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Effect of Yellow Pumpkin (*Cucurbita moschata*) Flour Addition on Proximate Levels and Calories of White Millet (*Panicum miliaceum*) Flakes

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Abstract

This research aims to determine the effect of adding pumpkin flour with different concentrations to the proximate levels and calories of white millet flakes. Complete randomized design used in this research with 4 treatments and 5 replications. This research consisted of formulations which was divided into 4 treatments in the form of adding pumpkin flour with concentrations of 0%, 10%, 20%, and 30% w/w white millet. The material used was white millet, pumpkin, sugar, salt, and water. Proximate levels were calculated using proximate analysis while calories was calculated based on the calculation of carbohydrate, protein, and fat composition of the samples produced. The results showed that the addition of pumpkin flour with different concentrations had a significant effect ($p<0.05$) on protein content, fat content, ash content, crude fiber content, carbohydrate content, calories, and had no effect ($p>0.05$) on water content. As conclusion the addition of pumpkin flour 30% was the best treatment proved by its highest fiber content and low in calories.

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Introduction

Flakes are breakfast cereal products that are flat, have uneven edges, generally brownish yellow, and have a crispy texture. In general, there are two types of breakfast cereals, which require a cooking process before eating and breakfast cereals that can be eaten directly with the addition of water or milk (Widowati, 2011). Flakes are generally made from local cereals such as rice, wheat or corn and tubers. In addition, local cereals such as white millet also have the potential to be used as material for making flakes because of their high carbohydrate content (Anandito *et al.,* 2016).

White millet is a type of cereal that has small white ears. The nutritional content of white millet is 80.4% carbohydrate, 11.29% protein, 2.58% fat, 1.8% ash, and 2.01% crude fiber (Anandito *et al*., 2016). So far, the use of white millet in the food sector is still lacking and is only used as bird feed. The use of white millet in food processing is expected to reduce the level of dependence on flour. White millet has low crude fiber so it needs other addition to increase the level of crude fiber. One ingredient that can be used is pumpkin flour. The nutritional content of yellow pumpkin flour is carbohydrate 65.11%, protein 4.84%, fat 0.76%, ash 6.25%, and crude fiber 5.03% (Rachmawati *et al*., 2016).

The previous research was conducted on the effect of adding pumpkin flour and sodium bicarbonate to the characteristics of taro flakes (Purnamasari and Putri, 2015). Research on white millet flakes with the addition of pumpkin flour which is high in fiber and low in calories has not been done so this research is important to do. This study aims to determine the effect of adding pumpkin flour with different concentrations to the proximate levels and calories of white millet flakes. The benefit of this research is to provide added value in the use of white millet and pumpkin flour on flakes as a diversification of healthy foods that are high in fiber and low in calories.

Materials and Methods

Materials

This research used 2 kg of white millet that was obtained from Mr. Londo Shop on Jl. Durian, Banyumanik, Semarang, 3 pumpkins (2,5 kg ; 2,5 kg ; 3,5 kg), 0,25 kg salt, 0,5 kg sugar that was obtained from Rasamala Market on Jl. Rasamala Raya, Banyumanik, Semarang, water, selenium catalyst, MR-MB indicator, 4% H_3BO_3, concentrated H_2SO_4, 45% NaOH, 0.1N HCl, ether solvent, distilled water, 95% alcohol, knife, cutting board, mortar, blender, cabinet dryer, rice cooker, oven,

80 mesh sieve, basin, pan, stove, baking pan, roller, pasta machine, porcelain cup, blast furnace, analytical balance, erlenmeyer, measuring flask, bunsen, cotton, filter paper, distillator, kjeldahl flask, burette, desiccator, fat flask and soxhlet device.

Making Pumpkin Flour

The making of pumpkin flour refers to (Purnamasari and Putri, 2015). Pumpkin was peeled, washed and thinly sliced. Pumpkin slices was dried with a cabinet dryer at 50°C for 6 hours. Pumpkin which has become chips then crushed with a blender until smooth then sifted with 80 mesh sieve.

