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The Effect Of Wheat Flour Substitution With Pumpkin Pure (Cucurbita moschata) On Betacarotein And Fiber Content Steamed Balloon (Bolu Kukus)

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ABSTRACT

Steamed sponge is a type of market snack, steamed sponge is substituted with pumpkin puree to increase the content of vitamins and minerals. This study aims to determine the effect of substitution of wheat flour with pumpkin puree on the characteristics of steamed sponge organoleptic and to increase beta-carotene and crude fiber levels. Type of Experimental research with Group Randomized Design (RAK), 5 treatments and 3 repeats. The treatment of P1, P2, P3, P4, and P5 given pumpkin puree substitution was 10%, 20%, 30%, 40%, and 50%. The results of organoleptic testing showed that the substitution of different pumpkin puree had a real effect. The higher the substitution of pumpkin puree, the increase in beta-carotene levels and fiber levels. The substitution of pumpkin puree in P4 (40%) and P5 (50%) treatments is the best treatment seen from the organoleptic average values, namely color 4.40 (like) and 4.43 (very like), aroma 4.96 (like) and 4.93 (like), taste 4.24 (like) and 4.24 (very like), texture 4.23 (like) and 4.24 (very like), overall reception 4.22 (very like) and 4.38 (very like), Color quality 2.97 (yellow) and 2.98 (yellow), texture quality with an average value of 2.72 (soft) and 2.80 (soft), with beta-carotene levels of 51.24 mg / 100g and 57.78 mg / 100g, crude fiber content of 4.46%bb and 4.67%bb.

Keywords: Steamed sponge cake, pumpkin puree, beta-carotene content, crude fiber content.

Introduction

Steamed cake is a traditional snack made from wheat flour and is usually made using synthetic coloring (Susanto, 2013). To reduce the use of synthetic coloring and wheat flour, the making of steamed cake is replaced by adding pumpkin as a color substitute and wheat flour is substituted with pumpkin puree[(1)] .

To minimize the use of wheat flour, one of the efforts that can be done in making steamed cake is to substitute wheat flour using pumpkin puree. Pumpkin is one of the yellow vegetables and has a nutritional content in 100 grams of pumpkin, namely containing Beta carotene (Pro-Vitamin A) as much as 1569 mg and Fiber 2.9 grams.[(2)]

Stefania's research shows that steamed sponge cake with the addition of 20%, 40%, 60%, 80% pumpkin porridge and the results of the treatment are 20% and 40% with good texture.[(3)] Thenir & Wahab's research shows that steamed sponge cake with pumpkin flour substitution of 0%, 10%, 15%, 20%, 25% and the results of the treatment are 15% with good texture and 25% with very poor texture.[(4)]

Based on the preliminary study, the researcher tried to make pumpkin steamed cake with pumpkin puree substitution of 10%, 20%, 30%, 40%, 50%, 60%. The results obtained in the 60% treatment produced less steamed cake, so this study used the 10%, 20%, 30%, 40%, 50% treatments.[(5)]

The general objective of the study was to analyze the effect of substituting wheat flour with pumpkin puree (Curcubita Moschata) on the beta-carotene and fiber content of Steamed Cake. Specific objectives determine organoleptic quality including texture; taste; color; aroma and overall acceptability of steamed sponge cake results, hedonic quality tests including texture and color of steamed sponge cake, analyzing beta-carotene and fiber content.

Research Method

Organoleptic tests were conducted at the Food Processing Laboratory of the Nutrition Department of the Ministry of Health Polytechnic of Denpasar. Beta carotene and crude fiber analysis were conducted at the Food Analysis Laboratory of the Faculty of Agriculture, Udayana University. The research was conducted from December 2021 to January 2022.

Results and Discussions

Subjective Analysis

Subjective analysis includes hedonic tests of preference for color, aroma, taste, texture and overall acceptance. Hedonic quality tests include color quality and texture quality tests on bread pudding. The average value of the hedonic test on steamed sponge cake can be seen in Tables 1 and 2.

Table 1
Average Hedonic Test for Steamed Cake

Treatment	Average Value of Hedonic Test				
	Color	Aroma	Taste	Texture	Overall Acceptance
P1	2.87^{b}	3.03^{bc}	2.96^{c}	2.59^{c}	2.79^{b}
P2	3.09^{b}	3.29^{bb}	3.58^{b}	2.73^{b}	3.10^{b}
P3	3.92^{a}	3.84^{ab}	3.89^{ab}	3.70^{a}	3.81^{a}

P4	4.40[a]	3.96[a]	4.24[a]	4.23[a]	4.22[a]
P5	4.43[a]	3.93[a]	4.23[a]	4.24[a]	4.38[a]

Note: Different letters behind the mean in the same column indicate significant differences based onthe BNT test at the 5% level (p<0.05).

