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YELLOW PUMPKIN BREAD: PRODUCT ACCEPTANCE ANALYSIS BASED ON SENSORY TESTS AND PHYSICAL CHARACTERIZATION

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ABSTRACT

This research seeks to determine the formulation of yellow pumpkin bread. This research used a Completely Randomized Design (CRD) with six different compositions of yellow pumpkin flour, which were 0% (P0), 5% (P1), 10% (P2), 15% (P3), 20% (P4), and 25% (P5). The data obtained was then analyzed using One-way ANOVA and continued with the Duncan Multiple Range Test (DMRT). The research shows that yellow pumpkin flour affects physical properties (specific volume, texture, bread expansion, and bread color intensity) and sensory properties (hedonics and hedonic quality). The chosen formulation of yellow pumpkin bread was P1 (95% wheat flour: 5% pumpkin flour). It has bread expansion at 73.15%, specific volume at 3.46%, texture at 87.44%, Color (L) at 67.4%, (a) 2.10%, (b) 40.36%, with hedonic quality had a yellowish-white color, tastes somewhat typical of pumpkin, smells somewhat typical of pumpkin, has a soft texture, and the uniform pores.

***Keywords**: Antioxidant Activity, Prebiotic, Functional Food, Healthy Bread*

1. INTRODUCTION

Food is one of the basic needs for human life as the population increases. Therefore, various types of food are needed to ensure its nutritional needs and maintain health. Food is one of the efforts to sustain human survival. With technological developments, food has experienced very significant changes. One food that has changed and is often consumed by people is bread (Wahyono et al., 2020).

Bread is a food product that is quite popular in Indonesia. The nutritional content in bread is a source of energy beneficial for the body when consumed. Bread is widely liked because it comes in various flavors and can be consumed directly, so it is more practical and can be consumed anywhere and anytime (Brouns et al., 2022).

Wheat flour has different properties from other flour because it contains protein in the form of gluten (Jasthi et al., 2020). The gluten content will increase when wheat flour is mixed with yeast and water. It will increase its elasticity, holding gas produced from yeast activity. However, wheat seeds are difficult to cultivate in Indonesia, so they must be imported from other countries. The demand for wheat flour has continued to increase. Therefore, efforts are needed to reduce dependence on the use of wheat. There are efforts to diversify ingredients by utilizing local ingredients, such as pumpkin (Dar et al., 2017; Mishra & Sharma, 2019; Subaktilah et al., 2021).

Based on data from the Indonesian Central Statistics Agency (BPS) in 2018, the average yield of pumpkin production throughout Indonesia from 2018 was around 55.74 tons per hectare (Hosen et al., 2021). However, the consumption of pumpkin in Indonesia is still deficient. People in Indonesia are still unable to optimize the processing of pumpkin products. Yellow pumpkin has many benefits but is still less popular with Indonesians. This can be seen from the annual consumption level of pumpkin, which is still below five kg per capita per year. This is due to a lack of innovation in pumpkin processing, both primary and secondary.

Pumpkin flour has a long shelf life and contains beta-carotene, which can be a yellow pigment (Adelerin et al., 2024). This can improve the sensory properties; the appearance of yellow becomes more attractive without adding food coloring. Apart from that, the price is relatively cheap, so it has excellent potential to be used in food processing in the community. One can be processed into flour as an ingredient in food mixtures such as bread (Davoudi et al., 2020). It should be noted that the potential for using yellow pumpkin is quite significant because its production value is high, and it has good nutritional content (Aljahani, 2022).

2. FOCUS & COPE

In this research, the problems include:

1. The chosen formulation of pumpkin flour for yellow pumpkin bread
2. The physical and sensory characteristics of yellow pumpkin bread.

3. MATERIALS AND METHODS

The ingredients used in making yellow pumpkin bread consist of wheat flour, pumpkin flour, eggs, sugar, powdered milk, yeast, tenderizer, salt, ice cubes, water, and margarine (Table 1).

