

# The Sensory Quality and Acceptability of Pumpkin Flour Cookies

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**Abstract:** Pumpkin is a nutritious food, rich in vitamins and minerals but low in calories. Pumpkin contains beta-carotene which has high antioxidant. The purpose of this study is to determine the difference in using pumpkin flour for the sensory quality of cookies and to know the difference in using pumpkin flour for the acceptability of cookies. This study applies the use of pumpkin flour as a substitute material in the cookies production, as much as 10%, 15%, and 20%. The making of cookies is done by the roasting process. Analysis conducted on pumpkin cookies was sensory quality carried out by trained panelists with a 7-point quality scale. The acceptability of cookies was analyzed by a consumer acceptability test with 80 panelists. Beta-carotene was analyzed by using spectrophotometry. Differential analysis was carried out by ANOVA and continued by using Duncan's test. The results of the sensory quality showed that there were differences in the quality of yellow color, crispness, and taste of pumpkin cookies, either with 15% pumpkin flour and 20% pumpkin flour. Sensory quality of cookies with 10% pumpkin flour has no difference with cookies with 15% of pumpkin flour in all attributes to. In the acceptability test, there are differences in the attributes of yellow color, crispness, and overall. The yellow color and overall attributes differences were found between cookies with 10% and 20% pumpkin flour and between cookies with 15% and 20% pumpkin flour. Whereas in the crispness attribute, the difference was found between cookies with 10% and 15% pumpkin flour and between cookies with 10% and 20% pumpkin flour. There was no correlation ( $p > 0.05$ ) between sensory quality and acceptability of cookies in all sensory attributes, except for the pumpkin flavor attributes ( $p = 0.039$ ). The content of beta-carotene cookies with 10%, 15% and 20% pumpkin flour respectively is 8.457 mcg, 9.796 mcg, and 12.712 mcg/100 g. There is still a bitter aftertaste that must be removed for the sample by increasing the duration of steaming.

## 1 INTRODUCTION

Cookies are a type of biscuit made from soft, crunchy dough and the texture is less dense when broken. Biscuits are dried bakery products made by baking dough made from wheat flour with or without substitution, oil/fat, with or without the addition of other food ingredients and permitted food additives (BSN, 2011). Cookies are widely consumed ranging from infants to the elderly. Various research results in Semarang stated that cookies are the most consumed food for children, after milk (Fathonah et al., 2014). The results of research on children aged 7-12 years in the Netherlands found that the consumption of energy-dense snacks was 1,568 kJ (375 kcal), half of them

is in the form of cookies and sweets in the afternoon and at home (Gevers et al., 2016). In the United States, Cookies are introduced from the age of 24 months, 57% of the people consume cookies or candy on certain days (Deming et al., 2017).

Cookies in the market contain high energy and fat. On the one hand, high energy and fat are needed to meet nutritional needs, but on the other hand, it is harmful if consumed excessively. Based on research in Brazil, candy and biscuits can increase energy intake by 12% and sugar-sweetened beverages (SSB) increase the energy by 7% (Sichieri et al., 2015). There is little indication that sugar intake plays a significant role in the development of ovarian cancer (King, et al. 2013). Various efforts have been made to improve the quality of cookies to

be healthier. Research by Akubor et al. (2003) shows that biscuits made from a mixture of soy flour or cassava flour will serve to increase protein and calorie intake so that it is suitable for feeding the children. In Mervina's research (2009), the manufacture of biscuits with the catfish flour has high protein content because it can meet the target of 20% protein based on AKG (nutrient standard) of children. It shows that biscuit is considered to have high protein. Biscuits made of spirulina powder can increase high fiber and protein (Singh et al., 2013). Research conducted by Fathonah produced green bean biscuits with 35% margarine that contains the energy of 453 kcal, 11.3% of protein, and 13.1% fiber. It means that the acceptability is very favored (Fathonah et al., 2015). The provision of biscuits for 30 days in Early Childhood/Anak Usia Dini (AUD) in 2 PAUD/Early Childhood Education in Gunung Pati, Semarang can improve AUD nutritional status to a standard or right direction (Fathonah, et al, 2016). Corn biscuits with 25% - 35% of margarine contains 441-468 kcal of the energy of, 6.4 - 7.3% of protein, 18.3 - 21.7% of fat, and 2.721 -4.134  $\mu$ g of beta-carotene (Fathonah et al, 2018).

