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Quality of Gluten Free Bread with the Addition of Xanthan Gum and Different Kneading Methods

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ABSTRACT

White bread generally uses wheat as the main ingredient due to its high viscosity and elasticity in the presence of gluten. However, because gluten is an allergen, not everyone can eat white bread. The aim of this study is to determine the quality of gluten-free white bread with the addition of xanthan gum and different stirring methods by testing the physical, chemical, and organoleptic properties of the product. This research was conducted using experimental research methods. The design uses a fully randomized factorial design (RALF) with two factors, namely xanthan gum concentration and different mixing methods with three replicates. This study uses the statistical ANOVA test with a significance of $\alpha<0.05$. The result: the higher the xanthan gum concentration in gluten-free white bread, the higher the texture value and the lower the swelling and moisture content. The result is that the longer the fermentation time when using the dough-free method with gluten-free white bread, the higher the value of swelling power and water content, as well as the textural value decreases. The results also showed that the best treatment was the addition of a xanthan gum concentration of 1.25% and the direct dough method with a texture value of 1562.9, swelling 430.269%, moisture content 35.18%, ash content 0.945%, fat content 6.675%, protein content Was 6.71%, carbohydrate content 50.45%, Hedonic test results ranged from 3-4 (rather similar) and Hedonic quality test results for crust color attributes 3.11-3.78 (brownish-yellow), crumb color (beige-brownish), aroma (slightly acidic).), pore uniformity 3.33–3.55 (rather uniform), texture (slightly soft), and flavor (slightly sour). The gluten-free test did not reveal any detectable gluten content in this study.

Keywords: hydrocolloid, gluten-free white bread, straight dough, no-time dough

INTRODUCTION

In general, white bread still uses wheat flour because of its high viscosity and elasticity in the presence of gluten (Herawati et al., 2017). When making white bread, gluten is used to bind the dough and make it elastic so it can be easily shaped. However, due to the allergenic gluten, white bread cannot be consumed by all groups. Especially those with celiac disease. This encourages the development of processed foods made from gluten-free flour (Herawati and Sunarmani 2016). One of them is gluten-free baked goods. Based on research (Sanchez et al., 2002), the use of corn starch, rice flour, and tapioca flour was found to have a ratio of 74.2; 17.2; 8.6 can produce an acceptable white bread, but the taste and final appearance are unacceptable.

Cornstarch is used as a starch source because it contains 88.11% starch (Nur, 2008). Cornstarch has a larger granule size of around 15–20 µm, so it can improve the texture of white bread. Tapioca flour is used as a source of starch due to its high amylopectin content, which means it has good water-holding capacity and forms a dough mass that is thick, sticky, and slightly elastic (Kuswardani et al., 2008). Rice flour is used as a protein source because it has a protein content almost equal to that of rice, namely 7.9 grams per 100 grams (Dep. Kes RI, 1992). Gluten-free flour generally lacks the potential for viscosity and elasticity like wheat (Herawati, et al. 2017). One way to overcome this is to add hydrocolloids (Herawati and Sunarmani 2016). Xanthan gum can form a thin film with starch, allowing it to act like gluten (Kuswardani et al., 2008). In the production of gluten-free white bread, xanthan gum is able to interact with other components present, such as starch and protein, and to bind water during dough formation, so that the water required for starch gelatinization is available during baking and gelatinization occurs more quickly.

Regardless of the presence of gluten in the raw materials, different mixing methods can affect the quality of the resulting white bread. According to Syarbini (2013), there are three main factors that can affect the quality of the bread produced, namely raw materials, recipe balance, and manufacturing process. According to Mudjajanto and Lilik (2013), there are three different mixing methods, namely the indirect method (sponge and dough), the direct method (straight dough), and the quick method (no time dough). Only two dough preparation methods were used in this study, namely the direct straight dough and the no-time dough method since the addition of xanthan gum is expected to play a role in replacing gluten by forming a thin film layer with starch (Kuswardani et al., 2008) and optimizing the rapid fermentation time with the presence of xanthan gum to allow the end result to stretch gluten-free bread as much as possible. Based on this, this research was carried out to obtain the best quality gluten-free white bread with the addition of xanthan gum and a different stirring method.

