



Effect of Lesser Yam Flour Addition on Water Content, Texture, Crude Fiber Content, and Reducing Sugar Content of Donut Made from Wheat Flour

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Abstract

This research aimed to determine the addition of lesser yam flour on water content, texture, crude fiber content, and reducing sugar content of donut made from wheat flour. This research was arranged using completely randomized design with 5 treatments and 4 replications consisted of 5 different lesser yam flour concentrations (0–30%) from total flour that had been used. Water content, texture, and crude fiber content were analyzed using Analysis of Variance (ANOVA) at 5% significance level and reducing sugar content was analyzed using regression equation. The result showed the addition of lesser yam flour can reduce water content. However, it can increase texture, crude fiber content, and reducing sugar content. As conclusion, the concentration of lesser yam flour affected the water content, texture, crude fiber, and reducing sugar in donut.

Article information:
Received: 11 March 2020
Accepted: 06 April 2020
Available online: 01 June 2020

Keywords:
Donut
lesser yam flour
wheat flour

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doi:10.17728/jaft.7364

Introduction

Bread is a staple food in several countries which are generally made from wheat flour. There are various types of bread depending on the shape, taste, and making process. Donut is described as a type of bread that has been deep-fried in hot oil with typically in the shape of a ring (Fajri *et al.*, 2018). The making process of donut is quite practical because it only goes through two times of fermentation. Yeast is used in the making of donut as an air producer to raise the dough, making the texture of donut becomes soft (Murdani, 2010). The main ingredient of donut is flour derived from wheat.

Indonesia is not a major wheat-producing country which can be processed into wheat flour. Wheat is not a staple food for Indonesian people because of the environment in Indonesia is not suitable for growing wheat crops (Ariani and Ashari, 2003). Indonesia is famous for its tubers. One of which is lesser yam. Lesser yam grows quite a lot in Indonesia, but the people are not familiar with this kind of tuber. Lesser yam is rich in carbohydrates and easily digested in the body. It also has several bioactive compounds that are useful for human health (Prabowo *et al.*, 2014).

Lesser yam can be processed into flour which will extend its shelf life. Lesser yam flour can be used as an

additional ingredient in the making of bread and cake products. However, lesser yam flour cannot rise optimally (Richana and Sunarti, 2004). Therefore, lesser yam flour is mixed at a certain ratio with wheat flour to be used as the main ingredient for making donuts. By using lesser yam flour, it can introduce Indonesia's potential food.

The aim of this research was to determine the addition of lesser yam flour on water content, texture, crude fiber content, and reducing sugar content of donut made from wheat flour.

Materials and Methods

Materials

The materials used in this research were lesser yam flour obtained from Hasil Bumiku Store in Yogyakarta, hard wheat flour, margarine, table sugar, powdered milk, yolk, instant yeast, bread improver, emulsifier, cooking oil, salt and cold water obtained from Toko Kabita Banyumanik. H₂SO₄ 0.3 N, NaOH 1.5 N, N-Hexane 95%, glucose anhydride, Nelson A&B solutions, and arsenomolybdat solution were used to determine the parameters. The equipment used to making donut and analysis were mixer, stove, plastic wrap, kitchen scale, donut molder, porcelain cup, Buncher funnel, oven,

Table 1. Analysis result of water content, hardness texture, and crude fiber content of donut

Parameter	Concentration of Lesser Yam Flour (%)				
	0	7.5	15	22.5	30
Water Content (%)	26.12±0.78 ^d	24.37±0.57 ^c	23.72±0.35 ^c	21.12±1.73 ^b	19.36±1.02 ^a
Hardness Texture (g)	11,18±0,24 ^a	13,62±1,80 ^b	18,50±2,48 ^c	25,37±0,63 ^d	30,12±1,70 ^e
Crude Fiber Content (%)	15,62±1,50 ^a	17,10±1,60 ^{ab}	19,37±1,85 ^{bc}	21,30±2,24 ^{cd}	23,22±0,26 ^d

Different superscript letters in the same column indicates the significant differences ($p < 0.05$).

desiccator, Whatman 41 filter paper, beaker glass, erlenmeyer, texture analyzer CT3-4500 (Brookfield, USA), cuvette, spectrophotometer mini UV 1800 (Schimadzu, Japan), and stationary.

Method

This research was conducted from October 2019 – January 2020, at the Laboratory of Chemistry and Food Nutrition, Laboratory of Food and Agricultural Products Engineering, Laboratory of Nutrition and Feed Science, Faculty of Animal and Agricultural Sciences, and Integrated Laboratory, Diponegoro University.

Data were obtained from water content, texture, and crude fiber content were analyzed using the Analysis of Variance (ANOVA) at 5% significance level and if the effect was significant then proceed with the Duncan Test. Data obtained from reducing sugar content were analyzed using regression equation.

Lesser Yam Flour Making

Lesser yam flour was made by grinding the lesser yam. The ripe lesser yam was chosen, then peeled, sliced, and dried in the oven. The final step was grinding the dry lesser yam with 90 mesh grinder (Richana and Sunarti, 2004).

