Physicochemical and sensory characteristics of egg roll from composite flour (mocaf, breadfruit flour, orange sweet potato flour, breadfruit starch, and orange sweet potato starch)

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Abstract. The aim of this study was to determine the formulation of composite flour from mocaf, breadfruit flour, orange sweet potato flour, breadfruit flour and orange sweet potato flour in making good quality egg rolls. The analysis was carried out using a completely randomized design with a composite flour formulation consisting of 8 composite flour treatments and 1 control treatment. The analysed parameters were ash content, moisture content, fat content, fibre content, protein content, carbohydrate content and colour. The suitable egg roll formulation was evaluated based on degarmo method amongst several parameters (moisture content, ash content, protein content, fat content, hedonic content dan colour value). It was concluded that, composite flour formulations of 40% mocaf, 20% breadfruit flour, 20% orange sweet potato flour, 10% breadfruit starch, and 10% orange sweet potato starch produced the best egg rolls. The finding research suggests that wheat flour can be replaced by other flours for egg roll making.

1. Introduction
Egg roll is one type of pastry that is in demand by the public. As the name implies, this egg roll is made using eggs and wheat flour. Egg roll is a cake roll in the form of a crunchy texture, low water content, small size, and sweet. Pastries need a binders such as flour, water, and eggs and a softening agents such as sugar, cake emulsifier, and eggs [1]. Wheat flour is widely used as the raw material for making cakes, however, there is an increase in imports of wheat flour every year [2]. Therefore, to overcome dependence on wheat flour, it is necessary to use local resources maximally as replacement for wheat flour such as cassava, sweet potato and breadfruit. Breadfruit is a local plant whose distribution is very wide and evenly distributed in tropical climates, including Indonesia. Breadfruit is a vegetable food that contains carbohydrates, the use of local plants can be used as a producer of flour [3]. Besides breadfruit, Mocaf (modified cassava flour) is a flour product from cassava or cassava which is processed using the principle of modifying cassava cells by fermentation. Mocaf also uses wheat flour as an addition to composite flour because mocaf has good nutritional ingredients [4]. Composite flour is flour made from two or more foodstuffs, aims to obtain material characteristics suitable for the desired processed product to obtain certain functional properties.
2. Materials and methods
The research was conducted at the Laboratory of Food Chemical Analysis, Food Technology Laboratory and Flour Houses, Food Science and Technology Study Program, Faculty of Agriculture, University of North Sumatera, Medan, mocaf was obtained from Bakery Innovations, orange sweet potato was obtained from Pasaraya MMTC and breadfruit obtained from Setia Budi, Medan.

The making of egg roll refer to Juliani [5] and Dewi, et al [6]. Consisting of composite flour and mixed according to research treatment. This research was made with one controls (100% wheat flour) and eight comparisons of a mixture of mocaf, breadfruit flour, orange sweet potato flour, breadfruit starch, and orange sweet potato starch. The one controls and eight comparative treatments, namely:

- P1 = 80% : 5% : 5% : 5% : 5%
- P2 = 70% : 10% : 10% : 5% : 5%
- P3 = 60% : 10% : 20% : 5% : 5%
- P4 = 50% : 20% : 20% : 5% : 5%
- P5 = 40% : 20% : 20% : 10% : 10%
- P6 = 30% : 30% : 20% : 10% : 10%
- P7 = 20% : 30% : 30% : 10% : 10%
- P8 = 10% : 40% : 30% : 10% : 10%
- P9 = 100% wheat flour (Control)

Each treatment was made in 3 replications, so that the total sample size was 27 samples.

The analysed parameter were moisture content [7], ash content [8], crude fiber content [9], fat content using the soxhlet method [10], protein content [11], carbohydrate content using by difference method [12] and color (brightness) using a Minolta chromameter (Type CR 200, Japan) [13], the de-Garmo method for determining the best egg roll [14].

3. Results and discussion

3.1. Moisture content
The moisture content of the product can be seen in Figure 1. The highest and lowest moisture content of the egg rolls were found in composite flour containing 40% (P5) and 80% (P1) mocaf, respectively. The presence of composite flour can affect the high moisture content of the product. It is important to know the moisture content of egg rolls because the egg rolls are a dry product that can affect the quality of texture, acceptability and storage capacity. The moisture content has an effect on the egg roll on the crispness of the product, because the more water that comes out of the material the more empty space there is in the network so that the egg roll when processed will expand to a certain level and causes the egg roll to become very crunchy [15].