MATERIALS AND METHODS

The study was conducted with an experimental method using a completely randomized factorial design (CRFD) with two factors, namely the factor A xanthan gum concentration consisting of 3 levels (1.25% b/w, 1.5% b/w, and 1 .75% v/w) and the Factor B method with a different mixture of 2 stages (straight dough and timeless dough) with 3 repetitions so that the treatment combinations became 18 experimental units. Data analysis was performed using analysis of variance (ANOVA) at a significance level of 5% to determine if there were any factors that differed significantly. If there is a significant difference in any of the factors, the analysis continues with Duncan's test.

The tools used to make gluten-free white bread consist of a gas oven, proofer, planetary mixer, baking sheet, scale, stainless bowl, brush, parchment paper, stainless knife, and stainless spoon. The tools used for testing in this study included hedonic testing and hedonic quality, chinaware, oven binders, frames, analytical balances, texture analyzer spectrophotometers, soxhlets, desiccators, and ovens. The ingredients used in making gluten-free white bread include cornstarch, rice flour, tapioca flour, xanthan gum, yeast, sucrose, chicken eggs, powdered milk, margarine, and salt. The materials used for the analysis are distilled water, NaOH, H_2SO_4, Hexane, H_3BO_3, and HCl.

The process of making gluten-free white bread using the straight dough method refers to research by Nur'utami et al. (2020), modified for the quick dough method (no time dough) and based on research by Mudjajanto et al. (2013), which has been amended. The first process was making a yeast solution by mixing warm water, sugar, and yeast and then letting it sit for 15 minutes until foam forms. Next is mixing with a planetary mixer. The first mix mixes cornstarch, rice flour, tapioca flour, and milk powder at low speed for one minute. Then proceed to the second mix by mixing the finished egg and yeast solution on medium speed for 4 minutes. Then proceed to the third mix by mixing xanthan gum (1.25%, 1.5%, and 1.75%) on medium speed for 4 minutes. After that, proceed to the fourth mix by mixing the salt and melted margarine on medium speed for 3 minutes. Then, in the no-time dough method, the dough is placed on a baking tray and fermented in a proofer for 45 minutes at 35°C and 80% relative humidity. In addition, roasting is done with a gas oven at a temperature of 170 °C for 35 minutes in an open pan. In the straight dough method, after mixing, the four batters are added to the pan, where they are first left to ferment for 15 minutes with the pan closed. The air is then released from the dough. The dough is then left to rest in a closed mold for 15 minutes, after which the dough is deflated. The final fermentation then took place in a fermentation cabinet for 60 minutes at a temperature of 35 °C and a relative humidity of 80 %. This is followed by roasting in a gas oven at a temperature of 170 °C for 35 minutes in an open pan.

RESULTS AND DISCUSSION

Physical Test

Texture (hardness)

The texture test carried out is the hardness test. Hardness or hardness is the presence of a compressive force which indicates the resistance of the food product being tested to change shape due to the force exerted in the form of pressure (Astuti and Andarwulan, 2014). Testing the texture value (hardness or hardness) is an indicator that is quite important for the analysis of the texture of food products such as bread and biscuits (Wenzhao et al., 2013). The value of the texture test results can be seen in Table 1.

Table 1. shows the results of texture testing ranging from 1562.9 gf to 1862.9 gf. The highest hardness value, namely 1862.9 gf, was found in gluten-free white bread with the addition of 1.75% xanthan gum; method no time dough. The lowest hardness value, namely 1562.9 gf, was found in gluten-free white bread with the addition of 1.25% xanthan gum; straight dough method. Based on the results of the analysis of variance (ANOVA) on the texture test, it showed that the significance value of the xanthan gum concentration was 0.008 or ($p < 0.05$), which means that H0 was rejected and H1 was accepted, so the addition of xanthan gum concentration affected the texture. The significance value of the different kneading methods is 0.001 or ($p < 0.05$) which means H0 is rejected and H1 is accepted, so the different kneading methods affect texture. The interaction between the two has a significance value of 0.004 or ($p < 0.05$), so the interaction between the two also affects texture.

