

Chemical Characteristics and Sensory Analysis of Cake Enriched Pumpkin Flour to Improve Food Security

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Abstract. Pumpkin contains a lot of vitamins A, B, and C, as well as minerals and carbohydrates. The use of local flour as a replacement for wheat flour is still being researched. The goal of this research is to determine the quality characteristics and consumer acceptance (organoleptic) of pumpkin flour cake. The following properties were observed: proximate content (moisture content, ash content, fat, protein, and carbohydrates) and organoleptic (texture, aroma, taste, color, appearance, and overall). A completely randomized design (CRD) was used in this study, with five treatments: Wheat flour (100%, 75%, 50%, 25%) can be used in place of pumpkin flour (0%, 25%, 50%, and 75%). Pumpkin flour contained 9.30% moisture, 4.35% ash, 1.02% fat, 6.07% protein, and 4.74% fiber when used to make cakes. Pumpkin flour concentration affects the water content, ash content, fat content, protein content, and carbohydrate content of pumpkin cake. Organoleptic tests revealed that the concentration of pumpkin flour had an effect on the panelists' pumpkin cake taste, appearance, and overall pumpkin cake. Proximate and organoleptic tests revealed that the best pumpkin-to-wheat flour ratio for baking cakes was 50%:50%. To improve family and community food security, pumpkin flour can be substituted for wheat flour.

1 Introduction

Pumpkin fruit has been distributed equitably across Indonesia because, aside from being easy to cultivate and manage, pumpkin fruit may be a consistent food supply. Yellow pumpkin, also known as pumpkin, contains a high concentration of vitamins A, B, and C, as well as minerals and carbohydrates. The flesh of the fruit also contains antioxidants, which act as an antidote to various cancers. Pumpkin's soft and easily digestible nature contains a lot of carotenes (pro vitamin A), which can add appealing colors to other processed foods. However, its application has been subpar thus far [1].

Yellow pumpkin is one of the fruits with a high fiber content, making it an excellent rice substitute [2]. Pumpkin has been utilized as a raw ingredient in various countries to make

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traditional cuisines [3]. Yellow pumpkin includes rubberoin, primarily in the form of beta-carotenoin, which protects the eyes against cataracts, cancer, heart disease, dysentery, renal illness, diarrhea, and other disorders [4]. Another advantage of pumpkin is that it can be used to treat fever, migraines, diarrhea, kidney problems, and inflammation [5].

A hundred g of pumpkin provides 29 kcal of energy, 91.20 g of water, 45 mg calcium, 64 mg phosphorus, and 1.40 mg iron [6]. Pumpkin is a food plant with a high -carotene concentration, with 262 g/100 g of material [7]. This fruit also includes inulin and dietary fiber, which are essential for good health, particularly in the digestive tract [8]. [9] discovered that dried pumpkin puree with a 30-minute room temperature pasteurization time has a total dietary fiber level of 57.82 g/100 g.

Making pumpkin flour is a simple way to use pumpkin fruit. The use of local flour as a replacement for wheat flour is still being researched. Pumpkin flour is one of the possible applications for local flour. Native pumpkin flour has functional flaws such as clumping, less swelling, and a lack of water binding [10]. The use of 10- 20% pumpkin flour instead of wheat flour in Thai desserts boosts the yellow hue and carotene content, which is acceptable to consumers [11]. Pumpkin flour may be stored for a long time and used to make a variety of foods [12]. Pumpkin flour can supplement and increase the nutrients and quality of bread when used in baking [13].

Cake has several versions that use many other types of food items to boost its nutritional and functional value, such as the use of pumpkin flour in [14] research to increase its carotene content. Pumpkin flour treated with acetic acid at 0.15% concentration and soaking time of 90 minutes has relatively strong swelling power (12.76 g/g) and high -carotene content (992, 45 g/g) [15]. The research findings contribute to information about the potential usage and utilization of underutilized pumpkin in making gluten free cakes that are attractive for autistic patients. Nutritional value, as well as texture and sensory characteristics, are equally important. Nutritional value, as well as texture and sensory properties, are all key factors to consider. The goal of this research is to investigate the quality characteristics and consumer acceptance (organoleptic) of cake made with pumpkin flour.

