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# Physicochemical characteristics of donuts from composite flour (modified sukun, sweet poultry, mocaf, saga seeds)

N Sanjaya<sup>1</sup>, M Nurminah<sup>1,2\*</sup> and T Karo-Karo<sup>1,2</sup>

<sup>1</sup> Department of Food Science and Technology, Faculty of Agriculture, Universitas Sumatera Utara, Medan, North Sumatra 20155, Indonesia

<sup>2</sup> Centre for Tubers and Roots Crop Study, Faculty of Agriculture, Universitas Sumatera Utara, Medan, North Sumatra 20155, Indonesia

\*E-mail: miminurminah@usu.ac.id

**Abstract.** This research aims to determine the composite flour formulation from modified breadfruit flour, purple sweet potato flour, mocaf and saga seed flour in making good quality donuts. The analysis was carried out using a non factorial complete randomized design, donut with composite flour formulation (modified breadfruit flour, purple sweet potato flour, mocaf and saga seed flour) (P): 10%: 40%: 50%: 0%, 15%: 35%: 45%: 5%, 20 %: 30%: 40%: 10%, 25%: 25%: 35%: 15%, 100% purple sweet potato flour, 100% mocaf, 100% modified breadfruit flour, and 100% wheat flour had a very significant influence on protein content, crude fiber content, fat content, specific volume and L. The final results of the study showed that the formulation of composite flour (modified breadfruit) purple sweet potato, mocaf and saga seeds) (25%: 25%: 35%: 15%) produce the best quality donuts.

## 1. Introduction

Donut are a type of bread that is shaped like a ring or round shape that has a hole in the middle and the maturation process by frying. Donuts are products made from flour, sugar, yeast, eggs, fat, and other additives. Donuts contain high carbohydrates, but low in fiber content, and therefore need to add food that is able to provide additional nutritional value in donuts. Donut is one of the foods that are much in demand by the people of Indonesia, this can be seen from the growing development of donut shops or outlets in all corners of the city or village. Other evidence that donuts are in demand is the growing development of donuts on the market, especially today related to the use of local food for donut products. In Indonesia, many people use potatoes as an ingredient in making donuts, not only potatoes that can be used as additional ingredients in making donuts. Indonesia, rich in agricultural products including tubers that contain a lot of high nutritional value such as mocaf, sweet potato, breadfruit and saga seeds [1].

The use of wheat flour as a basic ingredient in making food preparations is needed at this time. The high need for wheat flour in Indonesia has increased in the value of imports of wheat seeds which are the raw material in making flour. The volume of wheat imports in 2018 reached 4.59 million tons, while the value reached US \$ 1.13 million. If wheat flour demand continues to increase, wheat imports will also increase and will threaten national food security and sovereignty [2].



Therefore, it is necessary to continue to develop the use of flour made from local food ingredients such as modified breadfruit flour, purple sweet potato flour, mocaf, saga seed flour. As with the local raw materials, purple sweet potato is still very minimal in use [3]. Donuts with different treatments will be further tested for physicochemical properties and obtained composite donuts with the best treatment.

## 2. Materials and Method

This research was conducted at the Laboratory of Food Chemical Analysis and Food Technology and Food Technology Study Program, Faculty of Agriculture, University of North Sumatra, Medan. Mocaf obtained from Bakery Innovations, purple sweet potato obtained from Pasaraya MMTC, saga seeds obtained from the University of North Sumatra love garden and breadfruit obtained from Setia Budi, Medan.

Making donuts is done by flour and mixed according to treatment. Other ingredients are prepared and weighed accurately, dry ingredients like, instant yeast (fermipan) 2g, granulated sugar 25g, eggs 16g, bread improver 5g, 60ml full cream liquid milk, stir until evenly until half smooth, then add 0.5g salt and margarine 20g and then the mixture is kneaded until it isn't smooth until it doesn't stick to the hands anymore. Furthermore, the dough is weighed 10g round shaped like a donut with a hole in the middle using a donut mold, then allowed to stand for 30 minutes. After that, the donuts are fried in hot oil using medium heat, fry until brownish yellow and then drain and cool at room temperature for 15 minutes, then packaged in a sealed polyethylene plastic package.