Making White Millet Flakes

The making of white millet flakes refers to (Purnamayati *et al*., 2019) with modifications. White millet was washed and soaked in water for 1 hour then blended until smooth. 53.4 g finely millet added with 53.4 ml water and cooked using a rice cooker. Next, the cooked millet was added with 12 g sugar, 1.2 g salt, and pumpkin flour according to the treatment as much as 5.34 g, 10.68 g, and 16.02 g then stirred until blend. Those volume of pumpkin flour addition resulted the total concentration of addition pumpkin flour as much as 10, 20, and 30%, respectively. No additional pumpkin flour was also conducted as 0%. The dough that has been blend was flattened using a roller, ground using a paste machine with a thickness of 5, cut into square shape, and placed on a baking sheet. The oven was heated for 10 minutes at 120°C then the baking sheet was put in the oven and roasted for 20 minutes.

Water Content Measurement

Water content was measured using oven method. Porcelain cups were coded, then dried in an oven for 1 hour at 100ºC, put in a desiccator for ± 15 minutes, then weighed (weight A). As much as 2 grams of sample (weight B) was mashed and dried in the oven for 4 hours at 100ºC, put in a desiccator for ± 15 minutes and weighed. The sample dried again in the oven for 1 hour until a constant weight was reached then cooled in a desiccator and weighed (weight C). Water content was calculated using the following formula (Papunas *et al*., 2013).

Protein Content Measurement

Protein content was measured using Kjeldahl method. Sample of 0.5 g was added in Kjeldahl flask, 0.5 g of selenium as a catalyst, then 10 ml of concentrated sulfuric acid. Kjeldahl flask boiled until the sample's color turned into clear green. The sample were cooled, added 100 ml of aquadest and distillated with the addition of 40 ml of 45% NaOH. The distillate was stored in an erlenmeyer that has been filled with 5 ml of 4% boric acid and 3 drops of MR-MB indicators. Destilization was terminated if the distillate color turned from purple into green and the volume reached 40 ml. Then followed by titration step with 0.1 N HCl until the solution has turned into purple. The protein content was calculated using the following formula (Setyowati and Nisa, 2014).

Fat Content Measurement

Fat content was measured using Soxhlet method. The filter paper size 12x12 cm was dried in an oven at 100ºC for 15 minutes and cooled in a desiccator for 15 minutes. As mush as 2 g of mashed sample was wrapped in filter paper then put into an oven at 100ºC for 1 hour and cooled in a desiccator for 15 minutes. After that put into extraction (soxhlet), add hexane solvent and leave it for 6 hours until it reaches 6 cycles. Then the extraction results were dried in an oven at 100ºC for 1 hour and cooled in a desiccator for 15 minutes then weighed. The fat content was calculated using the following formula (Papunas *et al*., 2013).

Ash Content Measurement

Ash content was measured using furnace method. 5 g of mashed sample were put into porcelain cup with a fixed weight. Samples were dried in an oven at 105ºC for 7 hours then burnt in an electric furnace at 500-600ºC for 6 hours then cooled in a desiccator and weighed. The ash content was calculated using the following formula that was performed by previous researcher (Setyowati and Nisa, 2014).

Crude Fiber Content Measurement

Crude fiber content was carried out by means of Whatman 41 filter paper dried in an oven at 105ºC for 1 hour, put in a desiccator for 15 minutes, and weighed (a). ± 1 gram (x) sample was put in a 250 ml beaker, add 50 ml of H_2SO_4 0.3 N and boiled for 30 minutes. 25 ml of 1.5 N NaOH is added and boiled again for 30 minutes. The suspension was filtered with filter paper using Buchner, then add 50 ml of hot aquadest, 50 ml of H_2SO_4 0.3 N, 50 ml of hot aquadest, and 5 ml of n-hexane. The filter paper with the sample is dried into oven for 6 hours at 105ºC then put into a desiccator for 15 minutes and weighed (y), then put into a furnace or 6 hours at 600ºC then put in a desiccator for 15 minutes and weighed (z). The crude fiber content was calculated using the following formula by national standard as follow (SNI 01-2891-1992):

$$\text{Crude fiber content } (\%) = \frac{y-z-a}{x} \times 100\%$$

Carbohydrate Content Measurement

Carbohydrate content was measured using *by-difference* method (Cakasana *et al*., 2014).