2 Materials and Method

2.1 Tools and materials

Wheat flour, pumpkin flour, eggs, corn flour, granulated sugar, baking powder, milk powder, and chemicals needed for proximate analysis of cake were employed in this study. Scales, mixers, baking sheets, stirrers, ovens, and knives are among the items used in the meantime flour.

2.2 How to Make a Yellow Pumpkin Cake

The steps for making a pumpkin cake are as follows: a) Using a high-speed mixer, combine the butter, baking powder, and powdered sugar until the mixture turns yellowish white and is soft and smooth ; b) then, add the eggs one at a time into the dough while beating with a mixer and add the vanilla powder (2 g) until the dough expands; c) then, mix the dough with flour, pumpkin flour, milk powder, and corn flour until smooth and add little by little while sifting into the risen dough; d) Pour the dough into a round baking pan that has been greased with butter and sprinkled with flour evenly on all sides; e) Bake the dough for 40-45 minutes in a preheated oven at 170-180°C. The Yellow Pumpkin Cake is now ready to be tested.

2.3 Pumpkin Cake Organoleptic Analysis

An organoleptic evaluation was conducted with 20 panelists (non trained) to determine which cake product the panelists preferred for each treatment. Color, aroma, texture, taste, appearance, and overall were all considered.

2.4 Pumpkin Cake Proximate Analysis

The AOAC method was used to test the water, ash, fat, protein, and carbohydrate content of a cake produced with pumpkin flour [15].

2.5 Design of an Experiment

This study had a completely randomized design (CRD), with four treatments: pumpkin flour substitution (0%, 25%, 50%, and 75%): wheat flour (100%, 75%, 50%, 25%). Each treatment was carried out twice, for a total of eight experimental units. The data from the research were analyzed using ANOVA in the SPSS 21 program, and if the treatment had an effect on the variable, the Duncan's Multiple Range Test (DMRT) was utilized.

3 Result and Discussion

3.1 Pumpkin flour characteristic

Pumpkin (*Cucurbita moschata* D.) is a nutritious vegetable with a high fiber content. Pumpkin has previously only been used in traditional food processing. As a result, pumpkin's use must be expanded by producing pumpkin flour, which can be used as an ingredient in a variety of foods and has a longer shelf life and an easier distribution process.

According to the findings of pumpkin flour research, the water content was 9.30%, the ash content was 4.35%, the fat content was 1.02%, the protein content was 6.07%, and the fiber content was 4.74%. (Table 1). The amount of water contained in foods is expressed as water content [17]. According to SNI 01-3751-2009, the water content of wheat flour is 14.5%. Corn flour contains 10% moisture, while wheat flour contains 12.0% [18]. The obtained water content values are lower when compared to the literature and water content results from [13] research. The ash content of food indicates the total amount of minerals present. According to [19], Chemical or physical processes had little effect on the ash content, and only around 3% of the food cooking process was lost. The ash content value of pumpkin flour produced in this study was not significantly different from the ash content value of pumpkin flour obtained in [20] research, which was 5.39% and [13] research, which was 5.37%.

Table 1. Fresh pumpkin and pumpkin flour approximate content

Composition	Pumpkin Flour	Fresh Pumpkin*	Pumpkin Flour*
Moisture (%)	9.30	92.24	10.96
Ash (%)	4.35	0.76	5.37
Fat (%)	1.02	0.15	0.80
Protein (%)	6.07	0.98	9.65
Fiber (%)	4.74	0.56	0.81

.Base on research [13]

The fat content measured includes all components dissolved in non-polar solvents such as hexane. The heat process will cause tissue loosening, allowing the fat extraction process

to run smoothly. The obtained fat content value was around 1.02%, which was only 0.22% different from [20] 's value of 0.80%. Because of the presence of fat-soluble carotenoid pigments, pumpkin has a high fat content, which raises the value of the fat content measurement.

The protein levels obtained did not differ significantly. The conversion factor for flour-based food ingredients is 5.70%. [21] stated that the heating process can denature the protein and change the structure of the existing protein, but the protein content will remain the same due to the principle of protein analysis using the Kjeldhal method which calculates the total N content, so that the value of the N content measured in the material will remain constant.