Table 2
Average Hedonic Quality Test for Steamed Cake

Treatment	Average Value of Hedonic Quality Test	
	Color Quality	Texture Quality
P1	1.21[b]	2.32[b]
P2	1.52[b]	2.36[b]
P3	2.42[bc]	2.48[ab]
P4	2.97[a]	2.72[ab]
P5	2.98[a]	2.80[a]

Note: Different letters behind the mean in the same column indicate significant differences based on the BNT test at the 5% level (p<0.05)

Objective Analysis

Objective analysis of pumpkin steamed cake was conducted to determine the content of betacoten and crude fiber. (see table 3)

Table 3
Average Objective Analysis of Steamed Cake

Treatment	Average Value	
	Betacarotene (mg/100g)	Crude Fiber (%bb)
P1	12.27[c]	3.73[c]
P2	22.63[bc]	3.94[bc]
P3	43.00[bc]	4.21[bc]
P4	51.24[bc]	4.46[bc]
P5	57.78[a]	4.67[bc]

Note: Different letters behind the mean in the same column indicate significant differences based onthe BNT test at the 5% level (p<0.05)

Color

Color is the first thing perceived by the sense of sight, and because color is a pattern that is difficult to measure, there are different views on how to assess its quality. Although everyone can distinguish colors, everyone's vision is different, which results in differences in color perception (Dian Nila Sari, 2019).

Steamed cake in the fifth treatment (P5) with a 50% pumpkin puree substitution obtained the highest score of 4.43 (very much liked). The greater the replacement of wheat flour with pumpkin puree, the higher the yellow color produced. Pumpkin has a yellow color because it has a compound called carotenoid, which functions as a precursor to vitamin A and antioxidants (Radiani, 2020).

This is also in accordance with research by Mita & Rochmah, (2023) which states that "the factors that influence the color of sweet potato flour cake with the addition of dragon

fruit puree are that the more dragon fruit puree is added, the better the color produced."

The bright yellow color of pumpkin contains one of the carotenoid pigments, including β carotene. Pumpkin contains high carotenoids reaching 160 mg/100 gr. Yellow, red and orange pigments function as precursors of vitamin A and antioxidants that can be removed through extraction. The resulting dye extract can be applied to several types of food and drinks, where in making pumpkin steamed cake, the more pumpkin puree is added, the more concentrated the color, the higher the carotenoid pigment contained (Amanati, 2019)

Aroma

Aroma is a distinctive odor produced by a food and is subjectively assessed by the sense of smell. Food ingredients can generally be recognized by smelling their aroma. Aroma plays a very important role in determining the degree of assessment and quality of a food ingredient, someone who is faced with new food (Dian Nila Sari, 2019)

Based on the average hedonic test on the level of panelist acceptance of the aroma of steamed cake with pumpkin puree substitution, the one that obtained the highest value or score by the panelists was the fourth steamed cake treatment with 40% pumpkin puree substitution with a score of 3.96 (like). The higher the pumpkin puree substitution, the higher the panelists' preference value (Pitaloka, 2023).

In making pumpkin steamed cake, it shows that the greater the substitution of pumpkin puree, the higher the sweet aroma of pumpkin. Pumpkin has a sweet aroma because it contains high beta carotene pigment, the higher the beta carotene pigment, the sweeter the aroma of pumpkin (Bendri, 2019). This is also in accordance with the research of Mita & Rochmah, (2023) which states that the more dragon fruit puree is added to making sweet potato flour cake with the addition of dragon fruit puree, the sweet aroma of dragon fruit puree will be more aromatic.

Taste

When determining the consumer's final choice to accept or reject a dish, taste is the most important consideration. Taste is considered the main determining element; even though the color, texture, and aroma of the product are considered good, customers can still reject the product if it tastes bad (Rizki Padya & Rahmayati, 2023)

In the fourth treatment, namely 40% substitution of pumpkin puree, the steamed sponge cake had the most preferred taste, with an average hedonic value of 4.24 (like). This is because the panelists considered the steamed sponge cake to have a distinctive pumpkin taste that is not too sweet and the proportion of sugar and pumpkin puree is just right. The more wheat flour substitutes with pumpkin puree used, the sweeter the overall taste will be.

Texture

Texture is an assessment based on the sense of touch. Texture is related to the sensation of touch, looking at a product can give an idea of whether a product is rough, smooth, hard, or soft. The average test of the panelists' acceptance of the texture of steamed sponge cake with pumpkin puree substitution, the highest score was obtained by steamed sponge cake with 50% pumpkin puree substitution (P5). (Dian Nila Sari, 2019) Steamed sponge cake with wheat flour substitution with 50% pumpkin puree (P5) received the highest score from the panelists based on the average hedonic test that measures the panelists' acceptance of the texture. This is measured in terms of similarity, which is 4.24. This is proven by the texture quality test, where in the fifth treatment the highest average was obtained at 2.80 which showed a softer texture in the fifth

treatment which replaced wheat flour with 50% pumpkin puree compared to other treatments.

