Jurnal Sains Boga
Vol. 7 No. 2, 2024
Page 89-102
DOI: https://doi.org/10.21009/JSB.007.2.04
E-ISSN: 2622-5557
Journal homepage: https://journal.unj.ac.id/unj/index.php/boga

Development of Bontang City Typical White Bread Food Products with the Use of Mackerel Tuna Fish *(Euthynnus affinis)* Broth on White Bread Quality

Zulfiqo Ilham Chudori[1,a)], Nunung Nurjanah[2,b)]

[1] *Department of Culinary Art and Fashion Education, Faculty of Engineering, State University of Malang*
[2] *Department of Culinary Art and Fashion Education, Faculty of Engineering, State University of Malang*

Email: [a)]zulfiqo.ilham@gmail.com, [b)]nunung.nurjanah.ft@um.ac.id

Abstract

The development of white bread food products using mackerel tuna fish broth is a variation of innovation to produce a good nutritional value of animal protein. This research method uses experimental research methods. This research was conducted using a completely randomized design (CRD) to see differences in texture, aroma, taste, water content, and development of white bread added to mackerel tuna fish broth by 36%, 42%, and 48%. Each treatment has two repetitions, followed by physical tests (white bread development volume), hedonic tests (texture, taste, and aroma), and chemical tests (water content). The data obtained were analyzed statically using the ANOVA test, then continued with the DMRT (Duncan's Multiple Range Test) test if there were differences. The results research showed significant differences in the organoleptic hedonic properties, chemical tests, and physical tests of white bread development.

Keywords: mackerel tuna fish, white bread quality, food products, white bread

INTRODUCTION

Mackerel tuna fish (*Euthynnus affinis*) is the main type of marine fish caught in Bontang City. The total catch of tuna in 2017 was 1,623.5 tonnes (Badan Pusat Statistik Kota Bontang, 2018). The people of Bontang City generally like tuna served fresh. Some of the quality of fish that has just been landed/caught from ships in several fishing areas in Indonesia is no longer fresh (Kusdiantoro et al., 2019, p. 6). Many activities that occur in the sea and coastal areas of Bontang City have not been properly designed. This is a potential that can be developed for the development of Bontang City itself. The potential for developing the sea coast in Bontang can be seen from the many activities that occur on the sea coast of Bontang City. These activities are in the form of settlements, commerce, docks, conservation areas, tourist attractions in the form of natural tourism, culinary tourism and cultural tourism held on the sea such as sea parties and continental beach areas. These activities are carried out on the sea coast of Bontang City but have not been well designed (Laily, 2019).

This is because the long sea time combined with poor cooling conditions allows damage by bacterial and enzyme activity to continue during the process of catching, landing, auctioning and marketing the fresh fish. Even though the freshness condition of the fish is no longer good, generally some processors continue to process the fish into salted or boiled fish products (Hafiludin, 2011, p. 6). Based on Indonesian food composition data (2018) (in Chudori, 2020), the nutritional content of tuna consists of water, fat, protein, minerals, calcium and vitamin A and vitamin B. The composition of the nutritional content of tuna is presented in TABLE 1 below.

TABLE 1. Composition of the Nutrient Content of Mackerel Tuna Fish

Content	Total
Water (%)	74.7 gram
Energy (kal)	100 kal
Protein (%)	13.7 gram
Fat (%)	1.5 gram
Minerals (%)	1.20-1.50
Ash (%)	2.1 gram
Calsium (Ca)	92 mg
Phosphorus (P)	606 mg

The Bontang City people's love of tuna can be used as an idea for making variations in the taste of white bread. It is hoped that this white bread with the taste of tuna will become a typical bread in Bontang City. Recipes passed down from generation to generation in their area based on ethnography and demographics may provide culinary insight into a society that developed using vegetables, herbs, fish, and meat with added spices as seasonings (Sultani et al., 2020, p 147). The process of how culture is learned and passed from generation to generation through language acquisition and socialization is called enculturation (Kittler & Sucher, 2004). One of the most significant examples of the enculturation process in society relates to food. Food eating habits are a series of culturally standardized food-related behaviors expressed by individuals who grew up in a particular cultural tradition (Wijaya, 2019, p. 2). Eating habits can be seen as people's ways and rules for using food, from how they choose, obtain, and distribute it, to who prepares, serves, and eats it.

Moreover, the people of Bontang City are directly facing the sea, causing the food culture there to tend to be based on fish as its ingredients and eating habits. Food culture can be seen as a product of ethical codes regarding food that are acceptable or unacceptable in certain social groups. It also regulates the structure of social relations between members of society. This is an everyday reaffirmation of cultural identity through the symbolic meaning of rituals, traditions, and special events within a social group (Reynolds, 1993). This means that the food culture in one place will be different from other places. The cuisine of Kalimantan, the Indonesian island region of Kalimantan located in the maritime center of Southeast Asia, is also interesting.

Its wide coastline and many large rivers provide an abundance of seafood and freshwater fish for local cuisine (Gozali, 2022). Therefore, the characteristics of the food culture in Bontang City are based on geographical conditions that provide food in the form of fish supported by boats. So it is not surprising that the livelihood of coastal communities in Bontang City is to work as fishermen. Boats for the fishing community are an important means of supporting daily activities, so placing the boat very close to the house makes fishing activities easier. Among fishermen there is an agreement that there is no one who does not have a boat, therefore, if there are fishermen who do not have a boat, the residents will work together to help make those who do not have a boat a manifestation of the *makdanakan* philosophy (Budiman & Sudikno, 2023, p. 50).

To develop food products based on local wisdom, researchers chose white bread as a test ingredient for providing mackerel tuna fish broth. White bread is a dish that all groups like. According to national socio-economic data in 2005 (in Rahardian, 2010), the amount of white bread consumed in Indonesia amounted to 460 million packs. This figure increased by 61% to 742 million packs. White bread is a product that is easy for people to consume because it is durable, so it is easy to carry anywhere and has a good shelf life, it has a neutral taste so it is widely consumed in all conditions. Therefore, it is hoped that the development of white bread products with mackerel tuna fish broth can provide alternative taste variations to suit the taste buds of the people of Bontang City.

