



# Development of Bontang's White Bread with the Use of Mackerel Tuna (*Euthynnus affinis*) Broth

Zulfiqo Ilham Chudori\* and Nunung Nurjanah

Department of Culinary Art and Fashion Education, Faculty of Engineering, State University of Malang

\*Corresponding author: zulfiqo.ilham@gmail.com

## Article History

Received  
29 April 2024

Accepted  
05 October 2024

Published  
25 October 2024

**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 research results showed significant differences in the organoleptic hedonic properties and chemical and physical tests of white bread development.

Keywords: Mackerel tuna, broth, white bread.

## INTRODUCTION

Mackerel tuna fish (*Euthynnus affinis*) is the primary type of marine fish caught in Bontang City. The total tuna catch in 2017 was 1,623.5 tonnes (Bontang City Central Statistics Agency, 2018). The people of Bontang City generally like fresh tuna. Some quality fish that has just been landed/caught from ships in several fishing areas in Indonesia is no longer fresh (Kusdiantoro et al., 2019). Many activities in the sea and coastal areas of Bontang City still need to be appropriately designed. This potential can be used to develop Bontang City itself. The potential for developing the sea coast in Bontang can be seen from the many activities that occur on the coast of Bontang City. These activities include settlements, commerce, docks, conservation areas, tourist attractions in 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 need to be better 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 catching, landing, auctioning, and marketing of fresh fish. Even though the freshness condition of the fish is no longer suitable, some processors generally process the fish into salted or boiled fish products (Hafiludin, 2011). Based on Indonesian food composition data (2018) (in Chudori, 2020), the nutritional content of tuna consists of water, fat, protein, minerals, calcium, vitamin A, and vitamin B. The composition of the nutritional content of mackerel tuna fish is presented in **TABLE 1** below.

**TABLE 1.** Composition of the nutrient content of mackerel tuna fish.

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

Source: Chudori (2020).

The Bontang City people's love of mackerel tuna can be used to make variations in the taste of white bread. Hopefully, this white bread with the taste of mackerel 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). 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). Eating habits can be seen as people's ways and rules of 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 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 acceptable or unacceptable food 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 differ from that in others. 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 unsurprising that the livelihood of coastal communities in Bontang City is to work as fishermen. Boats for the fishing community are essential for 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).

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 (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 an easy product for people to consume because it is durable, easy to carry anywhere, and has a good shelf life. It has a neutral taste and 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 circulating white bread varieties 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, and upper classes (Pusuma et al., 2018)—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 products such as beet sponge cake, vegetables *dorayaki*, wheat bread, and black forest beetroot (European Union-Indonesia Business Network, 2016). Previous research, namely Susanti and Faridah (2023) and Nugroho et al. (2016), discusses using 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 using mackerel tuna (*Euthynnus affinis*) as a local raw material often found in Bontang City, East Kalimantan Province, to make broth and develop white bread products. This research was conducted to create nutritious food and culinary innovations to achieve balanced nutrition using local fish in Bontang City.

Data from Djunnaidah (2017) shows that the temporary figure for fish consumption in 2015 was 41.11 kg per capita per year, slightly exceeding the target the Joko Widodo government set. Therefore, researchers researched 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. This research has practical value in making culinary products by utilizing local fish in Bontang City, contributing to economic development, academic knowledge, and the advancement of local community culture. The problem raised in this research is the changes in the texture, taste, aroma, and water content of 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.

## METHOD

The research design used is experimental research. Experimental research is a method used to find the effect of specific treatments under controlled conditions (Sugiyono, 2014). 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  $p < 0.05$  ( $\alpha = 5\%$ ) or there are differences, then proceed with the DMRT (Duncan's Multiple Range Test) test to determine the differences between each treatment. This test is still within the scope of experimental design on a parametric scale (Chudori, 2020).

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).

Research on making white bread with the addition of mackerel tuna fish stock 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 and physical tests (volume) were conducted 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 must go through several steps, such as 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 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 mixing stage. Mixing the ingredients will produce gluten because there is a reaction of insoluble 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 not letting 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<sub>2</sub> gas, which is slightly acidic, 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 weighed on a digital scale and cut to mix the ingredients evenly, producing a bread dough texture that is not lumpy. The aim is to weigh the bread dough so it is not too heavy and according to the measurements when it is being formed. After weighing and cutting, the dough is then rounded and compacted. Rounding or compacting the dough aims to retain carbon dioxide gas formed during fermentation and make it easier 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 sprinkled with wheat flour to prevent the dough from sticking to the processing table and using a dough molding tool. 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 180-200°C for 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 65°C (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).