Various results of the above research show a positive effect of the raw materials modification or additional ingredients in making cookies or biscuits. In this study, modification will use pumpkin flour. Pumpkin is a nutritious food, rich in vitamins and minerals but low in calories. Pumpkin contains very high beta-carotene. Consuming foods rich in beta-carotene can reduce the risk of developing certain types of cancer, offering protection against asthma and heart disease, and delaying aging and degeneration of the body. The fiber, potassium, and vitamin C in the pumpkin supports heart health (Ware, 2018).

Various studies on the use of pumpkin's skin, seeds and flour show positive benefits. Bread made of flour containing 10-15 g of honey pumpkin skin fiber that through dehydration process or 5 g of pumpkin skin fiber that through ethanol treatment per 1 kilogram of wheat flour tends to be softer, while 10 g of honey pumpkin skin that through ethanol treatment per 1 kilogram of wheat flour produces softer bread throughout 9 days of storage (Pla et al, 2013). Ethanol extract from pumpkin seeds inhibits the growth of all bacteria; however, both quince seed extracts do not show activity against *S. typhii*, *E. coli* and *S. aureus* (Amin et al, 2018). Pumpkin slurry that is considered as waste can be used as a rich source of Cu, Zn-SOD (Superoxide dismutase) and can be commercially

exploited in cosmeceuticals, pharmaceuticals and nutraceuticals (Qin et al, 2012).

Based on the description above, pumpkin flour is known to have a potential to be used as an ingredient in making cookies, which is high in antioxidants, particularly the beta-carotene. Pumpkin flour cookies are expected to have high beta-carotene and can be served as a functional snack. The purpose of this study was to determine the differences in the use of pumpkin flour on the sensory quality of cookies, to know the difference in the use of pumpkin flour against the acceptability of cookies, to know the relationship between sensory quality and acceptability of cookies, and to know the content of beta-protein cookies.

## 2 METHOD

The subject in this study was cookies made of pumpkin flour. The treatment carried out was the substitution of 10%, 15%, and 20% pumpkin flour towards wheat flour. The ingredients of pumpkin cookies are presented in Table 1.

Table 1: Potential fault zone.

Ingredients	Substitution Treatment		
	10%	15%	20%
Pumpkin flour	50	75	100
Wheat flour	400	375	350
Cornstarch	50	50	50
Margarin	350	350	350
Refined Sugar	180	180	180
Yolk	32	32	32
Baking powder	5	5	5

The stages of making process are as follow: Margarine is mixed with refined sugar by using speed 1 of mixer in 5 minutes until they are well blended, then egg yolks are added and the remix them for 1 minute. Pumpkin flour, wheat flour, cornstarch and baking powder are added and stirred using two spatulas until they are well blended. The dough is ready to be shaped in 6 grams cookies by using molds, and are arranged on a baking sheet. Cookies are baked at the temperature of 150 0C on both upper and bottom flame for 18 minutes. The baking pan is turned every 5 minutes. Cookies are removed from the pan, cooled, and then packed in

hermetic packaging. There are two stages of packaging, four pieces of cookies are packed in plastic and then packed in an aluminum foil contains of 9 packs of small packaging. One recipe produces 160 pieces of cookies.

### 3 RESULT AND DISCUSSION

The resulted pumpkin cookies have particular orange yellow color which is typical of the substitute ingredients, which is pumpkin flour. Figure 1 shows that the more pumpkin is given the older the yellow-orange color cookies. This shows high beta-carotene content, which is useful as an antioxidant. Cookies in Figure 1 was tested for sensory quality by trained panelists. The result of sensory quality testing (Table 2) shows that cookies of 10% pumpkin flour have the highest intensity on the attributes of aroma, crispness and sweetness. The attributes of golden yellow and pumpkin flavor are highest in cookies with 20% pumpkin flour. However, overall (assessed simultaneously on all attributes) results that received the highest rating were cookies with 15% pumpkin flour, with a score of 5.70.

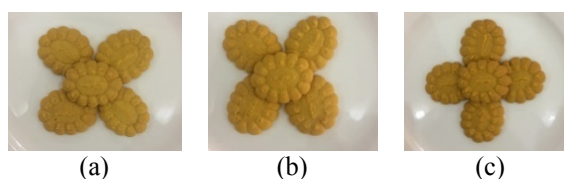


Figure 1: Pumpkin Biscuits with: (a), 10% pumpkin flour; (b), 15% pumpkin flour, and (c) 20% pumpkin flour.