People generally like white bread as the food they consume when traveling. There are many variations of white bread on the market, thus providing more varied product choices and aiming to meet consumer tastes. So far, the varieties of white bread that have been circulating include milk

white bread, peeled white bread, pandan white bread, chocolate white bread and wheat white bread. The relatively cheap price means that white bread is easily accessible to all levels of society, from the lower, middle to upper classes (Pusuma et al., 2018, p. 29). Benefits of consuming white bread as a staple food source of carbohydrates to replace rice. White bread is served as a breakfast menu smeared with butter or jam. The historical arrival of bread in Indonesia began in the nineteenth century when the Dutch began to colonize Indonesia. The presence of Dutch people in Indonesia brought new food patterns that were different from Indonesian food patterns which were full of spices (Rahman, 2016a; Rahman 2016b).

Indonesian bread began to be produced in various shapes and soft textures and coated with egg yolk, margarine, or simple syrup. Local producers saw the opportunity and began marketing various products such as beet sponge cake, vegetables dorayaki, wheat bread, and black forest beetroot (European Union-Indonesia Business Network, 2016, p. 11). Previous research, namely Susanti and Faridah (2023) and Nugroho et al. (2016) discusses the use of freshwater fish such as catfish as an innovative ingredient for quality and nutritional value in the pastry and bread sector. The novelty of this research lies in the use of tuna (Euthynnus affinis) as a local raw material which is often found in Bontang City, East Kalimantan Province in making broth for the development of white bread products. This research was carried out to create nutritious food and culinary innovations in the context of achieving balanced nutrition.

Based on data from Djunnaidah (2017), it shows that the (temporary) figure for fish consumption in 2015 was 41.11 kg per capita per year, slightly exceeding the target set by the Joko Widodo government. Therefore, researchers conducted research on the quality of white bread with mackerel tuna fish broth as a development of a typical white bread food product in Bontang City, East Kalimantan Province which has good nutritional value of animal protein. The problem raised in this research is the changes that occur in the texture, taste, aroma, and water content contained in white bread after adding mackerel tuna fish broth. This research aims to examine white bread with the addition of mackerel tuna fish broth using experimental research methods.

METHODS

The research design used is experimental research. Experimental research is a research method used to find the effect of certain treatments under controlled conditions (Sugiyono, 2014, p. 80). The experimental design used in this research was a Completely Randomized Design (CRD). CRD with the addition of mackerel tuna fish broth with a composition of 36%, 42% and 48%. The experiment was repeated twice to produce valid validation figures. If the data that has been analyzed using the ANOVA (Analysis of Variance) test shows $p<0.05$ ($a = 5\%$) or there are differences, then proceed with the DMRT (Duncan's Multiple Range Test) test to determine the differences between each treatment.

The data obtained in this research are chemical quality data (moisture content), physical quality (bread swelling), and organoleptic quality of white bread with the addition of different mackerel tuna fish broths. The data obtained was then analyzed using ONEWAY ANOVA (analysis of variance). If the analysis results show differences then continue with the DMRT test (Duncan's Multiple Range Test). This test is still within the scope of experimental design on a parametric scale (Chudori, 2020).

Research on making white bread with the addition of mackerel tuna fish broth was carried out in June-July 2020 at the Industrial Laboratory of the Department of Culinary Art and Fashion Education (formerly known as the Department of Industrial Technology) Faculty of Engineering, State University of Malang (FT UM). Organoleptic tests and physical tests (volume) were carried out at the Industrial Laboratory, Department of Culinary Art and Fashion Education, Faculty of Engineering, State University of Malang. Meanwhile, chemical tests (water content) were carried out at the Chemistry Laboratory of the University Muhammadiyah of Malang (UMM).

To make white bread with mackerel tuna fish broth, you need to go through several steps by preparing the tools and ingredients. The ingredients used are white bread, sugar, salt, *Bogasari Blue Triangle* wheat flour, chicken eggs, water, yeast, *Gulaku* brand sugar, Blue Band margarine as fat,

milk, mineral yeast food (MYF), malt, emulsifier, and dough improver. The equipment used in this research is a pan, digital scales, vertical planetary mixer machine, sieve, measuring cup, gauze, glass bottle, plate, glass, spoon, fork, blender, kneader or beater, container/ bread dough baking trays/trays, and automatic dough dividing and rounding machines.

The first part is making the white bread. In this section, the researcher follows the model created by Kiranawati and Chisbiyah (2016). According to Kiranawati and Chisbiyah (2016), the steps for making bread are selecting ingredients, weighing the weight of the ingredients, mixing the ingredients, fermenting the dough, cutting and weighing the dough (dividing), rounding the dough, developing intermediate proofing, rolling the dough (sheeting), forming/molding the dough (molding), placing the dough into the mold/pan (panning), developing the dough (proofing), baking/baking the dough, removing the bread from the mold (depanning), cooling bread, and wrapping or packaging bread (packaging).

The selection of ingredients for making white bread takes into account several things, namely the use of ingredients at a reasonable price, the selection of ingredients with the best quality, sustainable stock (inventory) of ingredients that have good durability and good shelf life to avoid depreciation of the quality of the ingredients (Kiranawati & Chisbiyah, 2016). The main ingredients include margarine, eggs, granulated sugar, salt, milk, bread improver and yeast. Hendrasty (2013) provides precise weighing using bread scales in international recipes, scales that are often used such as lb, pound, oz, and so on. The important size conversion factors used are contained in SNI including the quality requirements regulated by the Indonesian National Standardization Agency (BSNI) in 1996 based on SNI 01-3840-1995 (Badan Standardisasi Nasional Indonesia, 1996).

Then, the dough enters the stage of mixing the ingredients. The process of mixing the ingredients will produce gluten because there is a reaction of indoluble protein in wheat flour to water due to the mixing and kneading process (Suhardjito, 2006). The main characteristic of a smooth dough is that a thin, transparent dough film texture is formed, and if it is pulled until it is torn, there will be a straight tear in the dough. Things that must be avoided are, don't let the dough become less smooth (under mixing), because this will result in less fluffy bread volume, pale skin color, excessive cracking or tearing on the surface of the skin, and pores (crumbs) which is dense, and has a dense bread texture (U.S. Wheat Associates, 1983). Meanwhile, on the other hand, the dough is also avoided so that there is no over-mixing which will result in the dough becoming sticky, which will affect the volume of the bread, unevenly open pores (open crumb), the color of the skin surface which tends to fade quickly. dark, and the texture of the pores is uneven and rough (Lamadlauw & Arief, 2004).