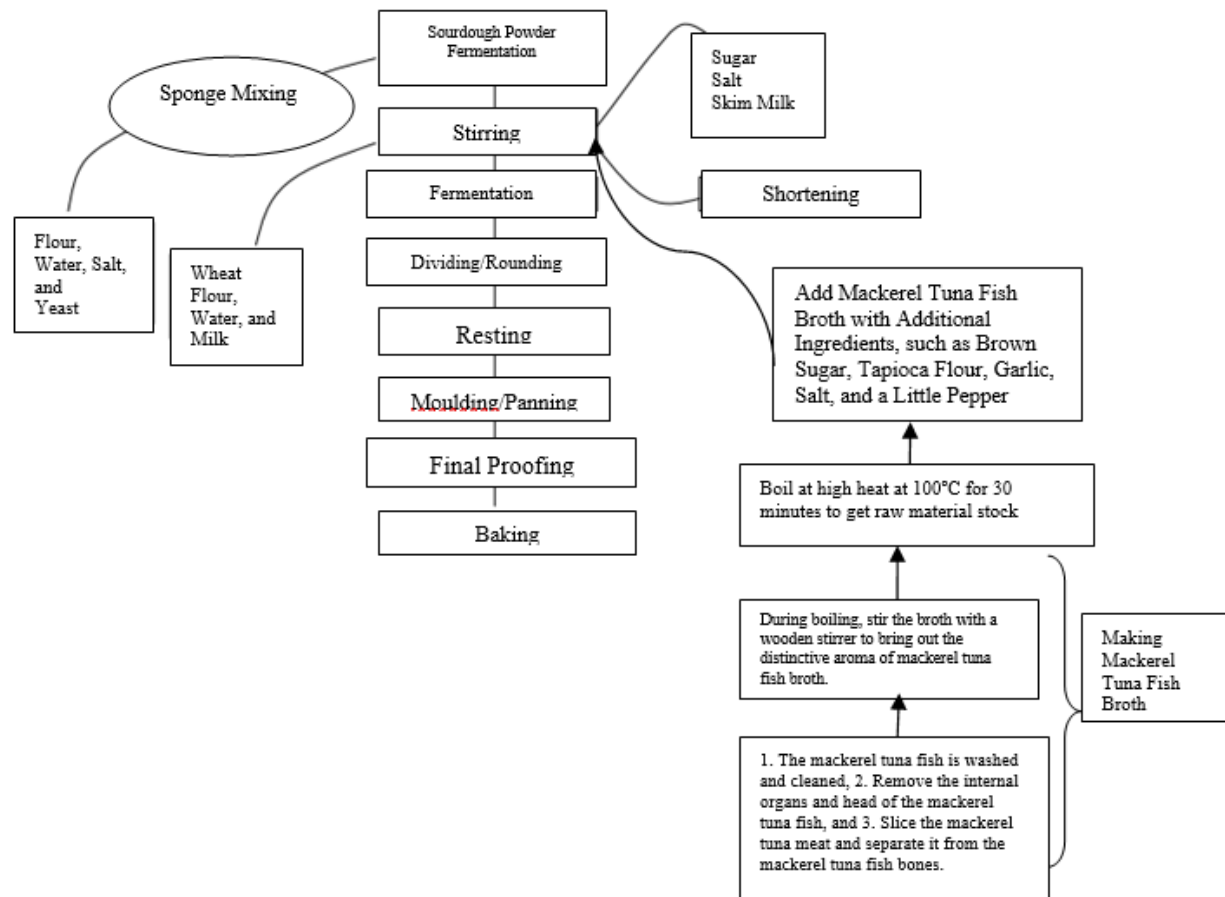
After making the white bread dough in the first part of making the white bread, the researchers made mackerel tuna fish broth in the second part. The broth is used as a flavor enhancer and flavoring in food, strengthening the taste of food and adding to the aroma of cooking (Finarti et al., 2018). The 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 100°C 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 prevents 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 fish. Slice the mackerel tuna meat and separate it from the fish bones.
2. Boiling. Mackerel tuna fish separated from the flesh and bones are boiled with 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 reducing the water, turn off the stove, 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 92-93°C for 3-5 minutes (Prihartono, 2003). Satuhu (1994) states that blanching can be done by immersing the material to be processed in boiling water at a temperature of 82-100°C. 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 material's surface, and expel air from the tissues of the material (Desrosier, 1988). Making white bread with mackerel tuna fish comprises three stages, as seen in **FIGURE 1**.