Based on the results of Duncan's test, the texture test treatment showed that the concentration of xanthan gum had a significantly different effect at the 0.05 significance level. The higher the concentration of xanthan gum added, the higher the hardness value, which means the texture of the gluten-free white bread is getting harder. Xanthan gum is a heteropolysaccharide of β-D-glucose via β1-4 glycosidic bonds. So, increasing the concentration of xanthan gum means increasing the amount of starch in the flour mixture so that the texture of the bread is hard because the starch granules increase and the water needed by the starch is taken from the gluten structure. According to Lineback and Inglett (1982), the texture of bread will become hard when xanthan gum is added at high concentrations due to gluten functional damage. The results also showed that different kneading methods had significantly different effects at the 0.05 significance level. The no-time dough method with a 45-minute fermentation time showed the highest results compared to the straight dough method with a 90-minute fermentation time. The longer the fermentation time used, the lower the hardness texture value, which means the longer the fermentation time, the softer the texture of the gluten-free white bread produced. According to Hendrasty (2013), in the fermentation process (proofing) dough development occurs because yeast breaks down sugar to form carbon dioxide gas (CO2) then carbon dioxide gas is trapped in the gluten network which causes the dough to expand and produce soft bread. Meanwhile, according to Adiluhung and Sutrisno (2018), due to the metabolic activity of yeast, it produces CO2 gas, where the longer the proofing time, the more gas is produced to increase the volume and the bread becomes softer (Adiluhung and Sutrisno, 2018).

Swelling

Swelling is the ability of a dough to form and retain gas due to processing (Saputra, 2014). According to Cauvin (2012), during the fermentation process, the added yeast will produce carbon dioxide gas as a result of glucose metabolism, and then carbon dioxide gas will increase air bubbles in the bread. Carbon dioxide gas is retained in the dough and cannot be released into the air so that it can expand the dough and during the baking process with the oven at high temperatures the carbon dioxide gas expands so that the dough expands more and more (Shabrina, 2017). The value of the swelling power test results can be seen in Table 2.

Table 2 shows the value of the expandability test results ranging from 242.5% to 430.2%. The highest swelling value, namely 430.2%, was found in gluten-free white bread with the addition of 1.25% xanthan gum; the straight dough method, while the lowest value, namely 242.5%, was found in gluten-free plain bread with the addition of 1.75% xanthan gum; method no time dough. Based on the results of the analysis of variance (ANOVA) the swelling power test showed a significant value of xanthan gum concentration was 0.00 or ($p < 0.05$) which means H0 was rejected and H1 was accepted, so the addition of xanthan gum concentration affected swelling power. The significance value of different kneading methods is 0.001 or ($p < 0.05$) which means H0 is rejected and H1 is accepted, so different kneading methods affect swelling power. The interaction between the two has a significance value of 0.00 or ($p < 0.05$), so the interaction between the two affects developmental power.

Based on the results of Duncan's test, the treatment of developmental power scores had a significantly different effect at a significance level of 0.05. The higher the concentration of xanthan gum added, the lower the swelling value, which means that the swelling power of gluten-free white bread decreases. Xanthan gum is a heteropolysaccharide containing 1-4 β-D glucose (2 glucose) bonds which causes xanthan gum to have a high water-holding capacity (Glicksman, 1983). According to Parwiyanti et al., (2016), the water-holding capacity of xanthan gum can influence the degree of development. The degree of swelling value reflects the ability of the bread dough to hold the gas that is formed during the baking process so that it affects the ability of starch to produce a hollow matrix in the bread. According to Lineback and Inglett (1982), the texture of bread will become hard when xanthan gum is added at high concentrations due to gluten functional damage. Based on this, the results obtained for the swelling power value are inversely proportional to the texture value (hardness), as evidenced by the lower the texture value (hardness), the higher the swelling power value obtained along with the lower concentration of xanthan gum which is added to gluten-free bread, the softer it is. The results also showed that different kneading methods had significantly different effects at the 0.05 significance level. The no-time dough method with a fermentation time of 45 minutes showed the lowest results compared to the straight dough method with a fermentation time of 90 minutes. The longer the fermentation time used, the higher the swelling power value, which means the longer the fermentation time, the higher the swelling power produced. This can be caused by the metabolic activity of yeast producing CO2 gas, where the longer the proofing time, the more gas is produced to increase the volume of bread (Adiluhung and Sutrisno, 2018). The resulting carbon dioxide gas is retained in the dough and cannot be released into the air so that it can expand the dough and during the baking process with the oven at high temperatures the carbon dioxide gas will expand so that the dough expands more and more (Shabrina, 2017).

Chemical Test

Water content analysis

Water content is one of the substantial compounds in food products because it can affect shelf life (Rochmawati N, 2019). The moisture content in food also determines freshness, durability, and acceptability. The more the addition of xanthan gum, the water content of non-gluten white bread will increase. The increase in water content is due to xanthan gum having a molecular weight of 2-11 million, with the greater the molecular weight, the more hydroxyl groups, and water trapping (Hui, 1992). According to SNI-8371-2018 the maximum limit for moisture content contained in white bread is 40%. The observed value of water content can be seen in Table 3.