Table 1. The composition of Yellow Pumpkin Bread

Materials	Composition (g)	%
Flour	51.67	51.67
Crystal Sugar	12.91	12.91
Milk powder	2.58	2.58
Whole Egg	5.16	5.16
Ice	7.75	7.75
Mineral Water	12.91	12.91
Yeast	0.77	0.77
Crumb softener	0.41	0.41
Salt	0.62	0.62
Margarine	5.16	5.16
Total	100	100

The process of making yellow pumpkin bread has several stages: weighing the ingredients, kneading the dough, weighing the dough, molding, developing, and baking. The first stage begins by weighing all the ingredients according to the formulation in Table 1 using a digital scale. Next, wheat flour, pumpkin flour, sugar, powdered milk, eggs, ice cubes, water, yeast, and tenderizer are put into the mixing machine and mixed slowly for 2 minutes, then accelerated mixing for 5 minutes. After that, salt and margarine are added to the dough, and the mixture is mixed slowly for 2 minutes, then accelerated for 7 minutes or until the dough is smooth. If you feel the dough is soft, weigh the dough at 55 grams per unit and mold it into a round shape with a diameter of 8 cm. Then the dough is developed (fermented) for 2 hours, then the dough is baked at a temperature of 190-200ºC for 15 minutes.

3.1 Research Design

The research method used was experimental, carried out using a one-factor Completely Randomized Design (CRD) consisting of six formulation treatments with four repetitions: formulations of wheat flour and pumpkin flour with a ratio of P0 (100:0), P1 (95:5), P2 (90: 10), P3 (85:15), P4 (80:20), and P5 (75:25). The yellow pumpkin bread will be tested for its sensory evaluation, specific volume, texture, and color using ImageJ software. Then, statistical analysis was carried out using the ANOVA (Analysis of Variance) method and continued with Duncan's Multiple Range Test (DMRT) if differences were found with results at the 5% level. The chosen formula will be further analyzed on its water content, ash content, crude fiber, and β-carotene contents.

3.3 Sensory Evaluation

Sensory testing based on the Indonesia National Standardization Agency (SNI 01-2346-2006) uses hedonic test methods and hedonic quality tests. The hedonic test is a sensory test using scoring for each that uses but which is based on the preference. Meanwhile, the hedonic quality test is a sensory test using a ratio scale that describes the intensity of each sensory attribute. Politeknik Negeri Jember students carried out testing as the panelist. (Visalli & Galmarini, 2024; Yulianti et al., 2024)

3.4 Physical Characteristic

Physical properties can greatly influence consumer acceptance of a product. The physical properties of yellow pumpkin bread analyzed in this research are the bread's rising power, bread crumb color, specific volume, and hardness.

3.4.1 Bread Expansion

The test was carried out to determine the rising power of yellow pumpkin bread. The testing procedure was done by measuring the dough center using a stick inserted into the dough before and after baking. The calculation of bread expansion can be seen in the following formula (1) (Coţovanu & Mironeasa, 2022):

$$\%\, Expand = \frac{B-A}{A}\, x\, 100\% \quad (1)$$

A = dough height before baking; B = dough height after baking

3.4.2 Crumbs Color

Color testing must be done because the human visual system differs from digital systems. Color testing is carried out using the image processing method, which is a testing method to equalize the perception of the working system between human visuals and digital imaging devices using the help of ImageJ software. (Yudiastuti et al., 2021)

3.4.3 Specific Volume

The test was carried out by weighing the sample, then placing the millet seeds into the measuring container until it was complete and leveling it right on the surface of the container. After that, transfer the millet seeds into a measuring cup to determine the volume of the measuring container. Put the weighed sample into the measuring container, then fill it with millet seeds until it is complete and even. Then, the remaining millet seeds are measured using a measuring cup, which will be used to measure the sample volume. Specific volume can be calculated using the following formula:

$$Specific\ volume\ \left(cm^3/g\right) = \frac{sample\ volume\ (cm^3)}{sample\ weight\ (g)} \quad (2)$$