The dough is then given yeast. During the fermentation process, yeast forms CO_2 gas which is slightly acidic in nature to help soften the gluten, and slowly the gluten will absorb water and produce a dough that has high elasticity. After that, the dough is then weighed on a digital scale and the dough is cut so that the ingredients are mixed evenly and produce a bread dough texture that is not lumpy. The aim is to weigh the bread dough so that it is not too heavy and according to the measurements when the dough is being formed. After weighing and cutting, the dough is then rounded and compacted. Rounding or compacting the dough has the aim of retaining carbon dioxide gas formed during fermentation and making it easier for the dough to absorb air to reach the optimum dough volume (Kiranawati & Chisbiyah, 2016). The process of rounding or compacting white bread dough using an automatic dough dividing and rounding machine.

The dough is then molded. Molding is done manually on a work table that has been sprinkled with wheat flour to prevent the dough from sticking to the processing table and using a tool called dough molding. After that, proofing (dough development) is carried out to give volume to the bread. The dough is continued with baking the bread. This stage uses a temperature of 180-200ºC with a duration of 15-20 minutes. Toasting bread will cause the volume of the bread to increase in the first half (5-6 minutes) and stop at a temperature of 65ºC (Kiranawati & Chisbiyah, 2016). After the dough has gone through the baking process, it continues with the stages of removing the bread from the mold (depanning) and cooling (cooling). Drying is carried out in the open air for 45-70 minutes. When cooling, the weight of the bread will decrease due to water evaporation of around 2% -3% (Kiranawati & Chisbiyah, 2016).

After making the white bread dough in the first part of making the white bread, the researchers made mackerel tuna fish broth in the second part of making the mackerel tuna fish broth. The broth is used as a flavor enhancer and flavoring in food, strengthening the taste of food and adding to the aroma of cooking (Finarti et al., 2018). The raw materials for making mackerel tuna fish broth require the addition of other additional ingredients, such as brown sugar, tapioca flour, garlic, salt, and a little pepper. Raw materials that have been washed clean and then boiled. Boil using high heat at 100ºC for 30 minutes. This boiling aims to obtain raw material stock. During boiling, the broth is stirred with a wooden stirrer to bring out the distinctive aroma of mackerel tuna fish broth. Further processing aims to prevent unwanted bacterial contamination (Rizqiati et al., 2020).

The steps for making mackerel tuna fish broth are as follows.

1. The mackerel tuna fish is washed and cleaned. Remove the internal organs and head of the mackerel tuna. Slice the mackerel tuna meat and separate it from the mackerel tuna fish bones.
2. Boiling.

Mackerel tuna fish that have been separated from the flesh and bones are boiled with the formula 150 ml of water for 40 grams, 50 grams, and 60 grams of mackerel tuna meat respectively. Boil until the water reduces to 100 ml for 15 minutes.

3. After the water has reduced, turn off the stove and prepare a filter to separate the boiling residue and get residue-free mackerel tuna fish broth.
4. Cooling. Before use, the mackerel tuna fish broth is kept at room temperature and undergoes a cooling stage to strengthen the taste of the broth.
5. Mackerel tuna fish broth is ready to use.

The temperature and heating time when blanching is different for each material depending on the nature of the material to be processed at a temperature of 92-93ºC for 3-5 minutes (Prihartono, 2003, p. 9). Satuhu (1994) states that blanching can be done by immersing the material to be processed in boiling water at a temperature of 82-100ºC. In general, blanching is done in up to 10 minutes because it depends on the thickness of the sliced ingredients and the amount of ingredients put into boiling water. The purpose of heating (blanching) is to inactivate the enzymes contained because the enzymes found in fish will cause undesirable color changes in the processed food ingredients. Furthermore, blanching can reduce the amount of initial contamination, remove dirt on the surface of the material, and expel air from the tissues of the material (Desrosier, 1988). The process for making white bread with the inclusion of mackerel tuna fish comprises three stages, as seen in FIGURE 1.

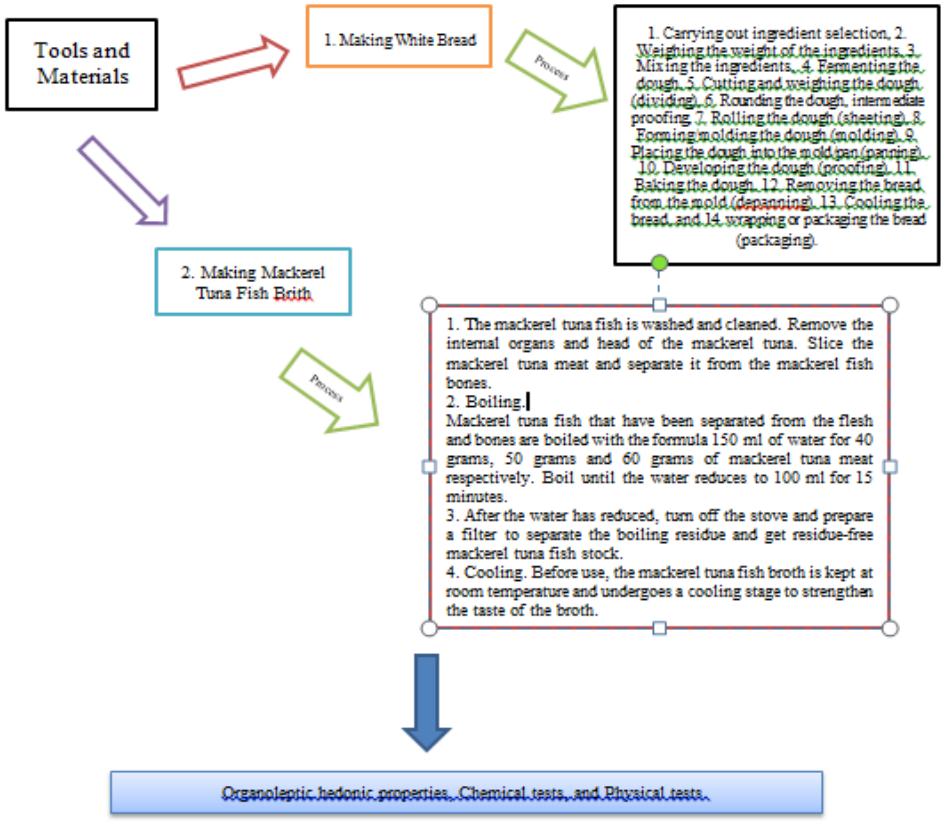

FIGURE 1. Research Design and Steps

After following the design and research stages of developing white bread products with mackerel tuna fish broth, the researchers made a suitable formulation from the tools and materials available. Please refer to TABLE 2 for a detailed description of the white bread formula with the addition of mackerel tuna fish broth stages.