**FIGURE 1.** Research design and steps.

**FIGURE 1** explains the research design and steps for developing white bread with mackerel tuna fish broth. 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  |
| 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 white bread's taste, aroma, and texture. Organoleptic quality data was obtained from assessments carried out by trained panelists. Panelists were asked to rate the bread under study and then fill in their assessment results in a form. Organoleptic hedonic quality test scores are as in **TABLE 3**.

**TABLE 3.** A 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    |

Source: Author documentation.

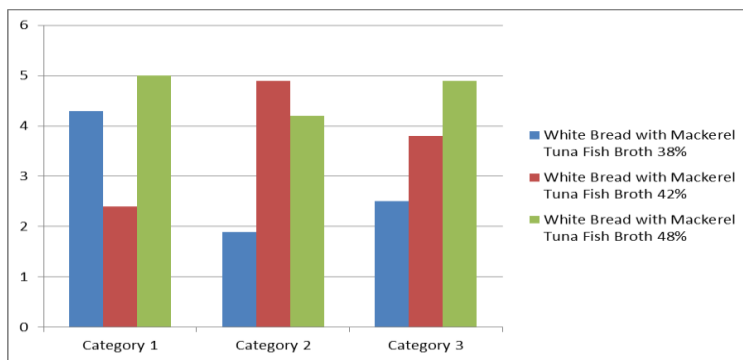
**TABLE 3** shows the hedonic organoleptic quality scores in the scoring test of white bread with the addition of mackerel tuna fish broth. The table can test hedonic organoleptics on texture, taste, and aroma. The hedonic scale can help companies understand the sensory quality of their products, which can help them adjust formulations and set shelf life guidelines (Agustina et al., 2021). Limbé et al. (2019) assessed the use of hedonic organoleptic in prospective food products under development, intending to maintain the quality of various food ingredients used to measure their shelf life and the quality of the ingredients when mixing.

#### Textures

Texture is a sensation of pressure observed with the mouth (when bitten, chewed, and swallowed) or touched with the fingers. Developing white bread products with mackerel tuna fish broth obtain a soft texture and taste. The texture of white bread is influenced by mixing water, salt, sugar, and wheat flour, thus producing gluten during 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). Adding a bread improver of the right size provides a smoother texture (Sugianto et al., 2017).

Gluten in wheat flour has a large water absorption capacity. This water absorption softens and maintains the bread texture's elastic properties (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.



**FIGURE 2.** Average hedonic texture test chart of white bread with added mackerel tuna fish broth.

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).

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. The dough can expand to an optimum point, which causes the gluten to be pulled or contracted (Hendrasty, 2013). Apart from that, in this research, you can use fat such as margarine to ensure that the texture of white bread with mackerel tuna fish broth produces a soft texture of white bread crust.

Using fat in specific amounts can produce very soft skin. High-fat content produces soft skin and shortens 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. It is also a very effective source of energy compared to carbohydrates and protein (Finarti et al., 2018; 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). Using 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). Using fat in specific amounts can produce very soft skin. The high-fat content produces soft skin and shortens 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 four things, namely temperature and humidity, pH, food source, and liquid (Lamadlaw & 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 no significant differences between the treatments for each sample. The results obtained resulted 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.