Total Calories Measurement

Total calories was measured based on the calculation of the composition of carbohydrates, proteins, and fats from the resulting sample. Total calories was calculated using the following formula (Sutamihardja *et al*, 2017):

Total calories =
(4 Kcal × protein) + (9 Kcal × fat) + (4 Kcal × carbohydrate)

Analysis Data

Data obtained from the results of proximate levels and calories of white millet flakes using pumpkin flour were analyzed using Analysis of Variance (ANOVA) with a significance level of 5% and continued the Duncan test

Table 1. The Result of Chemical Properties and Calories of White Millet Flakes

Parameters	Total Concentration of Pumpkin Flour (%)			
	0	10	20	30
Water content (%)	3.81 ± 1.11	3.91 ± 0.95	4.00 ± 1.55	4.31 ± 1.05
Protein content (%)	4.31 ± 0.67[a]	5.13 ± 0.52[ab]	5.46 ± 0.85[b]	5.52 ± 0.36[b]
Fat content (%)	2.67 ± 0.81[a]	3.10 ± 0.62[ab]	3.57 ± 0.41[ab]	3.91 ± 0.62[b]
Ash content (%)	3.15 ± 0.75[a]	4.00 ± 0.86[ab]	4.28 ± 0.33[b]	4.39 ± 0.48[b]
Crude fiber content (%)	12.25 ± 0.65[a]	16.04 ± 1.43[b]	19.16 ± 2.56[c]	19.38 ± 2.54[c]
Carbohydrate content (%)	73.80 ± 1.26[c]	67.64 ± 1.36[b]	64.06 ± 3.42[a]	62.50 ± 2.79[a]
Calories (kcal/100g)	336.52 ± 7.44[b]	318.94 ± 9.70[a]	310.11 ± 13.72[a]	307.26 ± 11.34[a]

Results are mean ± standard deviation. Different superscript letters in the same row indicates the significant differences ($p<0.05$).

if there were differences. All data were analyzed with the SPSS application for Windows 22.0.

Results and Discussion

Water Content

Based on Table 1, it is known that the addition of pumpkin flour with different concentrations had no significant effect ($p>0.05$) on water content. The average water content of white millet flakes in all treatments ranged from 3.81 to 4.31%. According to the research of Wijayanti *et al*. (2015) dan Papunas *et al*. (2013) the water content of flakes on the market ranged from 1.84 to 3.35%. The water content of white millet flakes depends on the material used, which in this research used white milet and yellow pumpkin flour. Based on the analysis that has been done, white milet and pumpkin flour have water content of 9.19% and 8.70%. Compared with the water content of flakes on the market, the water content of white millet flakes is higher. However, a difference of about 1% water content will not reduce the shelf life up to 1 year (Dewi, 2015).

Protein Content

The protein content of white millet flakes can be seen on Table 1. The result showed that the addition of pumpkin flour with different concentrations had a significant effect ($p<0.05$) on protein content. The average protein content of white millet flakes in all treatment ranged from 4.31 to 5.52%. According to the research of Wijayanti *et al*. (2015) dan Papunas *et al*. (2013) the protein content of flakes on the market ranged from 5.03 to 6.25%. Compared with the protein content of flakes on the market, the protein content of white millet flakes is lower. The protein content of white millet flakes depends on the material used and additional ingredients such as eggs and milk which is a source of protein. Protein content of white millet flakes can be increased by the addition of milk during the process of serving, where flakes are served as much as 45 g and instant milk powder as much as 27 g (Harisina *et al*., 2017).

Fat Content

The fat content of white millet flakes can be seen on Table 1. The addition of pumpkin flour with different concentrations had a significant effect ($p<0.05$) on fat content. The average fat content of white millet flakes in all treatments ranged from 2.67 to 3.91%. According to the research of Wijayanti *et al*. (2015) the fat content of flakes on the market is 5.78%. Compared with the fat content of flakes on the market, the fat content of white millet flakes is lower. This caused by the fat content of raw materials which is low so the fat content in flakes is also low (Papunas *et al*., 2013). White millet and pumpkin flour have fat content of 2.58% and 0.76% (Anandito *et al*., 2016; Rachmawati *et al*., 2016). Moreover, there was no additional ingredients such as eggs and margarine which is a source of fat. Fat content of white millet flakes can be increased by the addition of milk during the process of serving because milk contains animal fat, where flakes are served as much as 45 g and instant milk powder as much as 27 g (Harisina *et al*., 2017).