The result of statistical tests shows that there are significant differences in the attributes of golden yellow color ( $p = 0.001$ ), crispness ( $p = 0.006$ ), and pumpkin flavor ( $p = 0.037$ ). The golden yellow attribute and crisp texture occur in cookies with 10% and 15% pumpkin flour are no different, the difference occurs in cookies with 20% pumpkin flour. On the other hand, the pumpkin flavor attribute differs between cookies with 10% pumpkin flour with two other cookies, which are cookies with 15% and 20% pumpkin flour.

Table 2: Potential megathrust seismic zone.

Sensory Quality Attribute	Treatment	Minimum Score	Maximum Score	Mean	Deviation Standard
Golden Yellow*	10% pumpkin flour	2	5,1	3,54 <sup>a</sup>	0,84
	15% pumpkin flour	2	6	3,69 <sup>a</sup>	1,08
	20% pumpkin flour	2	6,4	<b>4,51<sup>b</sup></b>	1,16
Aroma	10% pumpkin flour	2	6,7	<b>5,27<sup>a</sup></b>	1,03
	15% pumpkin flour	3	6,8	5,33 <sup>a</sup>	0,89
	20% pumpkin flour	2	6,4	5,12 <sup>a</sup>	1,03
Crispness*	10% pumpkin flour	2	7	<b>5,59<sup>a</sup></b>	1,13
	15% pumpkin flour	3	7	5,51 <sup>a</sup>	0,99
	20% pumpkin flour	1,9	6,5	4,73 <sup>b</sup>	1,2
Sweetness	10% pumpkin flour	3,3	6,9	<b>5,43<sup>a</sup></b>	0,96
	15% pumpkin flour	3	6,8	5,38 <sup>a</sup>	1,08
	20% pumpkin flour	2	6,7	5,29 <sup>a</sup>	1,17
Pumpkin Flavor*	10% pumpkin flour	2	6,4	4,42 <sup>a</sup>	1,25
	15% pumpkin flour	2	6,4	4,82 <sup>b</sup>	1,24
	20% pumpkin flour	2	6,8	<b>5,26<sup>b</sup></b>	1,22
Overall	10% pumpkin flour	3	6,7	5,55 <sup>a</sup>	0,91
	15% pumpkin flour	3	7	<b>5,70<sup>a</sup></b>	1,03
	20% pumpkin flour	3	6,6	5,15 <sup>a</sup>	1,14

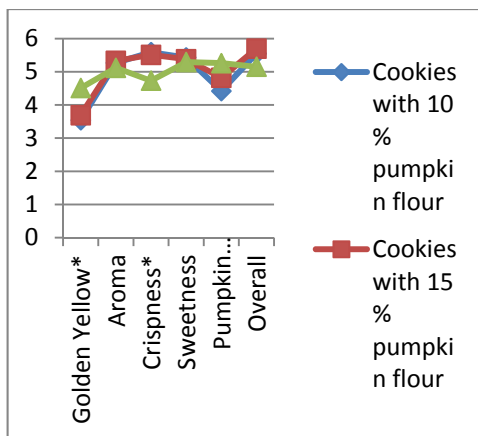


Figure 2: Sensory Quality of Cookies with Pumpkin Flour.

Based on Figure 2, the sensory quality of the golden yellow attribute has the lowest value. The highest sensory quality is in crisp texture except in cookies with 20% pumpkin flour. The most significant difference is in the pumpkin flavor, where the more pumpkin flour, the higher the taste.

The results of the received power test (Table 3) on pumpkin cookies showed that the substitution of 10% pumpkin flour was most preferred in 4 aspects, namely the aroma, crispness, sweetness and taste of pumpkin, with a score 4.5 - 5.2. Only one aspect, the most preferred color in yellow pumpkin cookies is 15% substitution, with a mean score of 4.9. Statistical test shows different attributes in the acceptability of color ( $p = 0.002$ ), crispness ( $p = 0.004$ ) and overall ( $p = 0.010$ ). The difference in color acceptability and overall is shown in cookies with 20% pumpkin flour, while the texture of crispness is shown in cookies with 10% pumpkin flour. Looking at the score, there is not much difference between cookies with 10% and 15% pumpkin flour and statistical tests are also not different, except for crispness.

Similar results occur when assessing acceptability with sensory quality. The highest overall acceptability rating is shown in cookies with 10% pumpkin flour. When arranged in graphical form (Figure 3), cookies with 10% pumpkin are on the outermost line of acceptability attributes. The highest acceptability value is found in the crispness attribute which is the most essential attribute of cookies.

Table 2: Potential megathrust seismic zone.