Donut Making

Donut was made by the method of Asyari *et al.* (2016) with modification. Flour, table sugar, instant yeast, bread improver, emulsifier, powdered milk, cold water, yolk, and salt were mixed. The addition of lesser yam flour concentrations were 0; 7.5; 15; 22.5; and 30% from total flour that had been used. Then, the dough was fermented for 30 minutes. After that, the dough was shaped and allowed to ferment for another 30 minutes. The dough then fried until the color turned golden brown.

Water Content Test

Water content of lesser yam donut was analyzed by oven drying method. Sample was mashed as much as approximately 2 grams and then heated in the oven. Water content was determined by subtracting the dry weight sample by put into the oven from the initial weight (Suastuti, 2008).

Texture Test

Hardness texture was tested refers to the method of Anggraeni *et al.* (2017) with modification. Test performed with CT3-4500 Texture Analyzer using deformation of 1 mm, probe of 4 mm.

Crude Fiber Test

Crude fiber content was tested with AOAC (2005) method.

Reducing Sugar Test

Reducing sugar content was analyzed by the

Nelson-Somogyi method using spectrophotometer at a wavelength of 540 nm and then converted to reducing sugar level base on the regression equation (Dewi *et al.*, 2005).

Result and Discussion

The result of water content, hardness texture, and crude fiber content of donut with addition of lesser yam flour are presented in Table 1. Based on Table 1, it can be expressed that the addition of lesser yam flour has a significant effect on water content of donut ($p < 0.05$). The zero concentration of flour as control treatment has the highest water content with an average of 26.12% and the 30% treatment or the highest lesser yam flour addition had the lowest water content with an average of 19.36%. Water content in donut that has a lot of wheat flour will increase because wheat flour has a hydrophilic group. This is consistent with the opinion of Winarti *et al.* (2017), which stated that wheat flour contains protein with hydrophilic group that might absorb water, the higher the hydrophilic group, the higher water absorption was also affected by the starch content in the flour. Wheat flour contains high levels of starch it can absorb more water. According to Richana and Sunarti (2004), lesser yam flour has a starch content of around 21.44% while wheat flour has a starch content of 60-68%.

Based on Table 1, it can be expressed that the addition of lesser yam flour has a significant effect on hardness texture of donut ($p < 0.05$). The 30% treatment or donut with the highest addition of lesser yam flour had the highest hardness texture with an average of 30.12 gf because the lesser yam flour does not have disulfide bonds. According to Nosoh and Sekiguchi (1991), disulfide bonds are present in gluten. The control treatment or donut without addition of lesser yam flour had the lowest hardness texture with an average of 11.18 gf. Wheat flour contains gluten protein. According to Pusuma *et al.* (2018), decreasing gluten content in a product causes the dough to be more hydrophilic, the interaction between starch granules be stronger. As of it, the reduction of wheat flour in donut will make the donut harder. According to Azhar (2009), lesser yam has an inulin content of 14.625%. Inulin in lesser yam can affect the hardness texture of donut. This is consistent with the opinion of Cegiela and Tambor (2012), which stated that inulin decreases the maximum compressive force which illustrates the level of hardness where the reduction of hardness is obtained because inulin is not used to substitute fat and inulin has a hydroxyl group that can absorb water.

Based on Table 1, it can expressed that the addition of lesser yam flour can increase the level of crude fiber content. Treatment with the highest crude

fiber content resulted 23.22% fiber content. Control treatment had the lowest crude fiber content with an average of 15.62%. According to the research conducted by Halwan and Nisa (2015), wheat flour has crude fiber content of 0.9% and lesser yam flour has a crude fiber content of 2.6%. According to Richana and Sunarti (2004), lesser yam flour contains crude fiber in the form of cellulose, as well as small amount of hemicellulose and lignin.

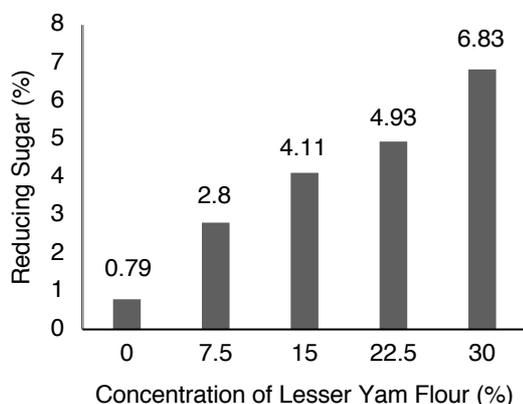


Figure 1. Reducing sugar content of donut using concentration of lesser yam flour at 0-30%

Figure 1 shows the reducing sugar content of donut with addition of lesser yam flour. It can be seen that the more addition of lesser yam flour, the more reducing sugar content increases. Reducing sugar is found in lesser yam flour and affect the color of donut to be browner. This is consistent with the opinion of Pusuma *et al.* (2018), which stated that the maillard reaction or reaction between the primary protein amine group and the carbonyl reducing sugar group will affect the brightness of the bread. Lesser yam has reducing sugar content. According to Harijono *et al.* (2012), lesser yam contains high percentage of glucose, mannose, and galactose which belong in reducing sugar group.

Conclusion

Based on this research that has been done, it can be concluded that the higher concentration of lesser yam flour could reduce water content and increase the hardness texture, crude fiber content, and reducing sugar content. The most optimal treatment was 15% addition of lesser yam flour which produced high crude fiber, reducing sugar content, and proper texture.

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