Dietary fiber is a component of food that digestive enzymes cannot hydrolyze. The fiber content as a result is 4.74%. According to [22], food is considered a source of fiber if it contains 4.5-6 g/100g of fiber. Based on the research data, it appears that pumpkin flour has a high fiber content value when adjusted to BPOM regulations. Because pumpkin flour is a source of dietary fiber, it can be used as an ingredient in functional foods that have a variety of health benefits for the body. Pumpkin flour can be used in a range of pastry dishes, including cakes, cookies, and muffins.

3.2 Chemical characteristic of Pumpkin flour cake

The use of pumpkin flour in the preparation of cakes results in a high nutritional content. This is due to the fact that yellow pumpkin contains carbohydrates, protein, fat, and crude fiber [23]. Pumpkin is good for food fortification as cake because of its nutritional content, particularly its high beta-carotene (provitamin A) content. Whole cake enriched with 25-75% pumpkin seed flour evaluated for its proximate composition is mentioned in Table 2.

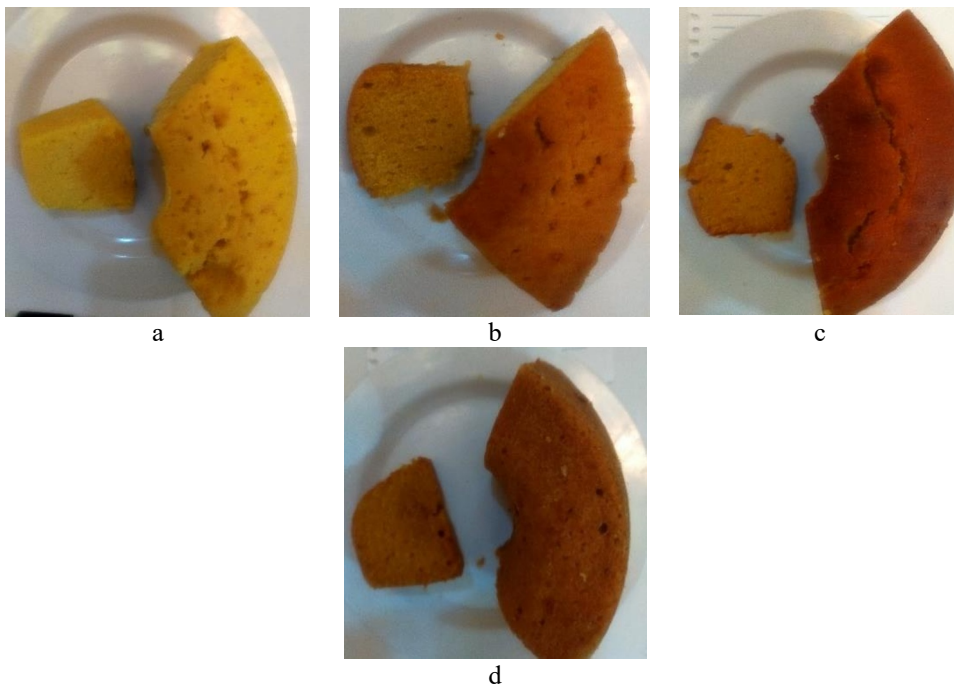


Fig 1. Cake of pumpkin flour a) 0%, b) 25%, c)50%, d) 75%

3.2.1 Moisture content

The low moisture content levels ensure that items have an extended shelf life. Table 2 shows that the pumpkin flour substitution cake differed significantly from the control. The use of pumpkin flour reduces the moisture content of the resulting cake. This is due to pumpkin flour's lower hygroscopic properties when compared to wheat flour. The moisture content of pumpkin flour substitution cake was found to be between 25.57% and 29.72% in this study. The variance results revealed that substituting pumpkin flour had a significant effect on the moisture content of the cake. Table 2 shows that the water content of the cake was lowest in the 50% pumpkin substitution treatment, at 25.57%, and highest in the absence of pumpkin flour, at 30.89%. Because the water content of the wheat flour (14%) used is larger than the water content of pumpkin flour (9.3%), the water content of the cake without pumpkin flour is higher.

3.2.2 Ash content

The analysis of variance results revealed that substituting pumpkin flour had a significant effect on the ash content of the cake. Table 2 shows that the control treatment (no substitution) yielded the lowest ash content of cake, 1.379%, while the substitution of 75% pumpkin flour yielded the highest ash content of cake, 1.59%. The goal of determining ash content is to determine the amount of mineral content in the cake. The highest cake ash content corresponded to the large amount of pumpkin flour used.