TABLE 2. White Bread Formula with the Addition of Mackerel Tuna Fish Broth

Ingredients	Standard recipe	Formula 1	Formula 2	Formula 3	
High Protein Wheat Flour	250 gram	250 gram	250 gram	250 gram	
Mackerel Tuna Meat	-	450 gram	505 gram	560 gram	Broth 148 gram
Water	150 gram	500 gram	500 gram	500 gram	
Yeast Instant	2,5 gram	5 gram	5 gram	5 gram	
Ice	150 gram	-	-	-	
Salt	5 gram	5 gram	5 gram	5 gram	
Sugar	15 gram	15 gram	15 gram	15 gram	
Fat (Margarine)	5 gram	5 gram	5 gram	5 gram	
Bread Improver	1,25 gram	5 gram	5 gram	5 gram	
Vanilla	0,25 gram	1 gram	1 gram	1 gram	
Eggs		-	-	-	
White Butter	25 gram	25 gram	25 gram	25 gram	
Milk	25 gram	25 gram	25 gram	25 gram	

Source: Kiranawati and Chisbiyah (2016) with modification.

RESULT AND DISCUSSION

Organoleptic Hedonic Properties

The organoleptic hedonic qualities observed were the taste, aroma and texture of white bread. Organoleptic quality data was obtained from assessments carried out by trained panelists. Panelists were asked to rate the bread under study, then fill in the results of their assessment in a form. Organoleptic hedonic quality test scores are as in TABLE 3.

TABLE 3. Hedonic Organoleptic Quality Test Score of White Bread with the Addition of Mackerel Tuna Fish Broth

Mackerel Tuna Fish Broth Taste	Mackerel Tuna Fish Broth Aroma	White Bread Textures	Skor
Strong	Strong	Soft	5
Quite strong	Quite strong	Quite soft	4
Rather strong	Rather strong	A bit soft	3
Less strong	Less strong	Not soft enough	2
Not strong	Not strong	Not soft	1

Textures

Texture is a sensation of pressure that can be observed with the mouth (when bitten, chewed, and swallowed) or touched with the fingers. In the development of white bread products with mackerel tuna fish broth, they obtain a soft texture and taste. The texture of white bread is influenced by the process of mixing water, salt, sugar, and wheat flour, thus producing gluten during the process of mixing the ingredients (Koswara, 2009). The texture of good white bread is smooth, soft, and elastic. The smooth texture of bread is caused by mixing the ingredients evenly at the right time (Hendrasty, 2013). The addition of bread improver of the right size provides a smoother bread texture (Sugianto et al., 2017). Gluten in wheat flour has a large water absorption capacity. This water absorption functions to soften and maintain the elastic properties of the bread texture (Hendrasty, 2013).

The average hedonic test results for the texture of white bread with the addition of mackerel tuna fish broth can be seen in FIGURE 2 below. The results of the average hedonic organoleptic texture test chart in FIGURE 2 illustrate that the trial development of white bread products with mackerel tuna fish produced an average texture score for white bread with 38% mackerel tuna fish broth of 2,897 (less soft). Meanwhile, the average texture score of white bread with 42% mackerel tuna fish broth was 3.7 (somewhat soft) and the average texture score of white bread with 48% mackerel tuna fish broth was 4.7 (quite soft).

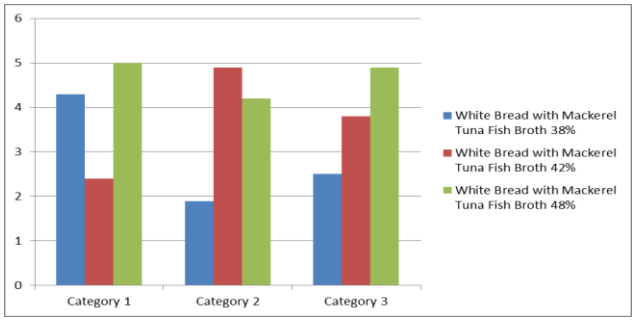

FIGURE 2. Average Hedonic Texture Test Chart of White Bread with added Mackerel Tuna Fish Broth

The results of the hedonic test for texture properties were obtained by weighing the ingredients using standard units and not using less standard units such as cups, spoons or mugs (Kiranawati &

Chisbiyah, 2016). Apart from that, the principle of mixing the ingredients is to beat and pull the gluten network so that the spiral structure changes parallel to the others which causes the dough to become shiny and not sticky and the dough can expand to an optimum point which causes the gluten to be pulled or contracted (Hendrasty, 2013, p. 54). Apart from that, in this research, to ensure that the texture of white bread with mackerel tuna fish broth produces a soft texture of white bread crust, you can use fat such as margarine.

Using fat in certain amounts can produce very soft skin. High-fat content produces very soft skin and has a shortening effect on the bread (Lange & Bogasari Baking Center, 2004). Fats and oils are found in almost all food ingredients with varying contents. Fat is an important food substance for maintaining the health of the human body. Apart from that, it is also a very effective source of energy compared to carbohydrates and protein (Finarti et al., 2018, p. 48; Winarno, 2008).