Table 3 shows the results of the water content test ranging from 37.15% to 38.12%. The highest water content value, namely 38.12%, was found in gluten free white bread with the addition of 1.75% xanthan gum; the no-time dough method, while the lowest value, namely 37.15%, was found in gluten-free plain bread with the addition of 1.5% xanthan gum; method no time dough. Based on the results of the analysis of variance (ANOVA) the water content test showed that the significant values of xanthan gum concentration and different kneading methods were 0.392 and 0.306 or ($p > 0.05$). Thus H0 is accepted and H1 is rejected, which means that the xanthan gum concentration and the different kneading methods do not affect the water content of the gluten-free white bread. The significance value ($p > 0.05$) means that H0 is accepted and H1 is rejected, so Duncan's further test was not carried out on the moisture content of gluten-free bread. This is similar to the results of research by Kuswardani et al (2008), in the manufacture of gluten-free white bread made from cornstarch, tapioca flour, and rice flour with the addition of 0.5% to 2.5% xanthan gum concentration, with no significant effect on water content. the resulting white bread. The results of Sasaki's research (2017) stated that bread made from rice flour and wheat flour with the addition of xanthan gum concentrations of 0.5%, 1.0%, and 2.0% also had no significant effect on water content. According to the results of Sika's research (2006), stated that the use of xanthan gum with a concentration of 0.5% - 2.5% in donut products without gluten from tapioca flour also did not affect the water content of the resulting product. Xanthan gum is a hydrocolloid that binds water, but the water content that can be measured by the gravimetric method is not bound to water but free water contained in the product so that the binding of water by xanthan gum does not affect the free water content in bread products (Kuswardani et al, 2008).

The water content in food ingredients can affect several characteristics such as taste, color, solubility, and food shelf life. Moisture content is an important parameter for dry products due to the tendency of damage to a food product. White bread is a type of food with wet bread with a high enough water content, causing a low shelf life. High water content can also cause mold and yeast to multiply rapidly because water is a medium for mold, yeast, and other microbes to grow so there will be changes in the quality of food ingredients. (Fadillah et al., 2020). The water content in this study refers to SNI-8371-2018, namely the maximum water content requirement for white bread is 40%. Gluten-free white bread with the addition of xanthan gum and a different kneading method for each treatment was still within the maximum limit, ranging from 37.15% to 38.12%.

Organoleptic Test

Organoleptic tests on gluten-free white bread with the addition of xanthan gum and different kneading methods were carried out based on hedonic and hedonic quality assessments by 30 semi-trained panelists. Assessment using sensory tools includes quality specifications for crust color, crumb color, aroma, pore uniformity, texture, and taste. The results of the organoleptic test will provide information on consumer acceptance of the product.

Color

Hedonic quality test

Crust color

Color is the first sensory that can be seen directly by the panelists using the senses, namely the eyes (Negara et al., 2016). Crust color is the color found on the outer skin. Crust color is an important aspect of sensory testing because the color of the crust can indicate that the product is cooked (Sachriani, S. and Yulianti, Y., 2021). The ideal crust color for making white bread is brown evenly. The results of the hedonic quality test can be seen in Figure 1.

Figure 1 shows the average score of the hedonic quality test for the preference level of panelists for crust color ranging from 3.44 to 3.96 (fawn). Based on the results of the analysis of variance (ANOVA) it showed that the significant values of xanthan gum concentration and different kneading methods were 0.059 and 0.342 or ($p > 0.05$). Thus H0 is accepted and H1 is rejected, which means that the concentration of xanthan gum and the different kneading methods do not affect the color of the crust on gluten-free bread. The significance value ($p > 0.05$) which means that H0 is accepted and H1 is rejected, so Duncan's further test was not carried out on the hedonic quality of crust color on gluten-free bread. The treatment of xanthan gum concentration and the best kneading method which had the highest crust color hedonic quality test was at 1.25% xanthan gum concentration using the straight dough method with a value of 3.96 (yellowish brown).

The brown color of the bread is caused by the Maillard reaction and caramelization of the sugar during baking (Sitepu, 2019). Caramelization of sugar is the degradation of sugar due to heating above its melting point resulting in a brown color change. This shows that the higher the simple sugar content in the bread, the browning that occurs during baking is higher (Sitepu, 2019).

Crumb color

Color is the first sensory that can be seen directly by the panelists using the senses, namely the eyes (Negara et al., 2016). Color is an important component in determining the acceptance of a product by consumers because it is the first visual appearance in addition to several other factors such as taste, aroma, and nutritional value (Winarno, 2004). The results of the hedonic quality test can be seen in Figure 2.