No	Fondness Level	10 % Pumpkin Flour	15 % Pumpkin Flour	20 % Pumpkin Flour
1	Color*	4.7 <sup>a</sup>	4.9 <sup>a</sup>	4.1 <sup>b</sup>
2	Aroma	4.8 <sup>a</sup>	4.8 <sup>a</sup>	4.4 <sup>a</sup>
3	Crispness*	5.2 <sup>a</sup>	4.8 <sup>b</sup>	4.5 <sup>b</sup>
4	Sweetness	4.9 <sup>a</sup>	4.8 <sup>a</sup>	4.3 <sup>a</sup>
5	Pumpkin Flavor	4.5 <sup>a</sup>	4.5 <sup>a</sup>	4.3 <sup>a</sup>
6	Overall*	5.1 <sup>a</sup>	4.9 <sup>a</sup>	4.5 <sup>b</sup>

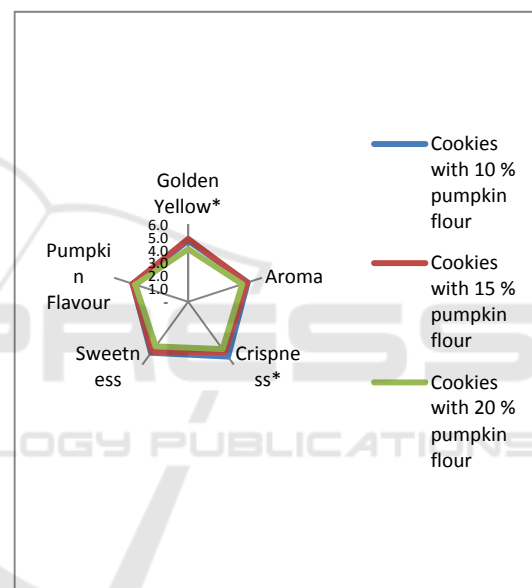


Figure 3: Chart of Acceptability of Pumpkin flour Cookies.

If the sensory quality and acceptability of cookies for pumpkin are correlated, it is found that only the pumpkin flavor attribute is significantly correlated, with the value of  $p = 0.039$ . In other attributes, sensory quality is not correlated with acceptability, with  $p > 0.05$  (Table 4).

Table 4: Significance Value of Correlation between Sensory Quality and Acceptability.

No	Attribute Comparison*	Correlation Significance
1.	SQ and AC of Yellow color	0,816
2.	SQ and AC of smell	0,646
3.	SQ and AC of crispness	0,37
4.	SQ and AC of sweetness	0,529
5.	SQ and AC of Pumpkin flavor	<b>0,039</b>
6.	SQ and AC of overall attributes	0,62

\*SQ= Sensory Quality, AC: Acceptability

The orange-yellow color of pumpkin indicates the beta-carotene. The beta-carotene analysis shows that the more pumpkin flour, the higher the beta-carotene. Cookies made of wheat flour do not contain beta-carotene. The highest beta-carotene content in cookies with 20% pumpkin flour is 12,712 µg. However, the highest sensory quality and acceptability of cookies with 15% pumpkin flour is 9,796 µg.

Table 5: Beta-carotene content of Pumpkin Cookies

Cookies	Betakaroten (mcg)
Cookies with 10 % pumpkin flour	8.457
Cookies with 15 % pumpkin flour	9.796
Cookies with 20 % pumpkin flour	12.712

Different sensory qualities are found in the attributes of golden yellow and pumpkin flavor, and highest is found in cookies with 20% pumpkin flour. Similar studies on muffin with pumpkin flour gave a significant effect on the organoleptic attribute of taste, color and tenderness (Budoyo et al, 2014). This shows that the dominant pumpkin flour that is yellow and has sharp taste gives a real impact on cookies. According to Ware (2018), the pumpkin contains very high beta-carotene. The beta-carotene in fresh yellow pumpkin is 1,569 mcg (Makananku.org, 2018) and the beta-carotene in the pumpkin flour used in this study is 87,317 mcg. This is supported by the results of the study (Table 5), that cookies with 20% pumpkin flour contains 12,712 mcg of beta-carotene. Consuming foods rich

in beta-carotene, including pumpkin biscuits, can reduce the risk of developing certain types of cancer, offering protection against asthma and heart disease, delaying aging and degeneration of the body. (Ware, 2018). Pumpkin is highly medicinal due to the presence of consumable natural substances. Some phyto constituents are included in the category of alkaloids, flavonoids, and palmitic, oleic and linoleic acids. It also has various critical medicinal functions including anti-diabetic, antioxidant, anti-carcinogenic, anti-inflammatory (Yadav, et al, 2010). The results showed that a body that has very low level of  $\alpha$ -carotene and  $\beta$ -carotene plasma has a higher risk of developing gastric cancer (Persson et.al., 2008). Romadhoni and Saragih (2014) show that pumpkin cookies with choco chips have IG = 63, and without choco chips is IG = 64, while IG = 73 is for commercial cookies. Difference in blood glucose level in volunteers who consume reference foods (pure glucose) (74.9 mg / dL) is higher than those who consume commercial cookies, pumpkin cookies with choco chips and pumpkin cookies without choco chips which consecutively the level is 31.9 mg/dL, 22.1 mg/dL, and 24.7 mg/dL.

