wheat flour with orange sweet potato flour in the processed food industry will reduce the use of wheat flour.

Sweet potato flour still has some disadvantages, including the colour of the flour that is less attractive and the aroma is unpleasant. The physical characteristics of sweet potato flour are also not good because the development pattern is limited when heating, tends to be easily retrograded and has low water absorption. This causes the sweet potato flour to not produce good product characteristics. Efforts that can be made to improve the characteristics of sweet potato flour are fermentation. The fermentation process using lactic acid bacteria causes changes in the physicochemical and...
amylographic properties as well as the organoleptic properties of the flour. Flour after the fermentation process has the advantage that it is easier to dissolve in water, expands more easily when heated, can cover an unpleasant aroma, and is texture than unfermented flour [1].

The ingredients used in the manufacture of dried choux pastry are wheat flour, margarine, salt, water, egg yolk and baking powder. Baking powder is a food additive used for making various types of cakes and breads. Baking powder is a developer or inorganic substance that is added to the dough (can be single or mixed) to produce CO\textsubscript{2} gas forms the core for texture development [2]. Baking powder can release gas until it is saturated with CO\textsubscript{2} gas and then regularly releases gas during baking so that the dough expands perfectly, keeps shrinkage, and to uniform crumbs. In addition, baking powder functions in volume formation, adjusts the aroma, controls the spread and the production becomes light.

Based on this description, the authors are interested in conducting research "The Comparison Effect of Wheat Flour and Fermented Orange Sweet Potato Flour and the Addition of Baking Powder on the Quality of Dried Choux Pastry".

2. Materials and methods

2.1 Equipment and materials

The materials used in this study were fermented orange sweet potato flour, wheat flour, baking powder, water, margarine, chicken eggs, and salt. The tools used in this study were a blender, 80 mesh sieve, scale beaker glass, analytical scales, boiling flask, measuring cup, aluminium cup.

2.2 Research method

The research used factorial completely randomized design, which consisted of two factors, namely:

Factor I : Comparison of wheat flour and fermented orange sweet potato flour (T);

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T_1 = 50:50; \quad T_2 = 60:40; \quad T_3 = 70:30; \quad T_4 = 80:20
\]

Factor II : Addition of baking powder (B);

\[
B_1 = 1\%; \quad B_2 = 2\%; \quad B_3 = 3\%
\]

Each treatment was made in 2 times.

2.3 Research Stages

In the process of making dried choux pastry, the following stages are carried out.

2.3.1 Making fermented orange sweet potato flour. The orange sweet potato that has been sorted is peeled and washed thoroughly and sliced with a thickness of 2 mm then soaked in a Bimo cf solution 1 g per 1 litre of water for 1 kg of orange sweet potato chips. Soaking in Bimo cf for 12 hours, washing, draining, drying at 60°C for 24 hours, shaving or grinding, sieving using an 80 mesh sieve, and packaging to obtain fermented orange sweet potato flour.

2.3.2 Making dried choux pastry. Heat 200 g of water, 80 g margarine, and 0.6 g of salt to a boil and then turn off the heat. Add a mixture of wheat flour and fermented orange sweet potato flour with a ratio of 50:50, 60:40, 70:30, 80:20 of 100 g by weight of flour, heated at 80°C while stirring until smooth. Add 40 g of eggs and stir, put back 40 g 0f eggs and stir with a mixer and then add 1%, 2%, and 3% baking powder of the weight of flour, stirring until evenly distributed. Put in the piping bag, mould the dough is printed on a baking sheet that has been smeared with margarine. Do the roasting in the oven at 200°C for 10 minutes. It was roasted again at 130° minutes then packed in polyethene plastic and let it stand for three days then analysed.

2.3.3 Method of measurement data. Moisture content [3], a specific volume af cake with displacement test method [4], sensory testing using the hedonic test (preference test) on a 1-5 scale includes colour and texture [5], sensory testing with a test score scale 1-5 includes texture [5].
3. Results and discussion

Table 1. The effect of the ratio of wheat flour to fermented orange sweet potato flour

| Quality parameters                  | Comparison of wheat flour : fermented sweet potato flour (T) |
|------------------------------------|-------------------------------------------------------------|
|                                    | T1  | T2  | T3  | T4  |
| Moisture content (%)               | 7.3386 | 7.1928 | 7.0256 | 6.7751 |
| Specific volume of cake (ml/g)     | 3.0623 | 3.5923 | 4.0599 | 4.2851 |
| Colour hedonic values (numeric)    | 3.2583 | 3.3000 | 3.4167 | 3.5500 |
| Texture hedonic values (numeric)   | 3.3833 | 3.4000 | 3.5583 | 3.5833 |
| Texture score values               | 2.9917 | 3.0583 | 3.1500 | 3.3000 |

Table 2. The effect of adding baking powder

| Quality parameters                  | Addition of baking powder (B) |
|------------------------------------|-------------------------------|
|                                    | B1  | B2  | B3  |
| Moisture content (%)               | 7.2689 | 7.1214 | 6.8587 |
| Specific volume of cake (ml/g)     | 3.5952 | 3.7732 | 3.8813 |
| Colour hedonic values (numeric)    | 3.4250 | 3.3938 | 3.3250 |
| Texture hedonic values (numeric)   | 3.4063 | 3.4625 | 3.5750 |
| Texture score values               | 3.0188 | 3.1375 | 3.2188 |