This research was made with four controls and four comparisons of a mixture of modified breadfruit flour, purple sweet potato flour, mocaf, saga seeds. The four controls and four comparative treatments, namely:

P1 = 10 : 40 : 50 : 0

P2 = 15 : 35 : 45 : 5

P3 = 20 : 30 : 40 : 10

P4 = 25 : 25 : 35 : 15

P5 = 100% purple sweet potato flour (Control 1)

P6 = 100% mocaf (Control 2)

P7 = 100% modified breadfruit flour (Control 3)

P8 = 100% wheat flour (Control 4)

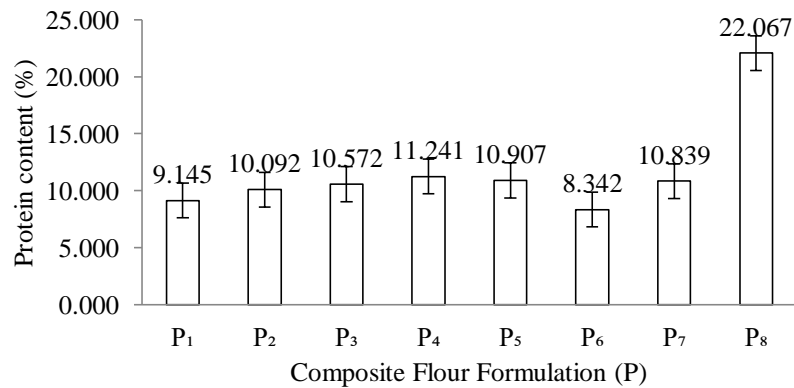
Each treatment was made in 3 replications, so that the total sample size was 24 samples.

Analysis of protein content was carried out using K-Jeldahl [4], crude fiber content was carried out using the Crude Fiber method [5], fat content was carried out with boiling flask [4], specific volume was carried out using the displacement test method [6] and color (brightness) with using the Minolta chromameter (type CR 200, Japan) [7], the de-Garmo method was used to determine the best donuts [8].

## 3. Results and Discussion

### 3.1. Protein content

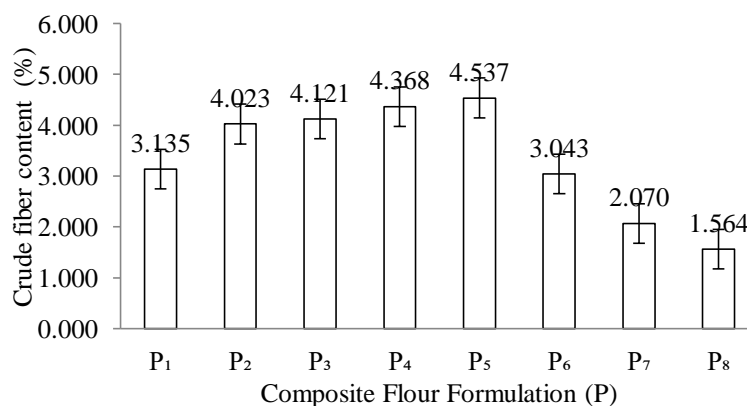
From the analysis, P8 donuts have the highest protein content of 22.067% while P6 donuts have the lowest protein content of 8.334%. The results of research carried out showed donuts with composite flour ingredients (P1-P4) have a value of increased protein content this is because saga seed flour has a protein content (34.14%), higher than modified breadfruit flour, purple sweet potato flour and mocaf so the addition will increase the protein content of the donuts produced. According to Pratiwiningsih the use of saga seeds as a raw material for protein sources has the potential to increase the nutritional value and quality of a product, and other raw materials such as breadfruit also contain a high protein content of 5.0278% so that the mixture of raw flour used can increase the protein content in food products [9].



**Figure 1.** Correlation between composite flour formulations (modified breadfruit flour, purple sweet potato flour, mocaf and saga seed flour) with protein content of donuts (error bar  $\pm$  standard deviation).