Although the sensory quality and pumpkin flavor were highest found in cookies with 20% pumpkin flour, the overall quality was highest found in cookies with 15% pumpkin flour. This result is consistent with studies on muffins, the optimal substitution rate is at the level of 15% (Budoyo et al, 2014), in wet noodles with 10% pumpkin flour (Rahmi, et.al., 2011). This shows that the standing out color and pumpkin flavor is not the highest criteria, since the pumpkin flavor gives a bitter aftertaste. This bitter taste affects the acceptability of cookies. In all acceptability attributes (color, aroma, crispness, sweetness, pumpkin flavor and overall) cookies with 20% pumpkin flour gets the lowest value, and cookies with 10% pumpkin flour has the highest value.

Different test results show that the attributes of color, crispness and overall is significantly different in the acceptability of pumpkin flour cookies. The same result of research occurs in wet noodles which shows that the pumpkin flour has a genuine effect on the average score of fondness. Cookies with 0%, 5%, 15% pumpkin flour are not significantly different, while substitution of 10 and 20% are significantly different (Rahmi, et.al., 2011), and the addition of 5% and 7.5% pumpkin flour in noodles are the most preferred (Lestario, et.al. 2012), and the addition of pumpkin puree into *semprong* cake has a genuine effect on fondness level (Damayanti, 2016). The use of more than 15% pumpkin flour gives

acceptable result. The use of 20% pumpkin flour with goat milk is the most preferred by consumers (Sari, 2017), 30% in donuts (Tamba, 2014), and 50% in Eggroll (Cahyaningtyas, et.al, 2014).

The correlation between sensory quality and acceptability of cookies only occurs in the pumpkin flavor attribute. This shows that pumpkin flour gives a genuine impact on the taste of cookies. The more pumpkin, the pumpkin flavor is more distinctive and bitter, which is not preferred. According to Hernani (2006), the pumpkin contains curcubitasm which tastes bitter. This is supported by the fact that states it has a darker yellow color and the highest beta-carotene content.

Cookies with 10-20% pumpkin flour contain high beta-carotene which is between 8,457 - 12,712 mcg/100 g, and the most preferred is 9,796 mcg beta carotene. The content is categorized as high. According to Drummond and Brefere (2004), food products are said as a high source if they contain 20% or more from Daily Value (DV). Daily value of vitamin A is 5,000 IU (9,009 mcg beta carotene). Consumption of 25 grams of cookies with 15% pumpkin flour can meet the needs of vitamin A as much as 2445 mcg beta-carotene (27.1% DV), which can be considered feasible as a functional snack. The research result related to beta-carotene shows that wet noodles with the addition of 5% pumpkin flour contains 7.77, mg / 100 g beta-carotene (Lestario, et. Al. 2012), semprong cake with pure pumpkin puree contains 93.70 mg beta-carotene (Damayanti, 2016).

## 4 CONCLUSION

Pumpkin flour cookies which has the highest overall sensory quality intensity are cookies with 15% pumpkin flour. There are different sensory qualities in the attribute of golden yellow color ( $p = 0.001$ ), crispness ( $p = 0.006$ ), and pumpkin flavor ( $p = 0.037$ ). There is no difference of golden yellow attribute and crispness in cookies with 10% and 15% pumpkin flour, but the two cookies are different from cookies with 20% pumpkin flour. The acceptability between cookies with 10% and 15% pumpkin flour does not have much different, and the statistical tests differ only in the crispness attribute, but the overall acceptability is 10% higher with a score of 5.1. The correlation of sensory quality and acceptability is found in the pumpkin flavor attribute. Cookies with 10-20% pumpkin flour contain beta-carotene between 8,457 - 12,712 mcg / 100 g. Cookies with 20% pumpkin flour has a bitter aftertaste, which means that there is a need examine

how to remove the bitter taste in the flour making process, such as increasing steaming time.

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