Adding fat to the process of making white bread dough can provide better nutritional value and improve the taste of white bread so that it does not taste bland (Koswara, 2009). The use of other ingredients that contain fat in the dough, such as margarine (80% fat content), will also affect the fat content of the bread (Halim & Rahmayuni, 2015, p. 51). Using fat in certain amounts can produce very soft skin. The high-fat content produces very soft skin and has a shortening effect on the bread (Lange & Bogasari Baking Center, 2004).

How do you get a texture that is soft and not sticky? namely, yeast activity is strongly influenced by 4 things, namely temperature and humidity, pH, food source, and liquid (Lamadlauw & Arief, 2004; Suhardjito, 2006; U.S. Wheat Associates, 1983). The results of the ANOVA analysis of the hedonic test for the texture of white bread with the addition of mackerel tuna fish broth showed that there were no significant differences between the treatments for each sample. The results obtained result in a bread structure that is sturdier, less brittle and has a softer texture because the pores are surrounded by gelatinized starch (Wahyuni & Warinangin, 2008). The texture of white bread with the addition of mackerel tuna fish broth is expected to become softer and tender.

Determining the texture of a material proposed by Rampengan et al. (in Duma & Rosniati, 2010, p. 132) is to apply a load to the material, for example by examining marks or finger pressure. Mixing is done by adding the ingredients one by one, not mixing yeast and salt together because salt can inhibit the yeast growth process (Nugroho et al., 2016, p. 12). The ingredients for making white bread with mackerel tuna fish broth are stirred first using a mixer before the liquid ingredients, after they are evenly mixed, water is added to the mixture little by little until it is evenly mixed.

Taste

Taste is influenced by several factors, namely concentration, temperature, and chemical compounds (Winarno, 2008). The taste of white bread can be determined when the bread is consumed. If white bread tastes sweet, sour, bland, or rancid, it can be determined after consumption by the sense of taste. The interrelated properties of bread are aroma and taste (Suhardjito, 2006). To find out the taste of a food product, you can do this by tasting the food directly because the taste can be determined by taste and chemical stimuli that can be received by the taste buds or tongue (Ligo et al., 2017, p. 7). The thicker the concentration of mackerel tuna used, the stronger the taste of the tuna on the white bread. To obtain the strength of the taste of mackerel tuna which is emulsified in broth so that it obtains nutritional value and is delicious, a hedonic test was carried out on the taste of white bread which was added with the addition of mackerel tuna fish broth.

Taste is influenced by several factors, namely concentration, temperature and chemical compounds (Winarno, 2008). The more concentrated the mackerel fish used, the stronger the taste of the mackerel in the white bread. According to Rampengan et al. (in Duma & Rosniati 2010), taste is an important element in the acceptance of food products. Taste can arise due to chemical stimulation received by the taste buds or tongue. If the texture, aroma, and color components are good but the consumer does not like the taste of the food, then the consumer cannot accept the food product. Sometimes added with food additives. Food addictive substances are substances that are added and mixed during food processing to improve quality, including colorings, flavorings, aromas, stabilizers,

anti-oxidants, preservatives, emulsifiers, anti-clumps, whiteners, and thickeners (Winarno, 2008, p. 214).

The average hedonic test results for the taste of white bread with the addition of mackerel tuna fish broth can be seen in FIGURE 3. The results of the hedonic taste test showed that the average taste score for white bread with the addition of 36% mackerel tuna fish broth was 2.8 (not strong), the average taste score for white bread with the addition of 42% mackerel tuna fish broth was 3.53 (rather strong), the average The taste score for white bread with the addition of 48% mackeel tuna fish broth was 4.07 (quite strong). Therefore, when mixing the bread dough with mackerel tuna, salt is added. Salt will inhibit autolysis and decay, where salt has high osmotic pressure which causes plasmolysis in bacterial cell walls. Apart from that, salt also inhibits protein changes due to enzyme activity (Sanger, 2010, p. 40).

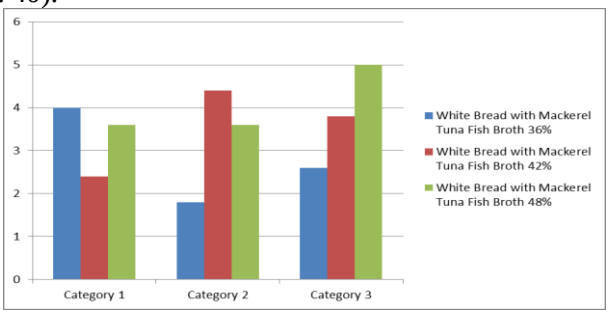

FIGURE 3. Average Hedonic Taste Test Charts of White Bread with added Mackerel Tuna Fish Broth

Aroma

The broth is used as a flavor enhancer and flavoring in food, strengthening the taste of food and adding to the aroma of cooking (Finarti et al., 2018). The resulting aroma does not produce a rancid or fishy odor. The expected result is that the mackerel tuna fish broth produces a clear color, the same as chicken stock and beef stock with the distinctive aroma of sea fish to produce amino acids from mackerel tuna fish. Processing processes including steaming and roasting using hot temperatures can affect the amino acid content of a material. Each type of amino acid has characteristics that are different from each other, as well as the effect of processing on its stability. In general, processing using heat can result in a reduction in the number of amino acids of up to 40% depending on the type of processing, temperature, and length of the processing process (Finarti et al., 2018, p. 46).

To obtain a good aroma from adding mackerel tuna broth to white bread, a hedonic test was carried out on the aroma containing amino acids. The average hedonic test results for the aroma of white bread with the addition of mackerel tuna fish broth can be seen in FIGURE 4, ranging from 2.67 (less strong) to 3.967 (quite strong). The resulting ranging the hedonic test analysis of the aroma of white bread with the addition of mackerel tuna fish broth with different concentrations did not have a significant effect. Because the range of concentrations of the mackerel tuna fish broth used is not too different.