![Figure 1. The relationship between mocaf, breadfruit flour, orange sweet potato flour, breadfruit starch, and orange sweet potato starch and moisture of the egg roll.](image)

Description: comparison of mocaf (M), breadfruit flour (BF), orange sweet potato flour (OF), breadfruit starch (BS) and orange sweet potato starch (OS):

- P1 = 80% M : 5% BF : 5% OF : 5% BS : 5% OS
- P6 = 30% M : 30% BF : 20% OF : 10% BS : 10% OS
- P2 = 70% M : 10% BF : 10% OF : 5% BS : 5% OS
- P7 = 20% M : 30% BF : 30% OF : 10% BS : 10% OS
- P3 = 60% M : 10% BF : 20% OF : 5% BS : 5% OS
- P8 = 10% M : 40% BF : 30% OF : 10% BS : 10% OS
- P4 = 50% M : 20% BF : 20% OF : 5% BS : 5% OS
- P9 = 100% wheat flour (Control)
3.2. Ash, protein, fat and carbohydrates

The ash (A), protein (B), fat (C) and carbohydrate (D) of the product can be seen in Figure 2. The results showed that the highest ash content of egg roll was in the P6 treatment of 2.05% and the lowest treatment in the P8 treatment of 1.87%. The high ash content in the product is caused by the addition of various flours in the product. The ash content of material shows the mineral content contained in it. If the ash content is high, the mineral content is also high [16].

For protein the results showed that protein content of egg roll was found in P8 treatment of 11.16% (the highest) and the lowest treatment in P2 treatment of 9.79%. The highest protein content of egg roll was P8 of 11.16% where in P8 formulation the addition of orange sweet potato flour was added the most compared to other formulations. This addition can be one of the factors in increasing the protein content in the product. The protein content of orange sweet potato is quite high. Orange sweet potato flour has a protein content of 4.42%, besides that, has a high carbohydrate content, namely 82.84% [17].
In terms of fat content the results showed egg roll (P7) had fat about 38.76% and the lowest treatment was in treatment P1 of 36.99%. With the addition of various flours, eggs, butter and milk to the product, the fat content in the egg roll increases. Margarine is an emulsion of water in oil, with the requirements that it contains not less than 80% fat [18].

For carbohydrate the results showed that the highest carbohydrate content of egg roll was in treatment P1 of 46.62% and the lowest treatment was in treatment P7 of 43.70%. The carbohydrate content is influenced by the other nutritional content of the product. The lower the content of other nutrients, the higher the carbohydrates. Carbohydrates also have an important role in determining the characteristics of food ingredients such as color, taste and texture. Carbohydrate content is influenced by other nutrients in the form of water content, ash content, protein content and fat content of these materials. Increasing the levels of other nutrients in product will decrease the carbohydrate content of that product [19,20].

3.3. Crude fiber content

The crude fiber content of the product can be seen in Figure 3. The results showed that egg roll (P4) had 2.04% of crude fiber (the highest) and the lowest treatment was in the P8 treatment of 1.89%. P4 has more mocaf composition than P8 so that P4 fiber is higher than P8. Fiber content is influenced by the raw materials used in the product. The higher the fiber content, the lower the crispiness of the product. Food with high fiber content will have a low crispness. This is because the fiber is cellulose from the plant wall which has a hard structure [19].

![Figure 3](image)

Figure 3. The relationship between mocaf, breadfruit flour, orange sweet potato flour, breadfruit starch, and orange sweet potato starch and crude fiber of the egg roll.

3.4. *Hue value, L*, a* and b*

The colour analysis including Hue (A), L* (B), a* (C) and b* (D) are presenting in Figure 4. The results showed that the highest color index value (*Hue) was found in treatment P3 at 39.00 and the lowest treatment at P4 at 34.11. L* value indicates brightness with values ranging from 0-100. the value of a* shows a red-green color with a value of 0-60. the value of b* indicates a yellow-blue color. In general, egg rolls have a brownish yellow color, which is due to the maillard reaction during roasting. The color produced by the product is also influenced by the raw materials used, such as orange sweet potato. The Maillard reaction is a non-enzymatic reaction that occurs because of a reaction between reducing sugars and amine groups free of amino acids or proteins [21].

The highest L* value was found in egg roll made of 100% wheat flour (control). In contrast, replacement the flour into 40% mocaf, 20% breadfruit flour, 20% orange sweet potato flour, 10% breadfruit starch and 10% orange sweet potato starch resulted in egg rolls with the lowest L*. This is because the L* value is an indicator of the brightness of the color with a value of 0-100. Wheat flour has a white color with a brightness value of 74.97 [22].

The results showed that the highest a* value was in treatment P1 of 15.67 and the lowest was in P6 of 9. The highest a* value was found in treatment P1 with the highest mocaf formulation. Mocaf has a white color while wheat has a distinctive white color. Mocaf has a white degree value of 84.0-80.6, so that the whiter the color of the flour, the higher the level of consumer acceptance of the flour [23].
The results showed that the highest b* value was found in treatment with the highest breadfruit and orange sweet potato flours formulation (P8). The use of orange sweet potato flour affect the b* because it has carotenoid pigments that can affect the color of the product. Carotene is the color red, orange, yellow, and green in fruits and vegetables. In addition to the presence of color pigments, it can be caused by the heating effect on the product [24].

![Figure 4. The relationship between mocaf, breadfruit flour, orange sweet potato flour, breadfruit starch and orange sweet potato starch and Hue (A), L* (B), a* (C), and b* (D) of the egg roll.](image)

4. Conclusions
Composite flour formulations (mocaf, breadfruit flour, orange sweet potato flour, breadfruit starch, and orange sweet potato starch) with a ratio of 40% : 20% : 20% : 10% : 10%, respectively producing the best quality and quality egg roll. Further research is needed regarding the storability of egg rolls.

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