3.1 Moisture content

The moisture content increased with the more fermented orange sweet potato flour used, and the less wheat flour used, the more moisture content increased. High water content is caused of crude fibre found in fermented orange sweet potato flour, which is around 2.6606% while the wheat flour is less, which is 1.0%, so the higher the fermented orange sweet potato flour, the moisture content in the product will be more increasing. Fibre (polysaccharides) affects the ability to bind water. The high fibre content will increase the ability to absorb water because in the fibre there are enough free hydroxyl groups that are polar [6]. The relationship between wheat flour and fermented orange sweet potato flour to the moisture content of the dried choux pastry can be seen in Figure 1.

Figure 1. The relationship between wheat flour and fermented orange sweet potato flour to the moisture content of the dried choux pastry

More and more baking powder is added, the moisture content of the dried choux pastry decreases. Sodium bicarbonate can produce CO₂, which causes more cavities or pores to form, the material is increasingly hollow and expands the surface area of the material so that the water contained in the material will quickly come out if the material undergoes a healing process [7]. The relationship
between the addition of baking powder and the moisture content of the dried choux pastry can be seen in Figure 2.

![Figure 2](image)

**Figure 2.** The relationship between the addition of baking powder and the moisture content of the dried choux pastry

### 3.2 Specific volume of cake

The effect of the interaction between the ratio of wheat flour and fermented orange sweet potato flour and the addition of baking powder on the specific volume of the pastry case can be seen in Figure 3. The higher the wheat flour along with the decrease in fermented orange sweet potato flour and the more baking powder, the specific volume value of the cake will increase. The increase in the specific volume of the cake can also be caused by the manufacturing process of the pastry cake. Which states that all processes have an effect, including the boiling process. Where the boiling process causes trapping of air that is still in the dough, so that during the baking process, the air will move and push the texture of the dough so that it gives a cavity to the shell [1].

![Figure 3](image)

**Figure 3.** The effect of the interaction between the ratio of wheat flour and fermented orange sweet potato flour and the addition of baking powder on the specific volume of cake of the dried choux pastry

### 3.3 Colour hedonic value

We can see in Figure 4 that the colour hedonic value has increased with the higher the wheat flour and the less fermented orange sweet potato flour. The increased colour hedonic value is because the resulting colour looks dried choux pastry yellow. The more orange sweet potato flour, the dry skin will
be golden yellow and brown at the bottom, because sweet potatoes contain beta-carotene, which is oxidized due to the long roasting process [8].

3.4 Texture hedonic value
We can see in Figure 5 that the hedonic value of the texture has increased with the higher the wheat flour compared to the fermented orange sweet potato flour. Fermented orange sweet potato flour does not contain gluten, so the sweeter potato flour, which is added, the less texture it will be. Starch in tubers such as sweet potato also contains relatively high levels of amylose, because the presence of high amylose content creates a dense and coarse texture in food [9].

Figure 6 that the hedonic texture value has increased with the higher the addition of baking powder, the hedonic value of the texture will increase and provide an increase in the texture favoured by the panellists. The increased texture hedonic value can happen because sodium bicarbonate in the dough will produce CO₂. CO₂ gas will fill the cavities of the matrix formed from the bonds between starch and water so that it expands more [10].

3.5 Texture score value
We can see in Figure 7 that the texture score value has increased with the higher the wheat flour and the less fermented orange sweet potato flour so that the texture is slightly crunchy. Fermented orange
sweet potato flour does not contain gluten so the sweeter potato flour which is added, the less texture it will be. Starch in tubers such as sweet potato also contains relatively high levels of amylose, because the high amylose content causes a dense coarse texture in food [9]. Figure 8 shows that the texture score value has increased with more baking powder the texture score value will increase. The highest score was found in treatment B_3 of 3.2188, and the lowest score was in treatment B_1 of 3.0188. Baking powder is a developer added to the dough to produce CO_2 gas which forms the core for texture development. Baking powder also functions to release gas until it is saturated with CO_2 gas and the regularly releases gas during baking so that the dough expands perfectly, keeps shrinkage, and to uniform crumb [11].

![Figure 7](image1.png)  
**Figure 7.** The relationship between wheat flour and fermented orange sweet potato flour to the texture score value of the dried choux pastry

![Figure 8](image2.png)  
**Figure 8.** The relationship between the addition of baking powder and the texture score value of the dried choux pastry

4. Conclusions
The results showed that a higher ratio of wheat flour would increase a specific volume of cake, hedonic value of colour, hedonic value of texture, and texture score value, while the higher ratio of fermented orange sweet potato flour would increase the moisture content. The addition of more and more baking powder will increase that specific volume of cake, hedonic texture value and hedonic score texture value. The interaction between the two factors gave a very significant effect on the specific on the specific volume value of the cake. The best treatment determinate by the De Garmo method [12] was obtained in the T_4B_3 treatment, namely the ratio of wheat flour to fermented sweet potato flour at 80:20 and 3% baking powder.

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