Figure 2 shows the average score of the hedonic quality test for the panelist's preference for crumb color ranging from 3.11 to 3.78 (brownish beige). Based on the results of the analysis of variance (ANOVA) it showed that the significance value of the xanthan gum concentration was 0.000 or ($p < 0.05$), so the addition of xanthan gum concentration affected the color of the crumb on gluten-free bread. The significance value of the different kneading methods was 0.002 or ($p < 0.05$), so the different kneading methods affected the color of the crumb on gluten-free white bread. The interaction between the two has a significance value of 0.000 or ($p < 0.05$), so the interaction between the two affects the color of the crumb on gluten-free bread. The longer the fermentation time used, the higher the hedonic quality value of the crumb color. The interaction treatment between xanthan gum concentration and the best kneading method had the highest crumb color hedonic quality test value, namely at 1.5% xanthan gum concentration using the straight dough method with a value of 3.78 (brownish beige).

Figure 3 shows the hedonic test average score of the panelists' preference for color ranging from 3.73-4 (somewhat like). Based on the results of the hedonic color test analysis of variance (ANOVA) in Table 15, the significance value of xanthan gum concentration was 0.004 or ($p < 0.05$), so the addition of xanthan gum concentration affected the color of gluten free bread. The significance value of the different kneading methods was 0.000 or ($p < 0.05$), so the different kneading methods affected the color of gluten-free white bread. The interaction between the two has a significance value of 0.000 or ($p < 0.05$), so the interaction between the two affects the color of the crust on gluten-free bread. The best interaction treatment between xanthan gum concentration and the best kneading method which had the highest color hedonic test value was at 1.25% xanthan gum concentration using the straight dough method with a value of 4 (likes).

Aroma

hedonic quality test

Aroma is one of the factors that determine the acceptance of a product so that it can be accepted by consumers. Aroma can be a determining factor whether a product is acceptable or not, besides that aroma can be used as an indicator of damage to the product (Kartika et al., 1988). Aromas arise from aroma-producing substances that can evaporate such as volatile compounds (Ratri lusia, 2019). According to Syarbini (2013), a good aroma of white bread is a distinctive aroma of wheat or a distinctive smell of grains or nuts. Aroma is a parameter that can be observed with the sense of smell. The value of the aroma hedonic quality test results can be seen in Figure 4.

Figure 4 shows the average score of the hedonic quality test for the panelist preference for aromas ranging from 2.90 to 3.01 (sour-slightly sour). Based on the results of the analysis of variance (ANOVA) hedonic aroma quality test in Appendix 18, the significance values of xanthan gum concentration and different mixing methods were 0.825 and 0.884 or ($p > 0.05$). Thus H0 is accepted and H1 is rejected, which means that the xanthan gum concentration and the different kneading methods do not affect the flavor of the gluten-free white bread. The significance value ($p > 0.05$) means that H0 is accepted and H1 is rejected, so Duncan's further test was not carried out on the hedonic quality of aroma on gluten-free white bread. The best treatment of xanthan gum concentration and kneading method which has the highest aroma hedonic quality test is at 1.5% xanthan gum concentration using the straight dough method with a value of 3.01 (slightly sour).

Figure 5 shows the average hedonic test score for the panelists' preference for aromas ranging from 3.43 to 3.6 (rather like). Based on the results of the analysis of variance (ANOVA) the significance value of xanthan gum concentration and different kneading methods was 0.815 and 0.696 or ($p > 0.05$). Thus H0 is accepted and H1 is rejected, which means that the xanthan gum concentration and the different kneading methods do not affect the flavor of the gluten-free white bread. The significance value ($p > 0.05$) which means that H0 is accepted and H1 is rejected, so Duncan's further test was not carried out on the hedonic aroma of gluten-free bread. The treatment of xanthan gum concentration and the best kneading method which had the highest aroma hedonic test value was at 1.25% xanthan gum concentration using the straight dough method with a value of 3.60 (rather like).

Texture

Hedonic quality test

Texture (hardness or hardness) is an important indicator for food products such as bread and biscuits (Wenzhao et al., 2013). The value of the texture hedonic quality test results can be seen in Figure 6.

