# The effect of pumpkin with sorghum flour ratio on the characteristic of cookies gluten-free

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### Preface



### Papers

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**Abstract**. Pumpkin and sorghum flour ratio on the characteristics of gluten-free cookies was carried out. The treatment design consisted of a comparison of pumpkin flour with sorghum p1 (3:1), p2 (2:1), p3 (1:1), p4 (1:2), p5 (1:3), and p0 as control. The results of the preliminary study showed that the mixing time for 8 hours obtained a spread ratio of 56.85% and a yield of 92.14%. The main results of the study showed that the ratio of pumpkin flour with sorghum flour had an effect on the chemical response (water content, ash content) and organoleptic response (color, aroma, taste, and texture). Based on the results of chemical analysis and organoleptic, the treatment was p5 (the ratio of pumpkin flour with 1:3 sorghum flour) had tannin content of 0.26%, crude fiber content of 11%, and beta-carotene content of 0.44 ppm.

**Keywords**: Cookies, Pumpkin Flour, Sorghum Flour, Cookies Gluten Free

## 1. Introduction

Cookies are one type of biscuit made from soft, crispy dough and when broken the cross-section looks less dense [1]. Flour is the main ingredient in making cookies. Wheat flour has a protein (gluten) content which can form a sticky and elastic mass when moistened with water. Gluten is a mixture of two groups or types of wheat protein, namely glutenin and gliadin. Gluten is a substance that is only found in wheat flour while other types of flour do not exist. Some foods that are mostly made from wheat flour are sweet bread, cereals, pasta, cakes, and biscuits [2]. But the use of flour in making biscuits has an impact on children with autism because gluten cannot be completely digested. The combination of amino acids in gluten cannot be broken down into single amino acids by the digestive system of children with autistic disorders, but still in the form of peptides.

One alternative to autism in order to consume cookies is to use pumpkin flour and sorghum flour. Pumpkin has a fairly complete nutritional content such as carbohydrates, proteins and vitamins, so it can increase nutritional value. In addition, pumpkin has a yellow color pigment from carotenoids. Carotene has functional properties as antioxidants that protect cells and tissues from damage caused by free radicals in the body. Another ingredient that can be added is sorghum flour. Sorghum has high nutritional value with a starch content of 72%, 12% protein, and 4% lipids [3]. However, what needs to be considered is sorghum which is contained in it. Therefore to improve the taste and nutritional value of sorghum, it is necessary to try to reduce the tannin content as low as possible. Based on the things above, it is necessary to study the use of pumpkin flour and sorghum flour which is applied to cookies. The

purpose of this study is to determine the comparison between pumpkin flour and sorghum flour on the characteristics of cookies.

## 2. Materials and methods

### *2.1. Materials*

The raw materials were pumpkin and sorghum flour from Gede Bage market. The chemicals used for analysis were $H_2SO_4$ 0.3 N, NaOH 0.3 N, NaCl, $KMnO_4$ 0.01 N, kaolin, indigo, gelatin, and aquadest.

### *2.2. Methods*

***2.2.1.*** *Sample preparation.* Pumpkin flour was produced from pumpkin through the steps process of cutting, trimming, washing, blanching, slicing, drying, grinding and sieving, while sorghum flour was produced from sorghum through steps process of drying, grinding and sieving.

*2.2.2. Determination of mixing time.* The Mixing time conducted for determination of a well mixing time was 4, 8 and 12 min. The spread ratio and yield of cookies were to determine the expected mixing time.

*2.2.3. Flour blending and cookies production*. The Pumpkin flour and sorghum flour were blended at various proportions of p1(3:1); p2(2:1); p3(1:1); p4(1:2); p5(1:3) and p0(control). The pumpkin and sorghum flour blends, sugar, baking powder, shortening, egg yolk and maizena were mixed well in a rubber bow to a creamy consistency. The dough was rolled out on a rolling pin and the desired shapes were given to the cutout dough. The cookies were baked, allowed to cool and packaged well.