This is because pumpkin flour contains more minerals than wheat flour, so the amount increases when pumpkin flour is added. According to raw material analysis results, the ash content of pumpkin flour is 4.53%, which is higher than the ash content of wheat flour, which is 0.70%. [24]. Pumpkin contains calcium (45.00 mg/100g), phosphorus (64.00 mg/100g), and iron (1.40 mg/100g) [8]. Minerals serve as building blocks as well as regulators in the body. Some of the functions of minerals in the body include calcium, which aids in the formation of bones and teeth as well as the regulation of biological processes, and phosphorus, which aids in energy storage and expenditure [25].

Table 2. Proximate composition of cake

Pumpkin flour content	Composition					
	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Carbohydrate (%)	Energy (kkal)
0%	30.89 ^d	1.37 ^a	22.69 ^b	7.18 ^c	37.88 ^a	384.41 ^b
25%	28.23 ^b	1.42 ^{ab}	23.44 ^c	6.38 ^b	40.53 ^b	398.60 ^c
50%	25.57 ^a	1.55 ^{bc}	18.59 ^a	6.12 ^b	48.18 ^d	384.48 ^b
75%	29.72 ^c	1.59 ^c	18.55 ^a	5.83 ^a	44.31 ^c	367.53 ^a

Note: the numbers in the comparable column with various superscript letters differ considerably ($p < 0.05$)

3.2.3 Protein content

The results of the protein content test in the cake samples differed, according to the study results of the cake protein content test in Table 2. The control sample had a protein content of 7.18%, the 25% pumpkin flour substitute had a protein level of 6.38%, and the 50% and 75% pumpkin flour substitution treatments had protein contents of 6.12% and 5.83%, respectively. Because of the decreased amount of bread flour in the formulation, the incorporation of pumpkin powder in the bread resulted in a decrease in protein and fat content [13].

According to the analysis of variance, substituting pumpkin flour in cake recipes has a significant effect on protein content. The higher the pumpkin substitution, the lower the protein content of the cake. Because the raw material used to make cakes is high protein flour (11-13%), the higher the substitution with pumpkin flour, the lower the protein content of the cake. This could be attributed to increased nitrogen loss in the pumpkin augmented cake during the baking process at high temperatures (180°C). In baked goods, pumpkin is more sensitive to high temperatures than wheat [26].

3.2.4 Fat content

The 25% pumpkin substitution had the highest fat content in the cake (23.44%), while the 75% pumpkin substitution had the lowest fat content (18.55%). Adding 80 g of butter to brownies resulted in brownies with 6.78% fat [27]. Furthermore, the fat content analyzed using the Soxhlet extraction method can explain how the heating process can reduce the fat content of foodstuffs as well as the essential and non-essential fatty acids.

3.2.5 Carbohydrate and Energy content

When additional pumpkin was added to wheat flour, the carbohydrate content of the cake increased. This could be because pumpkin flour has more starch granules than wheat flour, resulting in a higher carbohydrate load in the control cake. The overall energy content of the composite cake samples was considerably ($p < 0.05$) lower than that of the control cake (0% pumpkin flour). This could be owing to the pumpkin flour's low energy level. The outcomes of this study were equivalent to those of [3] and [28], which showed that replacing pumpkin in composite flour reduced energy content.

3.3 Organoleptic test

Organoleptic testing, often known as sensory testing or sensory testing, is a form of testing that uses the human senses as the primary tool for determining the acceptability of items. Quality assurance relies heavily on organoleptic testing. Organoleptic testing can detect spoilage, decline in quality, and other problems in a product. The sensory test in this study was carried out by testing the panelists' preference level using a scoring method involving 20 panelists. In this study, the preference test for the scoring method included the extent of preference for texture, aroma, color, taste, appearance, and overall. Table 3 shows the results of the cake preference test with various percentages of pumpkin flour substitution.