Figure 6 shows the average score of the hedonic quality test for the panelists' preference for texture ranging from 3.35 to 3.63 (slightly soft). Based on the results of the analysis of variance (ANOVA) for the texture hedonic quality test in Appendix 19, the significance value for the xanthan gum concentration was 0.015 or ($p <0.05$), so the addition of xanthan gum concentration affected the texture of gluten-free white bread. The significance value of the different kneading methods was 0.052 or ($p > 0.05$), so the different kneading methods did not affect the texture of the gluten-free white bread. The interaction between the two has a significance value of 0.024 or ($p <0.05$), so the interaction between the two affects the texture of the gluten-free white bread. The treatment of the interaction between xanthan gum concentration and the best kneading method which had the highest textural hedonic quality test value was at 1.25% xanthan gum concentration using the straight dough method with a value of 3.63 (a bit soft).

Bread pore uniformity

Bread pores are thin layers formed on gluten which function to capture carbon dioxide gas. Pores are formed during the fermentation process, and yeast activity (Pusuma et al., 2018). The following results of the analysis of hedonic quality testing for pore uniformity of gluten-free plain bread with the addition of xanthan gum and different kneading methods can be seen in Figure 7.

Figure 7 shows the average score of gluten-free plain bread with xanthan gum concentrations and different kneading methods. The hedonic quality test score of the panelist's preference level for pore uniformity ranged from 3.33 to 3.55 (slightly uniform). Based on the results of analysis of variance (ANOVA) the hedonic quality test for pore uniformity in Appendix 20 showed a significant value of xanthan gum concentration was 0.004 or ($p <0.05$), so the addition of xanthan gum concentration affected pore uniformity in gluten-free bread. The significance value of the different kneading methods was 0.636 or ($p > 0.05$), so the different kneading methods did not affect pore uniformity on gluten-free white bread. The interaction between the two has a significance value of 0.024 or ($p <0.05$), so the interaction between the two affects pore uniformity in gluten-free white bread.

The higher the concentration of xanthan gum, the lower the hedonic quality value of the pore uniformity or the less uniform it is.

According to Sukamto (2010), xanthan gum plays a role in regulating water distribution and preventing syneresis so that the dough structure forms more even pores. The interaction treatment between xanthan gum concentration and the best kneading method which had the highest pore uniformity hedonic quality test value was at 1.25% xanthan gum concentration using the straight dough method with a value of 3.55 (rather uniform).

Figure 8 shows the average hedonic test score for the panelists' preference for texture ranging from 3.57-4 (somewhat like). Based on the results of the analysis of variance (ANOVA) hedonic texture test in Appendix 24, the significance value of the xanthan gum concentration was 0.003 or ($p < 0.05$), so the addition of xanthan gum concentration affected the texture of gluten-free white bread. The significance value of the different dough methods was 0.000 or ($p < 0.05$), so the different dough methods affected the texture of the gluten-free white bread. The interaction between the two has a significance value of 0.000 or ($p < 0.05$), so the interaction between the two affects the texture of gluten free white bread. Treatment of the hedonic value of texture on gluten free white bread with the addition of xanthan gum and different kneading methods showed that the concentration of xanthan gum had a significantly different effect at the 0.05 significance level. The best interaction treatment between xanthan gum concentration and the best kneading method which has the highest textural hedonic test value is at 1.25% xanthan gum concentration with the straight dough method with a value of 4 (likes).

Flavor

hedonic quality test

Taste is the main factor that is important in an assessment of food products using the sense of taste. Taste is very important to determine the panelist's decision to accept a food product. The taste of a food can come from the food itself or from ingredients added during the processing (Kumalaningsih et al., 2005). The value of the taste hedonic quality test results can be seen in Figure 9.

Figure 9 shows the average score of the hedonic quality test for the panelists' preference for flavors ranging from 3.75 to 3.81 (slightly sour). The sour taste that appears on gluten-free white bread is suspected when the fermentation time is too long. According to Prabowo et al., (2021) states that the occurrence of over proofing causes the taste of the bread to become sour. Based on the results of the analysis of variance (ANOVA) it showed that the significant values of xanthan gum concentration and different kneading methods were 0.686 and 0.920 or or ($p > 0.05$). Thus H0 is accepted and H1 is rejected, which means that the concentration of xanthan gum and the different kneading methods do not affect the taste of the gluten-free white bread. The significance value ($p > 0.05$) means H0 is accepted and H1 is rejected, so Duncan's further test was not carried out on the hedonic quality of taste on gluten-free white bread. The best treatment of xanthan gum concentration and kneading method which had the highest taste hedonic quality test was at xanthan gum concentrations of 1.25% and 1.5% with the straight dough method with a value of 3.81 (slightly sour).