3.4.4 Hardness

Hardness texture testing is carried out using a texture analyzer. Hardness is one of the essential physical characteristics to determine the quality of bread. The test was carried out by cutting a sample measuring 3cmx3cmx3cm, placing it on the texture analyzer machine table, and then applying pressure using a flat probe that had a thickness of 3.2 mm. The analysis results will appear

in the program on the texture analyzer computer screen in graphic form in Newtons (N) (Shikama et al., 2024)

3.5 Proximate Analysis

Analysis is carried out to determine the chemical components of the product that affect the physical, sensory and microbiological properties of the product. In this research, chemical property analysis was carried out on water, ash, crude fiber and β-carotene content analysis. These four ingredients will tend to be influenced by the substitution of pumpkin in the product.

3.5.1 Water content

Water content analysis was carried out using the gravimetric method by drying the empty cup in an oven at 105ºC for 1 hour, which was cooled for 15 minutes in a desiccator and then weighed (A). Weigh the sample as much as 2 grams and put it in a dry cup (B). Next, it was dried in the oven at 105ºC for 5 hours. Then cooled in a desiccator for 15 minutes and weighed (C). The formula for determining the amount of water content is as follows (Bell, 2020):

$$water\ content\ (\%) = \frac{(B-C)}{(B-A)}\ x\ 100 \quad (3)$$

A = empty cup weight (g); B = weight of cup and sample before drying (g); C = weight of cup and sample after drying (g)

3.5.2 Ash Content

The ash content test begins by preparing the ashing cup to be burned in a furnace at 550ºC for 15 minutes, then cooling it in a desiccator and weighing the empty cup (A). After that, weigh the sample as much as 2 grams (W). Burn in an electric furnace at 550ºC for 6 hours or until complete ashes (occasionally open the furnace door to allow oxygen to enter). Next, cool in a desiccator and weigh (X). The formula for determining the amount of ash content is as follows (4) (Ismail, 2024)

$$Ash\ content = \frac{(X-A)}{W}\ x\ 100\% \quad (4)$$

3.5.3 Crude Fiber

Crude fiber analysis was started by weighing 2 grams of the sample and removing the fat using the Soxhlet extraction method for 4 hours. Then oven for 1 hour and put in a 250 ml Erlenmeyer flask. After that, add 50 ml of H_2SO_4 solution and heat to 200ºC for 30 minutes. Next, add 50 ml 3.25% NaOH and reheat at 200ºC for 30 minutes. Filter with filter paper whose weight has been constant. Next, put it in the oven at 105ºC for 4 hours. After that, take it out and cool it in a desiccator for 15 minutes. Crude fiber can be calculated using the following formula (5): (Vitanti et al., 2021)