Table 3. Sensory evaluation of cake from composite pumpkin flour

Pumpkin flour content	Composition sensory					
	Texture	Aroma	Taste	Color	Appearance	Overall acceptability
0%	4.00a	4.14a	4.50a	4.13a	3.88ab	4.00a
25%	4.13a	4.63a	4.88ab	4.25a	4.25b	4.13a
50%	4.67a	4.44a	5.00b	4.44a	4.22b	4.89b
75%	4.11a	4.56a	4.22a	3.89a	3.56a	4.22a

Note: the numbers in the comparable column with various superscript letters differ considerably ($p < 0.05$)

3.3.1 Texture

Each sample produces the same cake texture, which is soft textured. Based on the cheese texture preference test, the average panelist stated the level of preference for sponge texture, which was widely preferred, namely sponge cake with 50% pumpkin substitution with a value of 4.67, sponge cake with 25% pumpkin substitution with a value of 4.13, and sponge cake with 75% pumpkin substitution with a value of 4.11. This meant that there was no statistically significant difference in the panelists' preferences for the pumpkin-substituted cake texture (25%, 50%, and 75%). Texture is a tangible pressure experience by biting, chewing, or swallowing or by touching it with the ring finger. Rubbing the fingers is a common method of assessment.

3.3.2 Aroma

Aroma testing is a simple test that quickly determines whether a food product is acceptable or not. The average panelist stated the level of preference for cake aroma with 25% pumpkin flour substitution based on the preference test for cake aroma. According to the results of the analysis of variance, pumpkin flour substitution did not differ significantly from the panelists' aroma acceptance. The greater the amount of addition of pumpkin flour tends to produce a sharper pumpkin aroma. According to [29], Food fragrance is created by the synthesis of volatile chemicals that quickly evaporate and different cooking processes result in different aromas.

3.3.3 Taste

According to the analysis of variance, the panelists' taste tests were significantly influenced by the substitution of pumpkin flour. Panelists' preference for cake flavor with 50% pumpkin flour substitution was the most preferred, but 75% pumpkin flour substitution was the least preferred. This is due to the fact that the higher the substitution of pumpkin flour causes a distinct flavor of pumpkin flour, which greatly affects the flavor of the resulting pumpkin cake. According to [30], taste is a factor that panelists evaluate after texture, color, and aroma, and it can affect the acceptance of food products. Consumers are more likely to like food than taste because good taste can attract attention. If the aroma, color, and texture components are all satisfactory, but the consumer.

3.3.4 Color

According to [31], color variations in product are frequently utilized as the primary criterion for consumers to assess whether a fruit is raw or ripe. Table 3 shows that the pumpkin flour substitution cake (25%, 50%, and 75% pumpkin flour) was not markedly different from the control cake. Panelists preferred the color of the 50% pumpkin flour substitute cake because it was bright (yellow) and disliked the color of the 75% pumpkin flour substitute cake because it was dark (reddish). The greater the pumpkin flour substitution, the lower the panelists' color preference. The more pumpkin flour used, the brighter the yellow color of the cake. This is due to the β -carotene content of pumpkin; additionally, the dominant color of pumpkin flour is yellow-orange, which affects the color of the final food product [13].

3.3.5 Overall

The overall parameter is used in the hedonic test to determine the panelist's preference for the product's overall quality attributes (texture, aroma, color, taste, overall). Table 3 shows

that the pumpkin flour substitution cake was significantly different from the control (no pumpkin flour substitution), whereas the 25% and 75% pumpkin flour substitute cakes did not differ substantially from the control (0%) cake. Overall, panelists in this study were willing to accept up to 50% pumpkin flour substitution in pound cake. Cake with pumpkin flour substitution has a chance of up to 50% substitution if it is associated with sensory characteristics. Several factors influence the cake's overall acceptance, including color, aroma, texture, and taste.

4 Conclusion

The addition of pumpkin flour changed the moisture content, ash content, fat, protein, and carbohydrates of the cake, as well as its organoleptic est (texture, taste, appearance, and overall acceptability). The best cake characteristics are the use of 50% pumpkin flour substitution, which has a moisture content of 25.57%, an ash content of 1.51%, a fat content of 18.59%, a protein content of 6.12%, and a carbohydrate content of 48.18%, and an organoleptic texture test value. 4.67, 4.44 for aroma, 5.00 for taste, 4.44 for color, 4.22 for appearance, and 4.89 for overall acceptability.

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