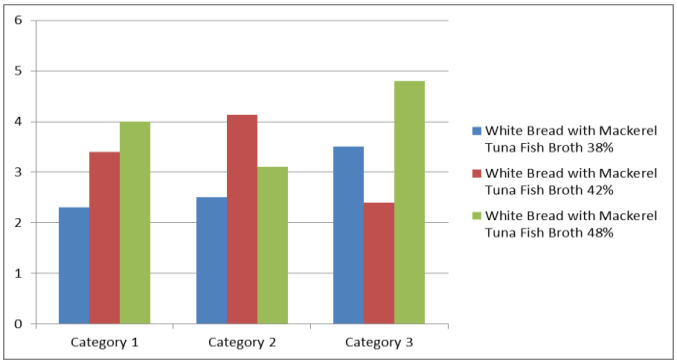

FIGURE 4. Average Hedonic Aroma Test Charts of White Bread with added Mackerel Tuna Fish Broth

Aroma is a compound that easily reaches the human olfactory sensor in gas form (Badewi, 2016). The ingredients used in making white bread will influence the aroma of the resulting white bread (Pusuma et al., 2018). The higher the level of substitution for mackerel tuna fish broth, the lower the value of the aroma of the white bread produced.

This aroma has volatile properties, namely the property of being easily evaporated/smelled by the human sensory sense. Therefore, providing mackerel tuna fish broth in the development of white bread food products uses a low percentage dose. This is because using a high percentage of mackerel tuna fish broth will give a more intense aroma, thereby reducing consumers' preference for the taste of the broth from mackerel tuna fish heads (Pardede et al., 2020, p. 47).

Physical Properties

The physical quality test in the development of white bread food products with mackerel tuna fish broth that was observed was the volume of bread expansion. Bread development is calculated from the volume of the bread dough and the volume of the bread after it is cooked. The following formula calculates bread development.

$$\text{Development volume} = \frac{\text{Initial volume (U1)} - \text{Final volume (U2)}}{\text{Initial volume (U1)}} \times 100\%$$

The initial volume is the volume of bread dough. The final volume is the volume of white bread after it is cooked. Volume is obtained by measuring the length of the mold, the width of the mold, and the height of the dough surface or the top surface of the bread. To calculate the volume of white bread dough, use the bread volume formula: length x width x height. Volume measurements are carried out in two stages, namely after dough development (proofing) and after the bread comes out of the oven.

Development Volume

Good quality bread is characterized by an even distribution of pores (bread cells). Bread pores are holes or air cells found in bread, and are formed during the fermentation or baking process (Kartiwan & Badewi, t.t., p. 43). The fine pores of white bread are formed because air enters the dough and is dispersed in the form of fine bubbles when flour and water are mixed and kneaded (Pusuma et al., 2018, p. 37). To obtain the expansion volume of white bread with tuna broth, the rape seed displacement test method was carried out (Wahyudi, 2004). The average volume of expansion in white bread with the addition of tuna broth can be seen in TABLE 4.

TABLE 4. Average Volume Expansion in White Bread with the Addition of Mackerel Tuna Fish Broth

White Bread with added Mackerel Tuna Fish Broth	Development Volume (%)			
	U1	U2	Total	Average
36%	953.735 cc	736.977 cc	1.690,712 cc	845.356 cc
42%	650.274 cc	693.625 cc	1.343,899 cc	671.950 cc
48%	563.571 cc	650.274 cc	1.213,845 cc	606.923 cc

The results of the analysis of the volume of white bread with the addition of mackerel tuna fish broth showed that the average volume of white bread with the addition of 36% mackerel tuna fish broth was 845,356 cc, the average volume of white bread with the addition of 42% mackerel tuna fish broth was 671,950 cc, the average volume of white bread with the addition of mackerel tuna fish broth by 48% is 606,923 cc. This is because the range of concentrations of the mackerel tuna fish broth used is not too different. The hydrophilic groups in mackerel tuna fish broth can bind water so that the dough becomes heavier and the bread does not rise perfectly. White bread becomes wetter. According to Kumara and Purwani (2017, p. 5), the more substitutes for wheat flour, the greater the amount of gluten in the dough, which will increase the ability of the dough to withstand CO_2 gas, which causes an increase in in in in the volume of swelling in white bread.

Chemical Properties

The chemical quality observed in white bread with the addition of different mackerel tuna fish broths was water content. The water content test was carried out using the gravimetric method. According to Widiarto (2009), the stages carried out in the gravimetric method of water content analysis are as follows.

a. Dry the empty cup and lid in the oven for 15 minutes.
b. Homogenize the sample.
c. Weigh the sample in a cup as much as 5 grams.
d. Oven the sample at 105ºC for 3 hours.
e. After oven, the sample was cooled for 3-4 minutes.
f. Reweigh the sample.
g. Record the sample weight.
h. Re-oven the sample for 30 minutes.
i. Weigh the sample again, and repeat until a constant weight is obtained.
j. Water content calculation uses the formula:

$$\text{Water content} = \frac{\text{Initial weight (U1)} - \text{Final weight (U2)}}{\text{Initial weight (U1)}} \times 100\%$$

Water content

The average water content in white bread with the addition of mackerel tuna fish broth can be seen in TABLE 5. A food product that has a water content of less than 14% can be said to be safe enough to prevent the growth of fungus or mold on food (Winarno, 1992). The water content value can affect the durability or storability of food ingredients. Water content is one of the factors that can cause undesirable changes in the chemical characteristics of a food ingredient (Novianti, 2020; Solihin et al., 2015). The water content of food can also affect the taste, texture and appearance of a food. The water content of food can influence physical properties, chemical properties, damage due to microbiology, as well as enzymatic changes (Nadhifah et al., 2021).

TABLE 5. Average Water Content in White Bread with the Addition of Mackerel Tuna Fish Broth

White bread with added mackerel tuna fish broth	Water content (%)			
	U1	U2	Total	Average
36%	33.230	31.259	64.489	32.244
42%	31.829	33.476	65.305	32.652
48%	32.407	34.052	66.459	33.230

The results of the ANOVA test on the water content of white bread with the addition of different mackerel tuna fish broth show a significance value of 0.751 > 0.05 at the 5% significance level which can be seen in TABLE 6. These results show no significant difference in the water content of white bread with the addition of mackerel tuna fish broth.

TABLE 6. ANOVA Test Results for Water Content of White Bread with Addition of Mackerel Tuna Fish Broth

	Sum of squares	df	Middle squares	F	Sig.
Between groups	.980	2	.490	.316	.751
In groups	4.653	3	1.551		
Total	5.633	5			

In this research, it can be seen that white bread with the addition of mackerel tuna fish broth with different contents has met the quality standard for water content in bread in the Indonesian National Standard (SNI) of a maximum of 40%.