$$crude\ fiber\ (\%) = \frac{B-A}{A}\ x\ 100\% \quad (5)$$

B = final sample weight; A = initial sample weight

3.5.4 β-carotene

the β-carotene analysis begins by weighing 5 grams of the sample, refluxing it in an Erlenmeyer flask, adding KOH in a 10% C_2H_5OH solution made from 10 grams of crystalline KOH, and adding absolute alcohol (Hagos et al., 2022). The Erlenmeyer flask was wrapped in carbon paper and heated over a water bath for 30 minutes with the help of a cooler to prevent oxidation. Next, it was filtered using a Buchner funnel with the help of a suction pump while washing with 20 ml of heated absolute C_2H_5OH; then, the residue was washed with 25 ml of ether three times. Next, the filtered product is put into a separating funnel and added with 200 ml of distilled water. The funnel is turned slowly to help with the mixing process. The ether layer is then put into another separating funnel. The C_2H_5OH layer (top layer) is extracted again by adding 25 ml of benzene petroleum, and then the ether layer (top) is mixed with the original ether layer. After that, the ether solution mixture was washed using 50 ml of distilled water ± 5 times until the distilled water layer was free from carotene. Then, the ether solution that binds the carotene is evaporated over a water bath at 40-50ºC until the residue becomes ±5 ml. Then, the residue is added to 25 ml of petroleum benzene and transferred to a separating funnel. Then 25 ml of 92% CH_3OH was added, shaken, and left for 2 minutes until there were two layers. The two layers are separated. The bottom layer is methanol containing xanthophyll, which is discarded. In contrast, the top layer consists of petroleum ether containing carotene, extracted again with 25 ml of 92% CH_3OH until the bottom layer is colorless. Next, the petroleum ether layer (top) was washed with distilled water three times. The obtained carotene extract was then transferred to a 50 ml measuring flask through a filter filled with Na_2SO_4 anhydride powder and diluted with petroleum benzene to the limit mark. Pipette 20 ml of the solution and then put it in a cuvette (Coleman tube). The blank solution, namely 10 ml petroleum benzene solution, was put into another cuvette. Both solutions were examined in a Coleman spectrophotometer at 436-456 MU. The sample material was compared with a blank.

4 DISCUSSION

The pumpkin bread products produced in this research are presented in Figure 1.

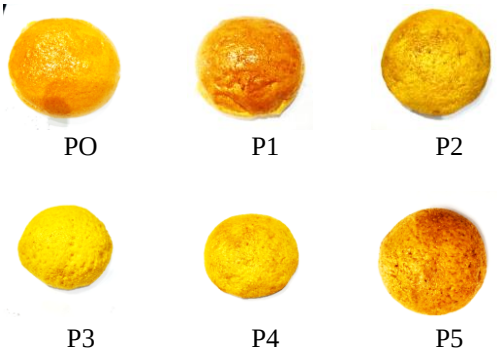

Figure 1. Yellow Pumpkin Bread

P0 = 100% wheat flour: 0% pumpkin flour, P1 = 95% wheat flour: 5% pumpkin flour, P2 = 90% wheat flour: 10% pumpkin flour, P3 = 85% wheat flour: 15% pumpkin flour %, P4 = 80% wheat flour: 20% pumpkin flour, P5 = 75% wheat flour: 25% pumpkin flour.

Based on the results presented in Figure 1, the resulting pumpkin bread products have almost the same appearance. Product analysis is carried out based on product characterization based on the results of sensory and physical analysis of the product.

4.1 Sensory Evaluation

The sensory evaluation consisted of a hedonic and a hedonic quality test. Hedonic testing focuses more on how much consumers like a specific product. In contrast, hedonic quality is more oriented on how the overall quality of the product affects consumer experience and satisfaction. Both are important in product development to ensure that the product is liked and meets consumers' expected quality standards. The results of the hedonic and hedonic quality test for yellow pumpkin bread can be seen in Table 2.

The panelists' preference for color was between 2.16% and 4.08%, with statements of immensely dislike and very like. The lowest level of panelists' preference for color was in treatment P5, with a percentage of 2.16%, while the most preferred by panelists was treatment P1, with a rate of 4.08%. The higher the addition of pumpkin flour, the darker and more striking the resulting color is. This is in line with the panelists' level of preference. The higher the percentage of pumpkin flour added, the darker the resulting color, making it less popular with the panelists.