*2.2.4. Sensory evaluation.* A total of 30 panelists made up of males and females were selected from the Department of Food Technology of Engineering Faculty of Pasundan University. The panelists were educated and requested to evaluate the various cookies samples for colour, texture, flavor, taste, and general acceptability using a 6-point Hedonic scale where 6 was equivalent to like extremely and 1 meant dislike extremely as described by Ihekoronye and Ngoddy (1985) [4]. The samples were presented in a packaged material, coded with different random alphabets. It was served simultaneously to ease the possibility of panelists evaluating the sample. Necessary precautions were taken to prevent bias of panelists. They were given a sachet of water to rinse their mouth after each stage of sensory evaluation and by ensuring that the panelists were ignorant of the actual sample represented by a code. The sensory evaluation data were analyzed using analysis of variance (ANOVA) as described by Iwe (2002) [5].

*2.2.5. Chemical analysis*. The samples were analyzed on moisture content, ash content, tannin, crude fiber [6] and beta carotene by using HPLC (modified from N. L. Hanifah *et al* 2013 [7]). The chemical analysis data were analyzed using analysis of variance (ANOVA).

## 3. Results and discussions

### *3.1. Moisture and Beta-carotene content of pumpkin flour*

Table 1 shows the moisture content contained in pumpkin flour was 8.5%. See *et al* (2007) the moisture content of pumpkin flour of 10.96% ± 0.12% [8]. Pongjanta *et al* (2006), (6.01% ± 1.47%) [9], El-Demery (2011), (10.64%) [10], and Bhat *et al* (2013), (6.01%) [11]. The results indicate that the difference in moisture content can occur due to internal and external factors. An internal factor that might occur is the difference in the age of pumpkin used. Because of the older pumpkin, the higher the moisture content contained in the fruit. External factors that affect the length of drying, drying

temperature and type of drying equipment used so that the moisture content produced by pumpkin flour is lower than the results of See *et al* (2007) [8].

**Table 1.** Moisture and beta-carotene contents of pumpkin flour.

| Component | Amount |
|---|---|
| Moisture content | 8.5% [6] |
| Beta-caroten | 2.23 ppm [7] |

Based on the results of the analysis of beta-carotene using the HPLC method from the raw material of pumpkin flour, beta-carotene content was 2.23 ppm or 0.223 mg/100 grams. The results of the chromatogram of beta-carotene levels in pumpkin flour can be seen in figure 1. A study by Bhat *et al* (2013) [11], pumpkin flour has a beta-carotene content of 7.30 mg / 100 gram, whereas in a study conducted by Pongjanta *et al* (2006) [9] pumpkin flour has a beta-carotene content of 7.29 ± 3.82 mg / 100 grams. The results of the analysis of beta-carotene carried out had a lower content compared to the two literature. Factors that can affect the levels of beta-carotene from pumpkin flour are varieties, drying temperatures, and the level of maturity.

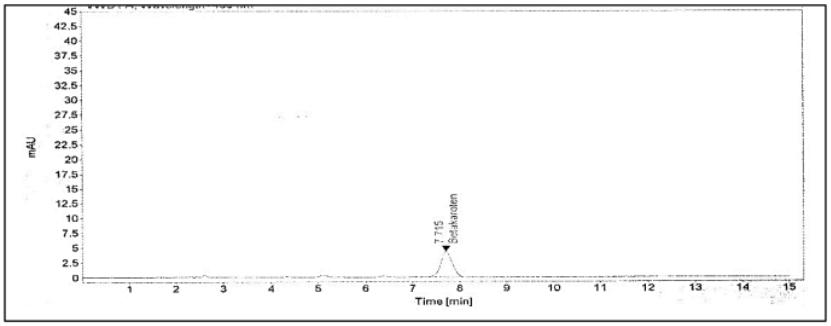


**Figure 1.** Chomatogram of Beta-carotene by using HPLC.

*3.2. Moisture and tannin content of sorghum flour*

Moisture and tannin contents represented in table 2. Moisture content in sorghum flour was 6.5%. This result indicates that sorghum flour has a low moisture content. Suarni (2004) in the research, sorghum flour has a moisture content of 11.02% [12], whereas according to Sari (2016) sorghum flour has a moisture content of 10.37% [13]. The results of the analysis of moisture content have had lower content compared to other research. The result indicates that moisture content affected the process i.e. drying time and temperature.