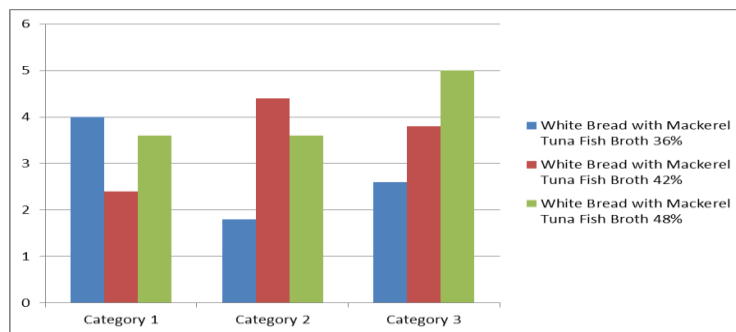
Determining the texture of a material proposed by Rampengan et al. (in Duma & Rosniati, 2010) is to apply a load to the material, for example, by examining marks or finger pressure. Mixing is done by adding the ingredients individually, not mixing yeast and salt, because salt can inhibit the yeast growth process (Nugroho et al., 2016). 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). The thicker the concentration of mackerel tuna used, the stronger the taste of the mackerel 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 essential element in the acceptance of food products. Taste can arise due to chemical stimulation from 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. They are sometimes added with food additives.

Food-additive 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). 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**.



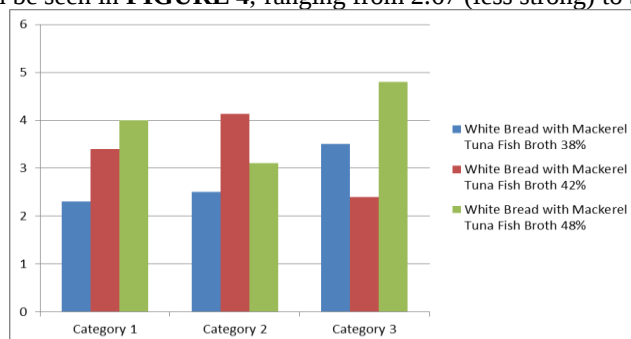
**FIGURE 3.** Average hedonic taste test charts of white bread with added mackerel tuna fish broth.

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% mackerel tuna fish broth was 4.07 (quite strong). Therefore, salt is added to the bread dough with mackerel tuna. 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).

## 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 transparent color, like chicken stock and beef stock, with the distinctive aroma of seafood to produce amino acids from mackerel tuna. Processing processes, including steaming and roasting using hot temperatures, can affect the amino acid content of a material. Each type of amino acid has different characteristics and the effect of processing on its stability. In general, processing using heat can reduce the number of amino acids by up to 40% depending on the type of processing, temperature, and length (Finarti et al., 2018).

To obtain a pleasing 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).



**FIGURE 4.** Average hedonic aroma test charts of white bread with added mackerel tuna fish broth.

Based on **FIGURE 4**, the results of the hedonic test analysis of the aroma of white bread with the addition of different concentrations of mackerel tuna fish stock did not significantly affect the aroma of white bread. Because the range of concentrations of the mackerel tuna fish broth used is similar. Aroma is a compound that quickly 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 substitution level 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 quickly evaporated/smelled by the human sensory sense. Therefore, providing mackerel tuna fish broth in developing 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, reducing consumers' preference for the taste of the broth from mackerel tuna fish heads (Pardede et al., 2020).

## Physical properties

The observed physical quality test in the development of white bread food products with mackerel tuna fish broth was the volume of bread expansion. Bread development is calculated from the bread dough's volume and the bread's volume 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: 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 formed during fermentation or baking (Kartiwan & Badewi, t.t.). The delicate pores of white bread are formed because air enters the dough and is dispersed in fine bubbles when flour and water are mixed and kneaded (Pusuma et al., 2018). To obtain the expansion volume of white bread with mackerel 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 mackerel 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 |

Source: Author documentation.

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 is similar. The hydrophilic groups in mackerel tuna fish broth can bind water, so the dough becomes heavier, and the bread does not rise ideally. White bread becomes wetter. According to Kumara and Purwani (2017), 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<sub>2</sub> gas, which causes an increase 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 using the gravimetric method of water content analysis are as follows.