Based on the results of analysis of variance (ANOVA) it showed that the significance value of xanthan gum concentration was 0.017 or ($p < 0.05$), so the addition of xanthan gum concentration affected the taste of gluten-free white bread. The significance value of the different kneading methods was 0.014 or ($p < 0.05$), so the different kneading methods affected the taste of gluten-free white bread. The interaction between the two has a significance value of 0.008 or ($p < 0.05$), so the interaction between the two influences the taste of gluten-free white bread. The treatment of the interaction between xanthan gum concentration and the best kneading method which had the highest taste hedonic test value was at 1.5% xanthan gum concentration using the straight dough method with a value of 3.83 (rather like).

CONCLUSION

Based on the research results on the quality of gluten-free white bread with the addition of xanthan gum and various kneading methods, the following conclusion can be drawn:

1. Different concentrations of xanthan gum (1.25%, 1.5% and 1.75%) have a significant effect on the texture test, the swelling test, the organoleptic test (hedonic quality: crust color, crumb, pore and texture uniformity) and the organoleptic test (hedonic: color, texture and taste).
2. Different kneading methods (straight dough and no time dough) had a significant impact on the texture test, swelling test, organoleptic test (hedonic quality: crust and crumb color) and organoleptic test (hedonic: color, texture and taste).
3. The interaction between different concentrations of xanthan gum (1.25%, 1.5% and 1.75%) and different kneading methods (straight dough and no time dough) has a significant impact on texture testing, swelling testing and organoleptic testing (hedonic quality : Color). of crust, crumb, pore uniformity and texture) and organoleptic test (hedonic: colour, texture and taste).
4. The best gluten-free white bread was found when treated with 1.25% xanthan gum concentration and the straight dough method with a texture score of 1562.9, 430.269% swelling power, 35.18% moisture content, 0.945% ash content, 6.675% fat content, protein content 6 .71%, carbohydrate content 50.45%, hedonic test scores range from 3-4 (rather similar) and hedonic quality test scores for crust color attribute 3.11-3.78 (brownish-yellow), crumb color (brownish-cream), flavor (slightly acidic), pore uniformity 3.33-3.55 (rather uniform), texture (slightly soft) and taste (slightly acidic). The results of the gluten free test showed no gluten content in gluten free white bread.

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Table 1. Texture (hardness) test results (gf)

XG concentration	Kneading method		Average
	Straight dough	*No time dough*	
1,25%	1562,9[ab] ± 200,32	1658,3[b] ± 55,01	1610,7
1,5%	1655,8[a] ± 150,58	1693,0[b] ± 108,83	1674,4
1,75%	1861,8[b] ± 20,80	1862,9[c] ± 195,88	1862,4
Average	1693,5	1738,1	1715,8

Note:

- The straight dough kneading method with different xanthan gum concentrations provides a significant difference in the texture values at concentrations of 1.5% and 1.75% but does not provide a significant difference at a xanthan gum concentration of 1.25%.
- The no time dough kneading method with different xanthan gum concentrations does not provide a significant difference in texture at concentrations of 1.25% and 1.5% but provides a significant difference at a xanthan gum concentration of 1.75%

Table 2. The value of the swelling test results (%)

XG concentration	Kneading method		Average
	Straight dough	*No time dough*	
1,25%	430,2[c] ± 8,78	357,0[b] ± 10,67	393,6
1,50%	406,6[c] ± 8,50	265,4[a] ± 5,74	336,0
1,75%	353,3[b] ± 23,98	242,5[a] ± 19,17	297,9
Average	396,7	288,3	342,5

Table 3. Value of water content test results (%)

XG concentration	Kneading method		Average
	Straight dough	*No time dough*	
1,25%	37,93 ± 0,51	37,40 ± 1,26	37,7
1,50%	37,82 ± 0,04	37,15 ± 0,64	37,5
1,75%	37,86 ± 0,13	38,12 ± 0,20	37,9
Average	37,9	37,6	37,7