**Tabel 2.** Moisture and tannin contents of sorghum flour.

| Components | Amount |
|---|---|
| Moisture Content | 6.5% [6] |
| Tannin | 0.52% [6] |

The result of tannin content in sorghum flour was 0.52%. This result indicates that sorghum flour has a high tannin content. Watson (1984) stated that sorghum flour has tannin levels of 0.003–0.17% [14]. The results of the analysis of tannin levels carried out have a higher content than other research. The results indicate that there are some factors to influence the tannin content sorghum flour i.e varieties, ignition, and the process of shading.

*3.3. Determination of mixing time*

In determining the time of mixing were carried out for 4 min, 8 min and 12 min. To determine a good mixing time, the analysis was carried out is to determine of spread ratio and yield. The results indicated in table 3.

**Table 3.** Influence of mixing time on a physical characteristic (spread ratio and yield).

| Mixing Time | Physical Characteristic | |
|---|---|---|
| | Spread Ratio | Yield |
| 4 minutes | (50.73%) 1 | (96.58%) 1 |
| 8 minutes | (56.85%) 3 | (92.14%) 3 |
| 12 minutes | (50.62%) 1 | (96.72%) 1 |

*3.4. Moisture content of cookies*

The results (table 4) show that the more ratio of pumpkin flour, the moisture content in gluten-free cookies will increase. While the more the ratio of sorghum flour, the moisture content in gluten-free cookies will decrease. The results indicate that pumpkin flour has hygroscopic properties or easily absorbs water because of its high sugar content. Pumpkin carbohydrates are high enough to play a role in making the dough. Starch granules will stick to proteins during the formation of the dough. The attachment between starch and protein granules will lead to continuity of the dough. The starch mixture will be able to hold water even though the available water is limited and only partial gelatinization occurs [15]. According to Pasha *et al* (2013), an increase in the ratio of pumpkin flour will increase the water absorption capacity of the final product [16], thus will reduce the development of the dough. According to See *et al* (2007) [8], this is due to the high absorption capacity of water in pumpkin flour compared to wheat flour which is in accordance with the results of Kurkani and Joshi (2013) [17].

**Table 4.** The ratio of pumpkin and sorghum flour on the moisture content of cookies gluten-free.

| Ratio of Pumpkin and Sorghum flour | Amount (%) | Significance difference (P < 0.05) |
|---|---|---|
| p0 (control/wheat flour) | 2.31 | a |
| p1 (3:1) | 4.75 | b |
| p2 (2:1) | 3.88 | ab |
| p3 (1:1) | 3.50 | ab |
| p4 (1:2) | 3.50 | ab |
| p5 (1:3) | 2.38 | a |

Mean value with different subscript are significantly different (P < 0.05)

**Table 5.** The ratio of pumpkin and sorghum flour on ash content of cookies gluten-free.

| Ratio of pumpkin and sorghum flour | Amount (%) | Significance difference (P < 0.05) |
|---|---|---|
| p0 (control/wheat flour) | 1.25 | a |
| p1 (3:1) | 2.50 | b |
| p2 (2:1) | 2.25 | b |
| p3 (1:1) | 2.25 | b |
| p4 (1:2) | 2.00 | b |
| p5 (1:3) | 1.75 | ab |

Mean value with different subscript are significantly different (P < 0.05)

The results (table 5) showed that the more the ratio of pumpkin flour, the higher the ash content of gluten-free cookies. While the more the ratio of sorghum flour, the lower the ash content of gluten-free cookies. This result is in accordance with the research of Pasha *et al* (2013) that increasing the ratio of pumpkin flour will increase the ash content in the final product [16].
The mineral content in the whole sorghum will be reduced after the ignition process is carried out. The process of ignition is the process of removing the outer part of the structure of sorghum seeds. The outer part which is lost partially or completely in the ignition process includes the pericarp layer which is rich in ash and fiber, the aleurone layer which is rich in ash, protein and fat, and the body part which is rich in protein, ash and fat [18]. Thus the sorghum flour that has been banned will have lower ash content compared to the ash content in pumpkin flour.