- Dry the empty cup and lid in the oven for 15 minutes.
- Homogenize the sample.
- Weigh the sample in a cup as much as 5 grams.
- Oven the sample at 105°C for 3 hours.
- After the oven, the sample was cooled for 3-4 minutes.
- Reweigh the sample.
- Record the sample weight.
- Re-oven the sample for 30 minutes.
- Weigh the sample again and repeat until a constant weight is obtained.
- 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 mackerel tuna fish broth can be seen in **TABLE 5**. A food product with less than 14% water can be safe enough to prevent fungus or mold growth in 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 its taste, texture, and appearance. The water content of food can influence physical properties, chemical properties, damage due to microbiology, and 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  |

Source: Author documentation.

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  |                |      |      |

Source: Author documentation.

This research shows 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%. Developing Bontang City signature white bread product with mackerel tuna fish stock can increase the potential for commercial application for local communities to meet nutritional needs. The potential for commercial application is the development of white bread products using mackerel tuna fish stock that can be sold in stalls at affordable prices.

## 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 mackerel 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.

From the results of the quality of the texture of white bread, testing the water content of white bread given mackerel tuna fish stock, and testing the physical characteristics of the volume of white bread given mackerel tuna stock, it has become a commercial potential for local communities so that the development of white bread products with mackerel tuna stock can increase income for the local community of Bontang City. This research contributes to academic knowledge and the development of the local economy and culture that utilizes the availability of local fish in Bontang City, East Kalimantan Province.

Contributions in the field of economic development in the form of white bread products with mackerel tuna fish broth from this development can meet nutritional needs and increase the income of local communities. The contribution to academic knowledge is the development of white bread with mackerel tuna fish broth, which provides benefits for creating nutritious food and culinary innovation using local fish. In addition, the development of white bread with mackerel tuna fish broth contributes to the advancement of local culture, making this product a typical cuisine of Bontang City, East Kalimantan Province.

## REFERENCES

1. Agustina, R., Fadhil, R., & Mustaqimah. (2021). Organoleptic test using the hedonic and descriptive methods to determine the quality of *Pliek U*. *IOP Conference Series: Earth and Environmental Science*, 644, 1-5. <https://iopscience.iop.org/article/10.1088/1755-1315/644/1/012006/pdf>.
2. Badan Pusat Statistik Kota Bontang. (2018). *Bontang dalam angka 2018*. Badan Pusat Statistik Kota Bontang Provinsi Kalimantan Timur.
3. Badan Standardisasi Nasional Indonesia (BSNI). (1996). *Standar Nasional Indonesia (SNI)*. Badan Standardisasi Nasional Indonesia (BSNI).
4. 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.