Table 2. Hedonic and hedonic quality test of yellow pumpkin bread

Code	Color	Taste	Hardness	Aroma	Uniformity Pore size
			Hedonic Test		
P0	3.88 ± 0.83^{c}	3.88 ± 0.83^{c}	4.00 ± 0.86^{d}	3.68 ± 0.85^{c}	
P1	4.08 ± 0.86^{c}	4.00 ± 0.76^{c}	3.80 ± 0.76^{d}	3.84 ± 0.85^{c}	
P2	3.24 ± 0.66^{b}	3.00 ± 0.86^{b}	2.96 ± 0.73^{c}	3.12 ± 0.72^{b}	
P3	3.04 ± 0.79^{b}	2.76 ± 0.97^{ab}	2.56 ± 0.96^{bc}	2.84 ± 0.80^{ab}	
P4	2.56 ± 0.96^{a}	2.52 ± 0.77^{ab}	2.28 ± 0.84^{ab}	2.68 ± 0.85^{ab}	
			Hedonic Quality Test		
P0	1.36 ±0.49^{a}	2,88 ± 0.72^{a}	4.00 ± 0.70^{d}	1.96 ± 1.20^{a}	3.20 ± 0.76^{b}
P1	2.12 ±0.66^{b}	3,24 ± 0.83^{ab}	4.36 ± 0.63^{d}	2.28 ± 0.98^{a}	3.28 ± 0.84^{b}
P2	3.36 ± 0.90^{c}	3,36 ± 0.63^{b}	3.08 ± 0.64^{c}	3.20 ± 1.08^{b}	2.92 ± 0.81^{ab}
P3	3.84 ± 0.62^{d}	3,40 ± 0.86^{b}	2.96 ± 0.84^{c}	3.44 ± 1.12^{b}	2.72 ± 0.93^{ab}
P4	4.20 ± 0.57^{e}	3,44 ± 0.76^{b}	2.28 ± 0.61^{b}	4.12 ± 1.01^{c}	2.76 ± 1.05^{ab}
P5	4.68 ± 0.47^{f}	3,64 ± 0.56^{b}	1.80 ± 0.81^{a}	4.48 ± 0.82^{c}	2.40 ± 1.22^{a}

P0 = 100% wheat flour: 0% pumpkin flour, P1 = 95% wheat flour: 5% pumpkin flour, P2 = 90% wheat flour: 10% pumpkin flour, P3 = 85% wheat flour: 15% pumpkin flour %, P4 = 80% wheat flour: 20% pumpkin flour, P5 = 75% wheat flour: 25% pumpkin flour. Data is the average result of four repetitions. Different notations indicate significant results according to the DMRT test (<0.05)

The lowest yellow pumpkin bread hedonic test value for taste was in treatment P5 (75% pumpkin flour), namely 2.28% with the criteria of dislike, while the most preferred was in treatment P1 (5% pumpkin flour) with a percentage of 4.00% with the requirements Like. The hedonic quality value of yellow pumpkin bread taste is 2.28% – 3.64%. The lowest hedonic quality test value was found at an average of 2.28% in treatment P0 (without the addition of pumpkin flour), which lacked the typical taste of pumpkin, while the highest average value was in treatment P5 (75% pumpkin flour) with an average of 3.64%. The level of typical pumpkin flavor in yellow pumpkin bread products is related to the composition of the pumpkin flour substitution in yellow pumpkin bread products (Adelerin et al., 2024).

Texture naturally affects the panelists' preference level, indicated by the different letter notations for each treatment. The percentage value of panelists' preferences for texture is 1.96% to 4.00%. The lowest level of texture preference was found in treatment P5, with the highest substitution of pumpkin flour, namely 75%. The average percentage produced was disliked, with a rate of 1.95%, while the most popular texture was in treatment P0 with the addition of 0% pumpkin flour. It has generated an average of 4.00% with likes. The texture in P0 is more popular because it does not use pumpkin flour; this is because the texture of the resulting yellow pumpkin bread is softer compared to P5. Pumpkin flour has the property of quickly absorbing water, which will cause the flour to clump and result in a denser texture (Aljahani, 2022).

The hedonic quality of yellow pumpkin bread texture has significant differences, and the different letter notations for each treatment prove this statement. The hedonic quality value of texture ranges from 1.80% (not soft) to 4.36% (soft). The average value in treatment P0 produces 4.00% according to the criteria (soft), P1 produces 4.36% (soft), P2 3.08% (somewhat soft), P3 2.96% (somewhat not soft), P4 2.28% (somewhat not soft), P5 1.80% (not soft).