### 3.2. Crude fibre content

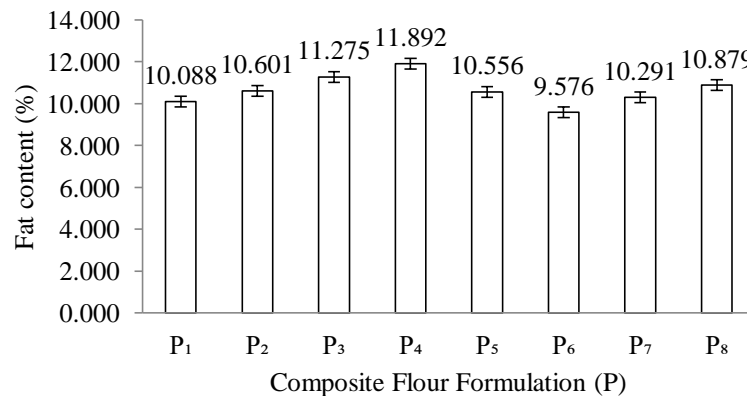
From the analysis, that the value of P5 donut fiber content has the highest crude fiber content of 4.537% while the P8 donut has the lowest crude fiber content of 1.564%. This is because purple sweet potato flour and saga seed flour have higher fiber content compared to modified breadfruit flour and mocaf so that the addition will add crude fiber to the donuts produced. According to Ardiyanti, the increase in crude fiber content occurs because the crude fiber of raw materials which has a high crude fiber content, purple sweet potato flour and saga seed flour have a higher fiber content compared to modified breadfruit flour and mocaf so that the addition will increase crude fibers in the resulting donuts [10].



**Figure 2.** Comparative relationship of composite flour formulations (modified breadfruit flour, purple sweet potato flour, mocaf and saga seed flour) with crude fiber content of donuts.

### 3.3. Fat content

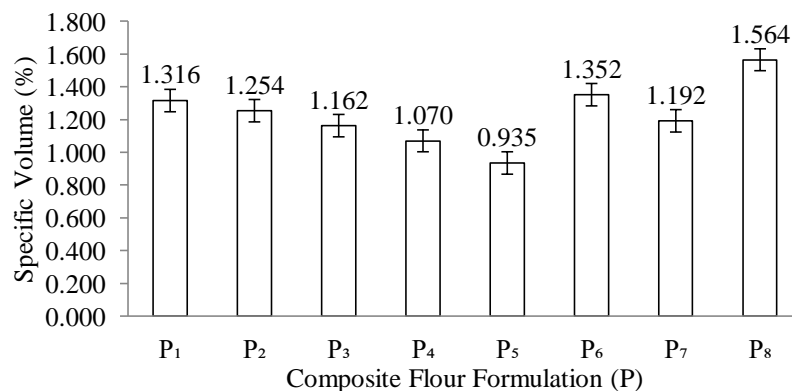
From the analysis, that the value of donut fat content is quite high. The high fat content is due to the use of other raw materials that contain fat such as margarine, egg yolk and full cream milk with a fairly high amount. The highest donut fat content is at P4 with a value of 11.889%, while the lowest value of donut fat content is P6 which is 9.576%. This is consistent with the results of raw material research, where the lowest mocaf fat content is 0.905%, modified breadfruit flour 1.371%, purple sweet potato flour 1.750% and saga seed flour 13.94%. According to Diniyah, et al., the fat content of mocaf is only around 0.9-2.1%, and the low fat content can be caused by the flour processing process which is through drying and using high temperatures for a long time so that the content low fat [11].



**Figure 3.** Correlation between composite flour formulations (modified breadfruit flour, purple sweet potato flour, mocaf and saga seed flour) with donut fat content

### 3.4. Specific volume

From the analysis, indicates the donut has a specific volume value that is fluctuating. The type of flour used affects the development of donuts. Flour contains starches and glutenin and gliadin proteins, which bind other ingredients together to produce the structure of the final product. Hydration and heating cause starch gelatinization, a process that breaks hydrogen bonds, resulting in swelling of the starch granules which gives a more compact dough structure [12]. Donut development is also influenced by developer material. The gas released by the development agent affects the volume and structure of the cell.



**Figure 4.** Comparative relationship of composite flour formulations (modified breadfruit flour, purple sweet potato flour, mocaf and saga seed flour) with specific volume of donuts

### 3.5. L value

From the analysis, composite flour formulation gives a very significant effect on donut L value. That the addition of flour will affect the brightness value of the donuts. [13] L \* values are quantities that indicate the level of color brightness. It was further explained that the lower the L value to the value 0 indicates a very dark color that is black and the higher the L value to the value 100 indicates a very bright color that is white. The results showed that donut P<sub>8</sub> (100% flour) had the highest L \* value of 43.22 and P<sub>1</sub> donut had the lowest L \* value of 18.00. The more purple sweet potato flour is added the brightness value of the donuts will decrease. Donuts with composite flour material, P<sub>3</sub> has the highest value of 22.44 this is because the raw material of mocaf has a high brightness value (22.11) the P<sub>3</sub> donut made of 40% mocaf has the highest level of brightness rather than P<sub>1</sub>, P<sub>2</sub> and P<sub>4</sub>.