### *3.5. Chemical and sensory evaluation of gluten-free cookies*

Based on the data from the statistical analysis of the scoring method on the chemical response and organoleptic response it can be concluded that the selected products in the main study were 432 p0 samples as control and 674 p5 samples with the ratio of pumpkin flour with sorghum flour 1:3. The best treatment refers to the Indonesian National Standard (SNI 2973: 2011) concerning cookies [1]. The selected sample was then subjected to chemical analysis, namely tannin, crude fiber, and beta-carotene.

**Table 6.** Chemical composition and sensory evaluation of gluten-free cookies.

| Code | Chemical Composition | | Sensory Parameters | | | |
|---|---|---|---|---|---|---|
| | Moisture (%) | Ash (%) | color | aroma | taste | texture |
| 432 (p0) | 2.31 a | 1.25 a | 5.64 c | 5.19 c | 5.57 e | 5.53 d |
| 245 (p1) | 4.75 b | 2.50 b | 3.65 a | 3.79 a | 3.80 a | 3.78 a |
| 315 (p2) | 3.88 ab | 2.25 b | 3.88 b | 4.04 b | 4.00 b | 4.28 c |
| 930 (p3) | 3.50 ab | 2.25 b | 3.92 b | 3.78 a | 4.15 c | 3.89 b |
| 196 (p4) | 3.50 ab | 2.00 b | 3.90 b | 3.89 ab | 4.20 cd | 3.86 ab |
| 674 (p5) | 2.38 a | 1.75 ab | 3.88 b | 3.89 ab | 4.33 d | 4.32 c |

Mean value with different subscript are significantly different ($P < 0.05$)

### *3.6. Tannin, crude fiber and Beta-carotene contents in selected gluten-free cookies*

Based on the results of the analysis of tannin content in selected products was found that gluten-free cookies treated p5 with a ratio of pumpkin flour with 1:3 sorghum flour had tannin levels of 0.26%. The results of the preliminary study showed that sorghum flour had 0.52% tannin content, after being cookies the tannin content decreased to 0.26%. Decreasing tannin levels is caused by tannins having water-soluble properties.

**Table 7.** Tannin, crude fiber and Betacarotene contents in selected gluten-free cookies.

| Treatments | Analysis | | |
|---|---|---|---|
| | Tannin (%) | Crude fiber (%) | Beta-caroten (ppm) |
| p0 (control) | - | 9 | - |
| p5 (1:3) | 0.26 | 11 | 0.44 |

Based on the analysis of crude fiber content in selected products was found that gluten-free cookies with p0 treatment as control and p5 with a ratio of pumpkin flour with 1:3 sorghum flour had crude fiber content of 9% and 11%. The results showed that crude fiber content in treatment p5 with a ratio of pumpkin flour with 1:3 sorghum flour had higher crude fiber content than treatment p0 as a control. This shows that sorghum flour has a higher fiber content than wheat flour.
Based on the results of the analysis of beta-carotene levels in selected products using the HPLC method, it was found that gluten-free cookies treated p5 with a ratio of pumpkin flour with 1:3 sorghum flour

had a beta-carotene content of 0.44 ppm or 0.044 mg / 100 gram. The preliminary results showed that pumpkin flour had a beta-carotene content of 2.33 ppm, after being cookies the beta-carotene level decreased to 0.44 ppm. This indicates because the ratio of pumpkin flour is less than sorghum flour. The amount of beta-carotene in the selected product is influenced by the comparison of pumpkin flour added. The more comparisons of pumpkin flour, beta-carotene levels in cookies will increase.

## 4. Conclusion

Comparison of pumpkin flour with sorghum flour has an effect on the quality of gluten-free cookies including chemical responses, namely water content and ash content and organoleptic responses, namely attributes of color, aroma, taste, and texture.

The results of the main study of selected gluten-free cookies based on the average value of statistical analysis of the scoring method on the chemical response and organoleptic response were p5 treatment with a ratio of pumpkin flour with 1:3 sorghum flour. The treatment has tannin levels of 0.26%, crude fiber content of 11%, and beta-carotene content of 0.44 ppm.

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