CONCLUSION

The hedonic quality test on the texture of white bread with the addition of mackerel tuna fish broth with percentages of 36%, 42%, and 48% did not show a significant effect. The hedonic quality test on the taste of white bread with the addition of mackerel tuna fish broth with percentages of 36%, 42%, and 48% had a significant effect. The strongest taste of tuna is found in white bread with the addition of mackerel tuna fish broth with a percentage of 48%, which has a score of 3.06 (quite strong). The hedonic quality test on the aroma of white bread with the addition of mackerel tuna fish broth with percentages of 36%, 42%, and 48% did not show a significant effect. The chemical properties of water content in white bread with the addition of mackerel tuna fish broth with percentages of 36%, 42%, and 48% did not have a significant effect. The physical characteristics of the volume of white bread expansion with the addition of mackerel tuna fish broth with percentages of 36%, 42%, and 48% did not have a significant effect.

REFERENCES

Badan Pusat Statistik Kota Bontang. (2018). *Bontang dalam angka 2018*. Badan Pusat Statistik Kota Bontang Provinsi Kalimantan Timur.

Badan Standardisasi Nasional Indonesia (BSNI). (1996). *Standar Nasional Indonesia (SNI)*. Badan Standardisasi Nasional Indonesia (BSNI).

Badewi, A. (2016). The impact of project management (PM) and benefits management (BM) practices on project success: Towards developing a project benefits governance framework. *International Journal of Project Management, 34*(4), 761-778.

Budiman, P. W., & Sudikno, A. (2023). The philosophy of "*makdanakan*" in the community settlement of Bontang Kuala Urban Village, Bontang City. *Arteks: Jurnal Teknik Arsitektur*, *8*(1), 45-60.

Chudori, Z. I. (2020). *Pengaruh penggunaan kaldu ikan tongkol (Euthynnus affinis) terhadap mutu roti tawar*. [Skripsi S1 tidak diterbitkan]. Jurusan Teknologi Industri Fakultas Teknik Universitas Negeri Malang.

Desrosier, N. W. (1988). *Teknologi pengawetan pangan*. Universitas Indonesia Press.

Djunnaidah, I. S. (2017). Tingkat konsumsi ikan di Indonesia: Ironi di negeri bahari. *Jurnal Penyuluhan Perikanan dan Kelautan*, *11*(1), 12-24.

Duma, N., & Rosniati. (2010). Substitusi tepung terigu dengan tepung maizena pada pembuatan pasta. *Dinamika Penelitian BIPA*, *21*(38), 128-135. https://media.neliti.com/media/publications/77352-ID-subtitusi-tepung-terigu-dengan-tepung-ma.pdf.

European Union-Indonesia Business Network (EUIBN). (2016). *Bakery ingredients* (1st ed.). Indonesian Benelux Chamber of Commerce (IBCOC).

Finarti, R., Wahyudi, D., Akbar, M., & Ula, R. (2018). Rendemen dan pH gelatin kulit ikan nila (*Oreochromis niloticus*) yang direndam pada berbagai kosentrasi HCl. *Jurnal Pengolahan Pangan*, *3*(1), 22-27.

Gozali. (2022). Planning of gastronomic tourism destinations in Balikpapan City. *E-Journal of Tourism*, *9*(2), 210-217.

Hafiludin. (2011). Karakteristik proksimat dan kandungan senyawa kimia daging putih dan daging merah ikan tongkol (*Euthynnus affinis*). *Jurnal Kelautan*, *4*(1), 1-10.

Halim, A. A., & Rahmayuni. (2015). Evaluasi mutu roti manis dari tepung komposit (tepung terigu, pati sagu, tepung tempe). *Jurnal Teknologi dan Industri Pertanian Indonesia (JTIPI)*, *7*(2), 48-52.

Hendrasty, H. K. (2013). *Bahan produk bakery*. Graha Ilmu.

Kartiwan, Z. H., & Badewi, B. (t.t.). Metoda pembuatan adonan untuk meningkatkan mutu roti manis berbasis tepung komposit yang difortifikasi rumput laut. *Partner*, *15*(1), 39-47. https://media.neliti.com/media/publications/160506-ID-metoda-pembuatan-adonan-untuk-meningkatk.pdf.

Kittler, P. G., & Sucher K. P. (2004). *Food and culture* (4th ed.). Wadsworth/Thomson Learning.

Kiranawati, T. M., & Chisbiyah, L. A. (2016). *Teknologi pembuatan bakery* (Cet. 1). Jurusan Teknologi Industri Fakultas Teknik Universitas Negeri Malang.

Koswara, S. (2009). *Teknologi pengolahan roti*. (Seri teknologi pangan populer: Teori dan praktek). eBookPangan.com.

Kumara, F. M., & Purwani, E. (2017). Pengaruh substitusi tepung kimpul (*Xanthosomasagittifolium*) terhadap tingkat pengembangan dan daya terima bolu. *Nutri-Sains*, *1*(2), 1-9.

Kusdiantoro, K., Fahrudin, A., Wisudo, S. A., & Juanda, B. (2019). Perikanan tangkap di Indonesia: Potret dan tantangan keberlanjutannya. *Jurnal Sosial Ekonomi Kelautan dan Perikanan*, *14*(2), 145-162.

Laily, P. N. (2019). *Perancangan gallery-resto di pesisir Bontang Kuala dengan pendekatan aristektur organik*. [Skripsi S1 tidak diterbitkan]. Departemen Teknik Arsitektur dan Perencanaan Wilayah dan Kota Fakultas Teknik Universitas Gadjah Mada.

Lamadlauw, F. N., & Arief, A. R. (2004). *Pastry and bakery production*. Graha Ilmu.

Lange, M., & Bogasari Baking Center (BBC). (2004). *Cake & cookies, teori dan resep internasional* (Cet. 1). PT Boga Favorit.

Ligo, H., Kandou, J., & Mamuaja, C. (2017). Pengaruh subtitusi tepung kimpul (*Xnathosoma sagitifolium*) dalam pembuatan roti. *Jurnal Teknologi Pertanian*, *8*(2), 1-11. https://ejournal.unsrat.ac.id/index.php/cocos/article/download/14875/14440.