The aroma of yellow pumpkin bread has significantly different effects in several treatments; namely, it is marked with varying notations of letters in treatments P0 and P1, P2 and P3, and P4 and P5. The panelists' preference for the aroma of yellow pumpkin bread ranged from 2.48% to 3.84%. Yellow pumpkin bread with a very disliked aroma, namely in the P5 treatment (75% pumpkin flour), produced an average of 2.48% with a dislike statement. In comparison, the most popular yellow pumpkin bread aroma was P1 (substitution of 5% pumpkin flour), with an average percentage of 3.84% in the like category. The hedonic quality of the yellow pumpkin bread aroma has significant differences, as indicated by different letter notations for each treatment. The hedonic quality value of aroma is in the range of 1.96% - 4.48%. The average value in treatment P0 produces 1.96% with aroma criteria (no pumpkin aroma), P1 produces 2.28% (weak pumpkin aroma), P2 produces 3.20% (medium pumpkin aroma), P3 produces 3, 44% (medium pumpkin aroma), P4 produces 4.12% (typical of pumpkin), P5 4.48% (typical of pumpkin).

The resulting average value of pore uniformity is (with the addition of 75% pumpkin flour), and the resulting average is 2.40% with the statement that it is not uniform. Namely, in treatment P1, the addition of 5% pumpkin flour resulted in a mean of 3.28, which is relatively uniform. The average value in treatment P0 produces 3.20% according to the criteria (somewhat uniform), P1 produces 3.28% (somewhat uniform), P3 2.92% (not uniform), P3 2.72% (not uniform), P4 2.76% (not uniform), P5 2.4 % (not uniform). Bread made without wheat flour results in a lack of gluten in the bread dough. This causes the volume of bread produced to be less fluffy and the resulting pores to be denser, non-uniform (large pores), and smaller. This is because the structure created and made is not sturdy, so CO2 gas can leave the initial structure, forming large and non-uniform pores (Madadi et al., 2024).

4.2 Physical Characteristic

The physical properties of pumpkin yellow pumpkin bread include swelling power, specific volume, texture, and crumb color (L, a, b). The results of further tests on the physical properties of yellow pumpkin bread can be seen in Table 3.

Table 3. Physical characteristics of yellow pumpkin bread

Code	Bread expand (%)	SpecifiVolumeme (cm^3/g)	Hardness (N)	*Color*		
				L	*a*	*b*
P0	$97,38 \pm 11,84^{d}$	$5,02 \pm 0,14^{d}$	$82,01 \pm 6,01^{a}$	$75,89 \pm 0,10^{f}$	$-182,73 \pm 362,8^{a}$	$26,02 \pm 0,53^{a}$
P1	$73,15 \pm 11,22^{c}$	$3,46 \pm 0,16^{c}$	$87,44 \pm 0,75^{b}$	$67,49 \pm 0,23^{e}$	$2,10 \pm 0,33^{a}$	$40,36 \pm 0,23^{b}$
P2	$59,37 \pm 8,11b^{c}$	$3,20 \pm 0,20^{c}$	$94,46 \pm 1,13^{c}$	$66,40 \pm 0,08^{d}$	$1,53 \pm 0,35^{a}$	$43,09 \pm 0,38^{d}$
P3	$53,47 \pm 9,87^{b}$	$2,84 \pm 0,22^{b}$	$93,45 \pm 3,15^{c}$	$64,98 \pm 0,14^{c}$	$3,48 \pm 0,25^{a}$	$43,20 \pm 0,39^{d}$
P4	$44,92 \pm 7,45^{ab}$	$2,60 \pm 0,22^{b}$	$94,34 \pm 1,24^{c}$	$61,63 \pm 0,42^{b}$	$3,84 \pm 0,31^{a}$	$41,44 \pm 0,38^{c}$
P5	$38,19 \pm 6,26^{a}$	$1,97 \pm 0,19^{a}$	$93,77 \pm 1,20^{c}$	$56,74 \pm 0,18^{a}$	$6,00 \pm 0,37^{a}$	$40,46 \pm 0,03^{b}$

