Banana blossom addition to increase food fiber in tuna (Thunnus sp.) floss product as functional food for degenerative disease’s patient

Hardoko1,2, E Suprayitno1,2, T D Sulistiyyati1,2, B B Sasmito1,2, A Chamidah1,2, M A P Panjaitan1,2, J E Tambunan1,2,3, H Djamaludin1,2,

1Fisheries Products Technology, Faculty of Fisheries and Marine Science, Universitas Brawijaya, Malang City, Indonesia.
2Research Group D’FISPRO (Development of Fishery Product)
3Corresponding Author: jenyetambunan@ub.ac.id

Abstract. Tuna (Thunnus sp.) is a high-economic fish that is most sought after in the Indonesian seas. Tuna has good nutrition for the human body, content such as high protein, vitamin and mineral content, and has a delicious taste, so this fish can be diversified. One of the products is fish floss that can be used as functional food. This study aims to determine: (1) determine effect of banana blossom addition in fish floss to organoleptic parameter (2) determine effect of banana blossom addition in fish floss to peroxide value and water content. The method used in this study is an experimental method with an experimental design in the form of a simple Completely Randomized Design (CRD). The independent variables in this study were the concentration of banana blossom 30%, 50%, and 70% while the dependent variables were organoleptic, water content and peroxide value. The best fortification of banana blossom is 70% with organoleptic score of appearance 5.178; scent 4.922; texture 5.078; and taste 4.944. The peroxide value in the tuna floss product with 70% banana blossom concentration is 0.578 meq/kg and water content 13.33%.

1. Introduction
Tuna (Thunnus sp.) is one of the high value economic fish which is important to fulfill domestic and international markets as a source of foreign exchange. This fish is commonly consumed by many countries in the world. Countries that consume a lot of tuna are Japan, the United States, Saudi Arabia and the European Union [1]. Tuna is an Indonesian marine product that has a fairly large production level, reaching 293,233 tons [2]. This fish is usually consumed as fresh fish, whereas large pelagic fish can increase the economic value of tuna by processing tuna products [3]. Tuna has a high protein content. The protein value in tuna is 81.65%. In addition to protein, tuna has high omega 3 fatty acids, namely eicosapentanoic acid (EPA) of 1.17% and docosahexaenoic acid (DHA) of 8.82% [4]. With the high protein content, tuna can be processed into diversified products in the food sector such as sausages, dumplings, nuggets and fish floss.

Fish floss Product is one of the diversified fishery products made from processed fish meat that is seasoned, which is usually processed by boiling and frying. This product has a soft shape, good taste, distinctive smell and has a relatively long shelf life. To provide good quality fish floss products, it is necessary to combine the right raw materials and additives. Additional ingredients provided in the processing of this fish floss product are shallots, garlic, bay leaves, lime leaves, pepper and coconut milk [5]. This fish floss product can be consumed by all ages. The value of the content of tuna floss according to [6], has a protein content value of 43.5%, which means that the value of the protein content exceeds the minimum protein limit of 30%. However, with the value of protein content in this tuna floss fish product, it can be developed as a food product that can be consumed by the community by adding nutritional elements and also being used as a functional food product.

Functional food is a food product that is healthy, beneficial and affects one or more functions in the body beyond the effects of nutrition that can improve health and well-being or reduce disease that is consumed as a normal diet. In general, functional food not only provides essential nutrients for the body, but can also provide a protective effect on the body, even a healing effect against several disease disorders [7]. The nature of this functional food is determined by the bioactive components contained therein, such as...
fructooligosaccharides (FOS), antioxidants, inulin, and dietary fiber [8]. This can encourage consumers, especially people with degenerative diseases, to consume functional food products with bioactive dietary fiber. Dietary fiber consists of polysaccharides (complex carbohydrates) that can make up plant cell walls. In the digestive tract, fiber is not digested because the human body is not equipped with enzymes that can digest fiber, so fiber does not provide much nutritional value for the body, but the function of fiber is very important for the body [9]. In general, humans are advised to consume dietary fiber of 25-30 grams/day, while the average Indonesian population consumes fiber 10.5 grams/day. The impact of low fiber intake can cause metabolic disorders and trigger degenerative diseases such as obesity, hypercholesterolemia, cancer and diabetes [10]. Sources of dietary fiber are found in fruits, nuts, and vegetables. Vegetables that have good fiber content, one of which is banana blossom, which is able to launch the body's digestive system, control body weight and bind blood fat and cholesterol [11].