5. 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.
6. 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.
7. Desrosier, N. W. (1988). *Teknologi pengawetan pangan*. Universitas Indonesia Press.
8. Djunaidah, I. S. (2017). Tingkat konsumsi ikan di Indonesia: Ironi di negeri bahari. *Jurnal Penyuluhan Perikanan dan Kelautan*, 11(1), 12-24.
9. 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-substitusi-tepung-terigu-dengan-tepung-ma.pdf>.
10. European Union-Indonesia Business Network (EUIBN). (2016). *Bakery ingredients* (1<sup>st</sup> ed.). Indonesian Benelux Chamber of Commerce (IBCO).
11. Finarti, R., Wahyudi, D., Akbar, M., & Ula, R. (2018). Rendemen dan pH gelatin kulit ikan nila (*Oreochromis niloticus*) yang direndam pada berbagai konsentrasi HCl. *Jurnal Pengolahan Pangan*, 3(1), 22-27.
12. Gozali. (2022). Planning of gastronomic tourism destinations in Balikpapan City. *E-Journal of Tourism*, 9(2), 210-217.
13. Hafiludin. (2011). Karakteristik proksimat dan kandungan senyawa kimia daging putih dan daging merah ikan tongkol (*Euthynnus affinis*). *Jurnal Kelautan*, 4(1), 1-10.
14. Halim, A. A., & Rahmayuni. (2015). Evaluasi mutu roti manis dari tepung komposit (tepung terigu, pati sagu, tepung tempe). *Jurnal Teknologi dan Industri Pertanian Indonesia (JTPI)*, 7(2), 48-52.
15. Hendrasty, H. K. (2013). *Bahan produk bakery*. Graha Ilmu.
16. 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>.
17. Kittler, P. G., & Sucher K. P. (2004). *Food and culture* (4<sup>th</sup> ed.). Wadsworth/Thomson Learning.
18. Kiranawati, T. M., & Chisbiyah, L. A. (2016). *Teknologi pembuatan bakery* (Cet. 1). Jurusan Teknologi Industri Fakultas Teknik Universitas Negeri Malang.
19. Koswara, S. (2009). *Teknologi pengolahan roti*. (Seri teknologi pangan populer: Teori dan praktek). eBookPangan.com.
20. Kumara, F. M., & Purwani, E. (2017). Pengaruh substitusi tepung kimpul (*Xanthosomasagittifolium*) terhadap tingkat pengembangan dan daya terima bolu. *Nutri-Sains*, 1(2), 1-9.
21. 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.
22. Laily, P. N. (2019). *Perancangan gallery-resto di pesisir Bontang Kuala dengan pendekatan arsitektur organik*. [Skripsi S1 tidak diterbitkan]. Departemen Teknik Arsitektur dan Perencanaan Wilayah dan Kota Fakultas Teknik Universitas Gadjah Mada.
23. Lamadlauw, F. N., & Arief, A. R. (2004). *Pastry and bakery production*. Graha Ilmu.
24. Lange, M., & Bogasari Baking Center (BBC). (2004). *Cake & cookies, teori dan resep internasional* (Cet. 1). PT Boga Favorit.
25. Ligo, H., Kandou, J., & Mamujaja, C. (2017). Pengaruh substitusi 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>.
26. Limbé, S. S., Mile, L., & Yusuf, N. (2019). Hedonic quality analysis of flour-based longgi brownies cake substituted with tilapia. *Nikè: Jurnal Ilmiah Perikanan dan Kelautan*, 7(4), 82-87.
27. 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.
28. 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.
29. 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.
30. Nurjanah, N., Nurilmala, M., Hidayat, T., & Ginanjar, M. G. (2015). Amino acid and taurine changes of Indian mackerel due to frying process. *International Journal of Chemical and Biomolecular Science*, 1(3), 163-166.

31. 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.
32. 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).
33. Pusuma, D. A., Praptiningsih, Y., & Choiron, M. (2018). Karakteristik roti tawar kaya serat yang di substitusi menggunakan tepung ampas kelapa. *Jurnal Agroteknologi*, 12(1), 1-14.
34. 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.
35. Rahman, F. (2016a). *Rijsttafel: Budaya kuliner di Indonesia masa kolonial 1870-1942*. PT Gramedia Pustaka Utama.
36. Rahman, F. (2016b). *Jejak rasa Nusantara: Sejarah masakan Indonesia*. PT Gramedia Pustaka Utama.
37. 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.
38. 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>.
39. Reynolds, P. C. (1993). Food and tourism: Towards an understanding of sustainable culture. *Journal of Sustainable Tourism*, 1(1), 48-54.
40. Sanger, G. (2010). Mutu kesegaran ikan tongkol (*Auxis tazard*) selama penyimpanan dingin. *Warta WIPTEK*, (35), 39-43.
41. Satuhu, S. (1994). *Penanganan dan pengolahan buah*. Penebar Swadaya.
42. 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.
43. Sugianto, F. R., Yogha, S., & Rahmawati, Y. (2017). Manfaat hasil belajar “Bread” sebagai kesiapan usaha bakery mahasiswa Program Studi Pendidikan Tata Boga. *Jurnal Media Pendidikan, Gizi, dan Kuliner*, 6(2), 1-12.
44. Sugiyono. (2014). *Metode penelitian kualitatif, kuantitatif, dan R&D*. CV Alvabeta.
45. Suhardjito, Y. B. (2006). *Pastry dalam perhotelan*. CV Andi Offshet.
46. 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.
47. 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.
48. U.S. Wheat Associates. (1983). *Pedoman pembuatan roti dan kue*. Djambatan.
49. 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.
50. 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.
51. Widiarto, S. (2009). *Kimia analitik 1*. Universitas Lampung Press.
52. Wijaya, S. (2019). Indonesian food culture mapping: A starter contribution to promote Indonesian culinary tourism. *Journal of Ethnic Foods*, 6(3), 1-10.
53. Winarno, F. G. (2008). *Kimia pangan dan gizi*. PT Gramedia Pustaka Utama.