P0 = 100% wheat flour: 0% pumpkin flour, P1 = 95% wheat flour: 5% pumpkin flour, P2 = 90% wheat flour: 10% pumpkin flour, P3 = 85% wheat flour: 15% pumpkin flour %, P4 = 80% wheat flour: 20% pumpkin flour, P5 = 75% wheat flour: 25% pumpkin flour. Data is the average result of four repetitions. Different notations indicate significant results according to the DMRT test (<0.05)

The average value of rising power for yellow pumpkin bread substituted for pumpkin flour is 38.19 - 97.38%. This shows that the increase in the rising power of yellow pumpkin bread is thought to be caused by pumpkin flour, which has higher carbohydrates and lower gluten content than wheat flour, so the resulting yellow pumpkin bread product does not rise ideally and is less elastic. The average specific volume of yellow pumpkin bread is 1.97% to 5.02%. The highest specific volume value of yellow pumpkin bread with the substitution of pumpkin flour was obtained in treatment P0, namely 100% wheat flour. In comparison, the lowest specific volume value was obtained in treatment P5 with a pumpkin concentration of 25%. The protein in wheat flour has a gluten content that reaches 80% of the total protein in pumpkin flour, which is sustainable with the specific volume and expanding power produced (Galenko et al., 2024). The gluten contained in flour plays a role in forming a solid dough. Apart from that, gluten has the advantage of being able to withstand the CO_2-expanding gas formed during the proofing process to produce bread with a better specific volume. Adding pumpkin flour resulted in a decrease in specific volume due to an increase in the concentration of pumpkin flour. This is related to a reduction of the gluten network formed due to an increase in the dietary fiber content of pumpkin flour in yellow pumpkin bread dough (Aljahani, 2022). The higher the pumpkin flour content, the lower the specific volume produced (Davoudi et al., 2020).

The resulting texture ranges from an average of 82.01-93.73%. From the resulting data, it can be concluded that the higher the pumpkin flour formulation, the harder the yellow pumpkin bread is produced due to the high fiber content in the pumpkin. Fiber source components such as

resistant starch cause the structure of the bread to become more compact and reduce the softness of yellow pumpkin bread (Vitanti et al., 2021).

Color is an essential parameter in determining consumer acceptance of the quality of yellow pumpkin bread products. The color of yellow pumpkin bread can be determined from the light intensity (L), red color intensity (a), and yellow color intensity (b). The color of the yellow pumpkin bread crumb can be seen in Figure 2.

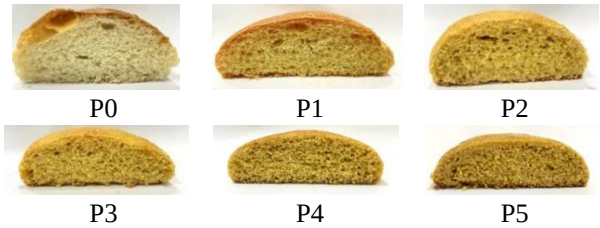

Figure 2. Crumbs of yellow pumpkin bread

P0 = 100% wheat flour: 0% pumpkin flour, P1 = 95% wheat flour: 5% pumpkin flour, P2 = 90% wheat flour: 10% pumpkin flour, P3 = 85% wheat flour: 15% pumpkin flour %, P4 = 80% wheat flour: 20% pumpkin flour, P5 = 75% wheat flour: 25% pumpkin flour.