Nadhifah, A., Kholifatuddin, Y., & Handrasari, E. (2021). Kadar air dan warna penyedap alami jamur tiram (*Pleurotus ostreatus*) berdasarkan perlakuan awal (*Pre-treatment*). *Jurnal Gizi*, *10*(2), 33-41.

Novianti, T. (2020). Kajian pemanfaatan daging ikan kembung sebagai bahan penyedap rasa alami non MSG dengan pendekatan bioekonomi perikanan. *Barakuda 45*, *2*(2), 56-68.

Nugroho, H. I., Dewi, E. N., & Rianingsih, L. (2016). Pengaruh penambahan tepung daging ikan lele dumbo (*Clarias gariepinus*) terhadap nilai gizi roti tawar. *Jurnal Pengolahan & Bioteknologi Hasil Perikanan*, *5*(4), 11-19.

Nurjanah, N., Nurilmala, M., Hidayat, T., & Ginanjar, M. G. (2015). Amino acid and taurine changes of Indian mackarel due to frying process. *International Journal of Chemical and Biomolecular Science*, *1*(3), 163-166.

Pardede, D. E., Febrianti, D., & Putri, R. M. S. (2020). Karakteristik organoleptik *flavor* alami dari kaldu kepala ikan tongkol (*Euthynnus affinis*). *Jurnal Teknologi Pertanian*, *9*(2), 43-52.

Prihartono, S. (2003). *Pengembangan produk nugget berbasis sayuran dengan bahan pengikat tepung beras sebagai pangan fungsional*. [Skripsi S1 tidak diterbitkan]. Departemen Teknologi Pangan dan Gizi Fakultas Teknologi Pertanian Institut Pertanian Bogor (FTP IPB).

Pusuma, D. A., Praptiningsih, Y., & Choiron, M. (2018). Karakteristik roti tawar kaya serat yang di subtitusi menggunakan tepung ampas kelapa. *Jurnal Agroteknologi*, *12*(1), 1-14.

Rahardian, Z. (2010). *Penentuan harga dan kebijakan inventori pada sistem rantai pasok PT. NIS dengan model permainan Stackelberg*. [Skripsi S1 tidak diterbitkan]. Program Studi Teknik Industri Institut Teknologi Bandung.

Rahman, F. (2016a). *Rijsttafel: Budaya kuliner di Indonesia masa kolonial 1870-1942*. PT Gramedia Pustaka Utama.

Rahman, F. (2016b). *Jejak rasa Nusantara: Sejarah masakan Indonesia*. PT Gramedia Pustaka Utama.

Rifhani, N. F. (2019). *Uji protein dan organoleptik penyedap rasa alami komposisi jamur shiitake dan ikan tongkol dengan variasi suhu pengeringan*. [Skripsi S1 tidak diterbitkan]. Program Studi Pendidikan Biologi Fakultas Keguruan dan Ilmu Pendidikan Universitas Muhammadiyah Surakarta.

Rizqiati, H., Nurwantoro, Febrisiantosa, A., Shauma, C. A., & Khasanah, R. (2020). Pengaruh isolat protein kedelai terhadap karakteristik fisik dan kimia kefir bubuk. *Jurnal Pangan dan Agroindustri*, *8*(3), 111-121. https://jpa.ub.ac.id/index.php/jpa/article/view/692/515.

Reynolds, P. C. (1993). Food and tourism: Towards an understanding of sustainable culture. *Journal of Sustainable Tourism*, *1*(1), 48-54.

Sanger, G. (2010). Mutu kesegaran ikan tongkol (*Auxis tazard*) selama penyimpanan dingin. *Warta WIPTEK*, (35), 39-43.

Satuhu, S. (1994). *Penanganan dan pengolahan buah*. Penebar Swadaya.

Solihin, Muhatrudin, & Sutrisna, R. (2015). Pengaruh lama penyimpanan terhadap kadar air kualitas fisik dan sebaran jamur limbah sayuran dan umbi-umbian. *Jurnal Ilmiah Peternakan Terpadu*, *3*(2), 48-54.

Sugianto, F. R., Yogha, S., & Rahmawati, Y. (2017). Manfaat hasil belajar "*Bread*" sebagai kesiapan usahan *bakery* mahasiswa Program Studi Pendidikan Tata Boga. *Jurnal Media Pendidikan, Gizi, dan Kuliner*, *6*(2), 1-12.

Sugiyono. (2014). *Metode penelitian kualitatif, kuantitatif, dan R&D*. CV Alvabeta.

Suhardjito, Y. B. (2006). *Pastry dalam perhotelan*. CV Andi Offshet.

Sultani, Z. I. M., Anastasia, M. S., & Yuliswara, R. R. P. (2020). *Cita rasa kuliner lokal bir pletok sebagai identitas budaya Betawi di Jakarta (1970-2000an)*. [Makalah presentasi[. Prosiding Seminar Nasional Sejarah tanggal 15 Oktober 2019 dengan tema "Sejarah Kehidupan Sehari-hari" di Aula Ki Hadjar Dewantara Lantai 7 I1 Fakultas Ilmu Sosial Universitas Negeri Malang.

Susanti, S. N., & Faridah, A. (2023). Studi komperatif kualitas sensori sus kering daging ikan nila. *Jurnal Pendidikan Tata Boga dan Teknologi (JPTBT), 4*(1), 31-36.

U.S. Wheat Associates. (1983). *Pedoman pembutan roti dan kue*. Djambatan.

Wahyudi. (2004). *Memproduksi roti*. (S. Wijandi, (Ed.)). Bagian Pengembangan Kurikulum Direktorat Pendidikan Menengah Kejuruan, Direktorat Jenderal Pendidikan Dasar dan Menengah Departemen Pendidikan Nasional Republik Indonesia.

Wahyuni, M., & Peranginangin, R. (2008). *Perbaikan daya saing industri pengolahan perikanan melalui pemanfaatan limbah non ekonomis ikan menjadi gelatin*. Departemen Perikanan dan Kelautan Republik Indonesia.

Widiarto, S. (2009). *Kimia analitik 1*. Universitas Lampung Press.