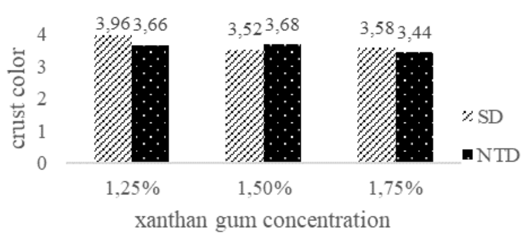

Figure 1. Diagram of the crust color hedonic quality test

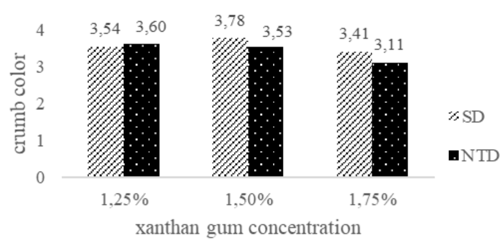

Figure 2. Diagram of crumb color hedonic quality test results

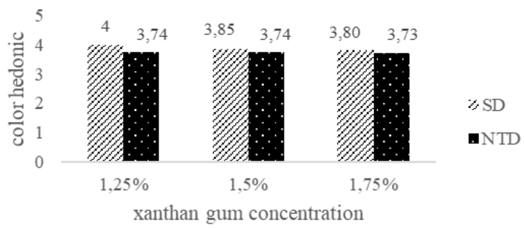

Figure 3. Color hedonic test result diagram

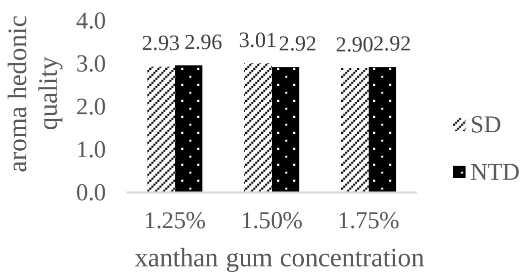

Figure 4. Diagram of aroma hedonic quality test

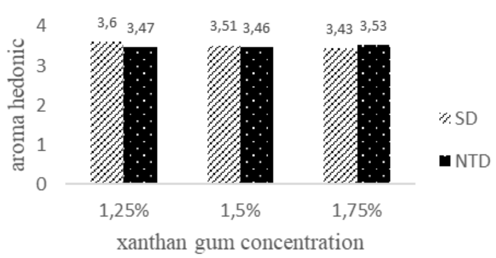

Figure 5. Aroma hedonic test result diagram

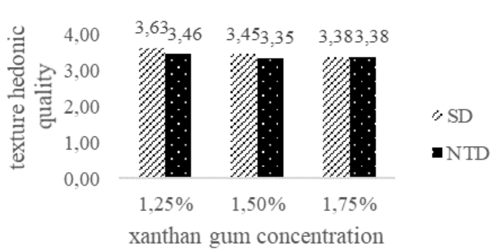

Figure 6. diagram of texture hedonic quality test

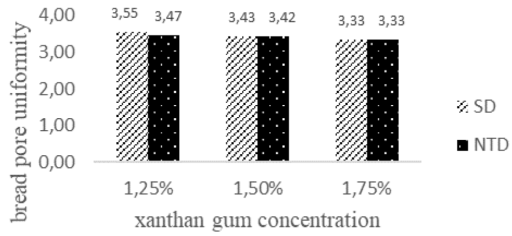

Figure 7. Diagram of pore uniformity hedonic quality test results

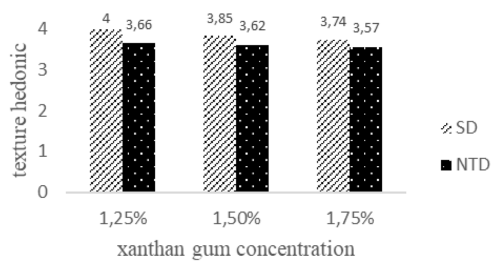

Figure 8. Diagram of the texture hedonic test results

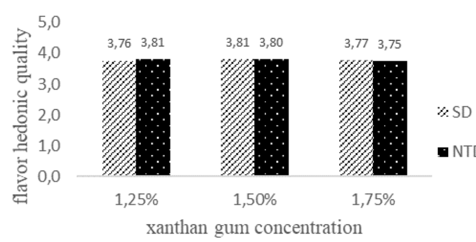

Figure 9. Diagram of the hedonic flavor test results

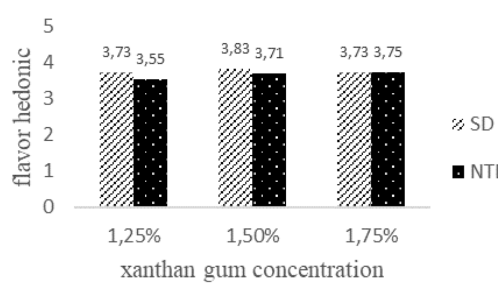

Figure 10. Diagram of the hedonic taste test results