Ash Content

The ash content of white millet flakes can be seen on Table 1. The result showed that the addition of pumpkin flour with different concentrations had a significant effect ($p<0.05$) on ash content. The average ash content of white millet flakes in all treatments ranged from 3.15 to 4.39%. According to the research of Wijayanti *et al*. (2015) dan Papunas *et al*. (2013) the ash content of flakes on the market ranged from 1.9 to 3.52%. The ash content of white millet flakes depends on the material used, which in this research used white milet and yellow pumpkin flour. Compared with the ash content of flakes on the market, the ash content of white millet flakes is higher. This is caused by minerals ingredients in pumpkin flour. Pumpkin flour contains minerals including phosphorus 64 mg/100g, calcium 45 mg/100g, and iron 1.40 mg/100g (Purnamasari and Putri, 2015).

Crude Fiber Content

The crude fiber content of white millet flakes can be seen on Table 1. The result showed that the addition of pumpkin flour with different concentrations had a significant effect ($p<0.05$) on crude fiber content. The average crude fiber content of white millet flakes in all treatments ranged from 12.25 to 19.38%. According to the research of Wijayanti *et al*. (2015) the crude fiber content of flakes on the market is 1.77%. Compared with the crude fiber content of flakes on the market, this shows that the crude fiber content of white millet flakes is very high. The crude fiber content of white millet flakes depends on the material used, which in this research used white milet and yellow pumpkin flour. The increasing of crude fiber content in flakes can be caused by the addition of other ingredients which also have crude fiber content (Rakhmawati *et al*., 2014). Based on the analysis that has been done, white milet and pumpkin

flour have crude fiber content of 12.23% and 4.27%. Crude fiber content is related to product quality. Crude fiber is an index in determining the value of food ingredients so the higher fiber, the better the quality of the food (Mayasari *et al*., 2017).

Carbohydrate Content

The carbohidrate content of white millet flakes can be seen on Table 1. The result showed that the addition of pumpkin flour with different concentrations had a significant effect ($p<0.05$) on carbohidrate content. The average carbohydrate content of white millet flakes in all treatments ranged from 62.50 to 73.80%. According to the research of Wijayanti *et al*. (2015) the carbohydrate content of flakes on the market is 87.56%. Compared with the carbohydrate content of flakes on the market, the carbohydrate content of white millet flakes is lower. The carbohydrate content of white millet flakes depends on the material used, which in this research used white milet and yellow pumpkin flour. Based on the research of Anandito *et al*. (2016) and Rachmawati *et al*. (2016) white milet and pumpkin flour have carbohydrate content of 80.4% and 65.11%. Carbohydrate is the main energy source for metabolism in humans, when consuming foods with high carbohydrates, the body's glycogen reserves will increase so the more activities can be carried out (Hastuti dan Zulaekah, 2010).

Calories

The calories of white millet flakes can be seen on Table 1. The result showed that the addition of pumpkin flour with different concentrations had a significant effect ($p<0.05$) on calories. The average calories value of white millet flakes in all treatments ranged from 307.26 to 336.52 kkal/100g. According to the research of Wijayanti *et al*. (2015) the calories of flakes on the market is 330.19 kkal/100g. The calories value of white millet flakes depends on the material used, which in this research used white milet and yellow pumpkin flour. Compared with the calories of flakes on the market, the calories of white millet flakes is lower. The lower calories is caused by pumpkin flour that can increase the levels of crude fiber in white milet flakes, where product with high crude fiber content are usually low in calories. The calories of white milet flakes can be can be increased by the addition of milk during the process of serving where flakes are served as much as 45 g and instant milk powder as much as 27 g (Harisina *et al*., 2017). According to the Departemen Kesehatan RI (2019) powdered milk contains 513 calories in 100 g of food.

Conclusion

The addition of pumpkin flour might increase water, protein, fat, ash, and crude fiber content, but decreased carbohidrate content and calories. The addition of pumpkin flour 30% was the best treatment proved by its highest fiber content and low in calories.

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