Based on the Duncan test in Table 3, there is a significant difference in the brightness (L) and yellowness (b) levels. Still, it does not have a real influence on the level of redness (a) on the brightness (L) level, with an average of 75.89% in treatment P0. This is because the resulting color is not yellow without adding pumpkin flour. The darkest yellow pumpkin bread color was obtained with an average figure of 56.74%, caused by the highest formulation of pumpkin flour. Then, the lowest level of redness is P0: -182.73%, while the formulation that produces an average close to brown is P5 with a percentage of 6.00%. At the best level of yellowness, P3 was obtained with an average of 4.20%. This was due to the content of pumpkin flour, which contains natural pigments. One of the primary pigments that give pumpkin its yellow color is beta-carotene. This pigment gives a yellow to orange hue to the food substitute for pumpkin flour, so the level of yellowness in the resulting yellow pumpkin bread varies.

The best treatment results can be seen in Table 4. Based on Table 4 of the six treatments, P1 gave the best results compared to treatments P0, P2, P3, P4, P5.

Table 4. Yellow pumpkin bread scoring levels

Parameters	Code Treatment					
	P0	P1	P2	P3	P4	P5
Bread expands	v					
Specific volume	v					
Hardness	v					
Color						
(L)	v					
(*a*)						v
(*b*)				v		
Hedonic Test						
Color		v				
Aroma		v				
Taste		v				
Texture	v	v				
Hedonic Quality Test						
Color		v				
Aroma		v				
Taste			v			
Texture		v				
Pore		v				
Score	5	7	1	1	0	1

P0 = 100% wheat flour: 0% pumpkin flour, P1 = 95% wheat flour: 5% pumpkin flour, P2 = 90% wheat flour: 10% pumpkin flour, P3 = 85% wheat flour: 15% pumpkin flour %, P4 = 80% wheat flour: 20% pumpkin flour, P5 = 75% wheat flour: 25% pumpkin flour. Data is the average result of four repetitions. Different notations indicate significant results according to the DMRT test (<0.05)

Based on Table 3, the pumpkin bread formulation chosen is formulation P1, with a ratio of 95% wheat flour to 5% pumpkin flour. The chemical characteristics tested on the P1 formulation are presented in Table 5.

Table 5. Chemical characteristics of yellow pumpkin bread

Characteristic	Value
Water Content (%)	26.94
Ash Content (%)	1.61
Crude fiber (%)	2.5
β-carotene (µg)	309

Composition information (P1) 95% wheat flour: 5% pumpkin flour.

Based on Table 5, the requirements for water content, ash content, and crude fiber of the pumpkin bread products produced have met the bread quality standards SNI 01-3840-1995. The advantage of this bread is that it contains beta carotene, which is higher than bread on the consumer market, so that it can be submitted as a food with a particular positive claim.

5 CONCLUSION

Substitution of pumpkin flour in bread significantly affects physical properties (swelling power, specific volume, texture, brightness intensity, and yellow color intensity) and sensory properties (hedonics and hedonic quality). Meanwhile, the substitution of pumpkin flour had no significant effect on the intensity of the red color of the bread. The best treatment obtained for yellow pumpkin bread was P1 (95% wheat flour: 5% pumpkin

flour). The resulting physical properties are swell ability at 73.15%, specific volume at 3.46%, and texture at 87.44 %. The color obtained was (L) 67.4%, (*a*) 2.10%, and (*b*) 40.36%. The characteristics of the hedonic quality are that the bread has a yellowish-white color, tastes somewhat typical of pumpkin, has a slightly typical aroma of pumpkin, has a soft texture, and relatively uniform pores.

6 SUGGESTION

Testing the antioxidant activity of yellow pumpkin bread, the product's shelf life, and the marketing model is necessary. Further research is needed regarding sweet bread with the substitution of pumpkin flour to improve the texture and uniformity of the pores with the addition of xanthan gum. Further research needs to be carried out regarding the stalling rate test and shelf life of sweet bread by substituting pumpkin flour.

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