The soft texture produced by this pumpkin steamed cake is due to a chemical reaction in the manufacturing process, the addition of ingredients used in making this pumpkin steamed cake such as wheat flour, where wheat flour mostly consists of starch and protein with a high content called gluten which when mixed with water, this gluten will match and have a flexible texture. Yeast is another complementary ingredient that has the function of creating carbon dioxide bubbles that make the texture of the steamed cake soft. Sugar here functions as the main food source for yeast, because the addition of sugar to yeast containing water will maximize the performance of the yeast to expand. Eggs are another complementary ingredient that can expand the dough because egg whites contain lecithin which is a protein that coats air bubbles, where this reaction can soften pumpkin steamed cake. This is also in accordance with the research of Mita & Rochmah, (2023) factors that can affect the texture of sweet potato flour cake are the ingredients used in the manufacturing process. Texture can be seen from the moisture, hardness, elasticity and fragility of a food.

Overall Acceptance

In the hedonic test that measures the general acceptance of the panelists towards steamed sponge cake with wheat flour substitution with pumpkin puree, the sample with wheat flour substitution with 50% pumpkin puree (P5) obtained the highest score, while the sample with wheat flour substitution with 10% pumpkin puree obtained the lowest score. This is because organoleptic testing, which measures texture, aroma, taste, and color, has an impact on overall acceptance. The replacement of wheat flour with 50% pumpkin puree feels soft and yellow in color.

Objective analysis

Beta-carotene content

Beta-carotene is a substance or pigment that gives color to vegetables or fruits. Beta-carotene is a provitamin A that plays an important role in the formation of vitamin A and functions as an antioxidant. This substance can dissolve in fat, is not soluble in water, and is easily damaged due to oxidation at high temperatures. Consuming 50 mg of beta-carotene per day in the diet can reduce the risk of heart disease (Elfariyanti et al., 2022)

The fifth treatment (P5) substitution of wheat flour with 50% pumpkin puree (57.78 mg/100 grams) had the highest average beta-carotene content, while the lowest average value was found in the first treatment (P1) with substitution of wheat flour with 10% pumpkin puree (12.27 mg/100 grams).

Crude Fiber Content

Crude fiber is a part of food that cannot be hydrolyzed by chemicals or strong acids and strong bases used to determine fiber content, namely sulfuric acid and sodium hydroxide. Crude fiber is very important in assessing the quality of food ingredients because this number is an index and determines the nutritional value of the food. Dietary fiber is only found in plant-based foods and its levels vary according to the type of ingredient (Hardiyanti & Nisah, 2021)

The first treatment (P1) had the lowest average crude fiber content, replacing wheat flour with 10% (3.73%) pumpkin puree; The fifth treatment (P5) had the highest average crude fiber content, replacing wheat flour with 50% (4.67%) pumpkin puree. The BNT test results showed a significant difference in fiber content. The amount of fiber produced increased with the amount of pumpkin puree used.

Conclusion

The conclusions that can be drawn up are as follows:

(1) Color, texture, taste, aroma, overall acceptance, color quality, texture quality, beta-carotene content, and crude fiber content of steamed sponge cake are all significantly affected when wheat flour is replaced with pumpkin puree.
(2) The results of subjective analysis of steamed sponge cake produced the level of preference for color 2.87 - 4.43 (neutral - very like), aroma 3.03 - 3.96 (neutral - like), taste 2.96 - 4.24 (neutral - like), texture 2.59 - 4.24 (neutral - very like), overall acceptance 2.79 - 4.38 (neutral - very like), color quality 1.21 - 2.98 (yellowish white - yellow) and texture quality 2.32 - 2.80 (rather soft - soft).
(3) The results of objective analysis of steamed sponge cake produced beta-carotene content ranging from 12.27 mg/100 gram – 57.78 mg/100 grams and crude fiber content ranging from 3.73% bb – 4.67% bb.
(4) Steamed pumpkin sponge cake with 40% and 50% puree substitution produced steamed sponge cake that was liked by the panelists in terms of texture, aroma, taste, color, overall acceptance, texture quality, aroma quality with beta-carotene content of 51.24 mg/100 grams and 57.78 mg/100 gram at fiber content of 4.46% bb and 4.67% bb.

Suggestions

Some suggestions that can be conveyed in this case are Based on the results of the research conducted, it is suggested to modify the pumpkin pure steamed cake in the fourth treatment (P4) by adding other food ingredients containing vitamins and minerals that can increase the panelists' preference in terms of color, aroma, taste and texture. It is hoped that with this steamed cake product, it can be used as a reference for the community to be able to process and utilize pumpkin into steamed cake as a snack that can meet nutritional needs, especially beta-carotene and fiber.

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