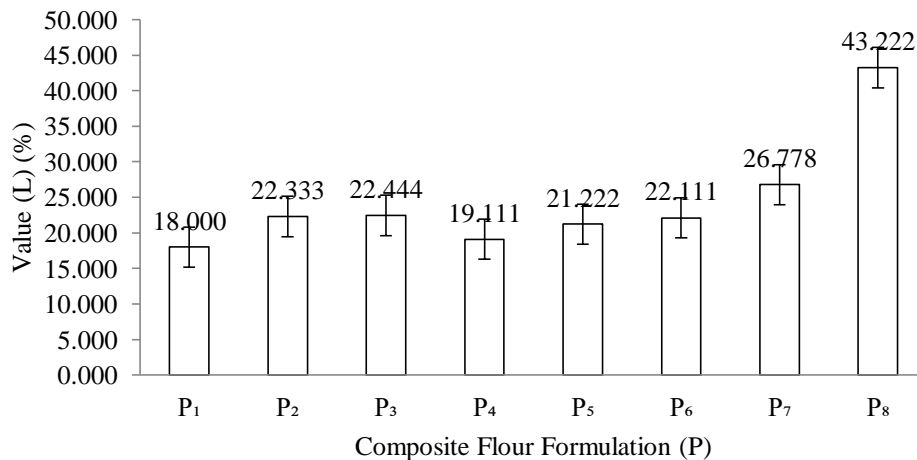


Figure 5. Comparative relationship of composite flour formulations (modified breadfruit flour, purple sweet potato flour, mocaf and saga seed flour) with L donut values

#### 4. Conclusion

Composite flour formulations (modified breadfruit, purple sweet potato, mocaf and saga seeds) P<sub>4</sub>(25%: 25%: 35%: 15%) produce donuts of the highest quality and quality.

#### References

- [1] Wahyuningtyas, T. A, and A. Bahar. 2018. The Effect of Proportion of Potatoes, White Sweet Potato Puree (*Ipomoea batatas*) and Carrot Puree (*Daucus carota* .L) on the Organoleptic Properties of Donuts. e-journal Catering. 7 (1): 116-125.
- [2] Central Bureau of Statistics. 2018. Wheat Imports in Semester I 2018 Decreased by 15.45%. Central Bureau of Statistics, Jakarta.
- [3] Nurminah, M., S. Ginting., and C. J. Sitorus. 2019. Physicochemical properties of egg roll from composite flour of wheat and purple flesh sweet potato. IOP Publishing. 1-5, doi:10.1088/1755-1315/305/1/012029
- [4] [AOAC] Assosiation of Analytical Chemist Publisher. 1995. Official Methods of Analysis. AOAC Publisher, Washington DC.
- [5] Apriyantono, A., D. Fardiaz, N. L. Puspitasari, Y. Sedarnawati, and S. Budianto. 1989. Food Analysis Laboratory Guidelines. Bogor Agricultural Institute, Bogor.
- [6] Yananta, A. P. 2003. Process Improvement of Minor Bulbs Flour. Essay. IPB Faculty of Agricultural Technology. Bogor.
- [7] Hutching, J. B. 1999. Food Color and Apearance. Aspen publisher Inc., Maryland.
- [8] De Garmo, E, P., W. G. Sullivan., dan J. R. Canada. 1984. Engineering Economy. Seventh Edition. Macmilan Pub. Co, New York.
- [9] Pratiwiningsih, T.I. 1984. Characteristics of saga seeds (*Adananthera pavonina* L.). Thesis, Faculty of Agricultural Technology, Bogor Agricultural University. Bogor.
- [10] Ardiyanti. 2001. Effect of proportion of wheat flour with wheat bran as a source of fiber and the addition of margarine to the quality of cookies. Brawijaya University, Malang.
- [11] Diniyah, N., N. Yuwana., Maryanto., B. H. Purnomo., And A. Subagio. 2018. Characterization of sera mocaf (modified cassava flour) from sweet and bitter varieties of cassava. Journal of Postharvest Agricultural Research. 15 (3): 114-122.
- [12] McWilliams M. 2001. Foods: Experimental Perspectives, 4<sup>th</sup> Edition. Upper Saddle River, N.J: Prentice Hall.

- [13] Ulyarti, and D. Fortuna. 2016. Application of simple digital imaging method to predict the color formation of flour as a result of uwi tuber processing. *Jambi University Research Journal Science Series*. 18 (1): 1-8.