Banana blossom is one part of the banana plant that is very underutilized, usually banana blossom is used as a vegetable only. Whereas in addition to the price of banana blossoms which tend to be economically low, this vegetable has good health benefits. The nutritional content of banana blossoms is very good, according to [12], mentioning that banana blossoms can reduce several diseases, such as diabetics can also consume banana blossoms because of their low glycemic index (GI). The content in this banana blossom can facilitate digestion and bind fat and cholesterol to be removed with feces. Banana blossom has the advantage of being a source of anthocyanins, besides that banana blossom contains protein, phosphorus, minerals, calcium, vitamin B1, vitamin C and high fiber content. Energy in banana blossom 31 kcal, carbohydrates 7.1 g, protein 1.2 g, fat 0.3 g, mineral phosphorus 50 mg, calcium 30 mg, and iron and vitamins such as beta carotene pro vitamin A, vitamin B1 0, 05 mg and Vitamin C 10 mg. An important component of banana blossom is dietary fiber that is beneficial for health, namely 1) it can slow down the speed of digestion in the intestines, so that the flow of energy into the body remains, 2) provides a longer feeling of fullness, 3) slows the appearance of blood sugar (glucose), so that less insulin is needed to convert glucose into energy, 4) helps control body weight by slowing the emergence of hunger [13]. The nutritional and fiber content in banana blossoms, which have quite a lot of benefits for the health of the body, allows it to be used as an ingredient that can be added to increase the nutritional value of dietary fiber, which is commonly referred to as fortification. One of them is processed into daily food preparations, such as stir-fried banana blossoms which are added to processed tuna floss products. Based on this, an analysis of the water content and peroxide value was carried out so that it can be used as functional food for patients with degenerative diseases.

2. Materials and methods
The study conducted to obtain the best concentration of tuna fish (Thunnus sp.) floss products with the addition of banana blossom. The result of the best concentration of banana blossom from the previous study is 50% [14] were used as the basis for the study. In this study, the test parameters carried out included analysis of organoleptic, peroxide value and water content. The formulations of making tuna fish floss products modified by [14] can found at Table 1. The procedure for making tuna fish floss products with the addition of banana blossom can be seen in Figure 1.

Table 1. Formulation of making tuna fish floss products

| Ingredients              | Formula | F1 (30%) | F2 (50%) | F3 (70%) |
|--------------------------|---------|----------|----------|----------|
| Thunnus sp. (g)          | 500     | 500      | 500      |
| Banana Blossom (g)       | 150     | 250      | 350      |
| Garlic (g)               | 22      | 22       | 22       |
| Onion (g)                | 42      | 42       | 42       |
| Coriander Powder (g)     | 8       | 8        | 8        |
| Sugar (g)                | 42      | 42       | 42       |
| Salt (g)                 | 33      | 33       | 33       |
| Turmeric (g)             | 20      | 20       | 20       |
| Galangal (g)             | 50      | 50       | 50       |
| Bay Leaf (g)             | 5       | 5        | 5        |
| Lemongrass (g)           | 38      | 38       | 38       |
| Lime Leaves (g)          | 3       | 3        | 3        |
| Cooking Oil (L)          | 2       | 2        | 2        |
| Coconut Milk (mL)        | 50      | 50       | 50       |
The test parameters carried out in main study include organoleptic, peroxide value and water content.

2.1. Organoleptic
Organoleptic test is a sensory assessment used to assess the quality of a product. In this study, the organoleptic test used was the hedonic test. The hedonic test is an organoleptic test that is carried out to determine the response of the panelists to the likes and dislikes of the product being tested. The preference level of the panelist was determined using a hedonic scale. In this test, the hedonic scale used is between 1-7, where 1 = very dislike, 2 = dislike, 3 = slightly dislike, 4 = neutral, 5 = somewhat like, 6 = like and 7 = like very much. Hedonic testing in main study using 30 panelists was untrained. This is based on research conducted by [15], which used 30 panelists untrained in the organoleptic test.

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| Process | Description |
|---------|-------------|
| Banana blossom (	extit{Musa balbisiana}) | Steamed banana blossom for 15 minutes | Blend banana blossom into small pieces |
| | Tuna fish (Tunnus sp.) | Steamed tuna fish meat for 30 minutes | Chop the tuna fish meat into small pieces |
| | | | Tuna fish weighing 500 grams |
| | | | Cook until boiling (5 minutes) |
| | | | Filter and throw the water |
| | | | Fry for 15 minutes until golden brown |
| | | | Drain with spinner |
| | | | Final Tuna fish floss Product |
| | | | Tasted for organoleptic, peroxide value and water content |

**Figure 1.** The processing of making tuna fish product on main study
2.2. Peroxide value

The peroxide value was determined using the following procedure. The first step was to take 2000 mg of the sample in the form of fish floss, then put it in a 250 mL Erlenmeyer and add 30 mL of a solvent mixture of acetic acid and chloroform, then cover with aluminum foil and homogenize it. After that, added 5 mL of saturated KI and homogenized, then add 30 mL of aquadest and homogenized again. Then add 5 mL starch indicator solvent, then titrate using 0.1 N sodium thiosulfate (Na$_2$S$_2$O$_3$) for constantly and homogenize until the blue color disappears. To determine peroxide value can use the formula:

$$\text{Peroxide Value} = \frac{\text{Titration Volume} \times N \times [\text{Na}_2\text{S}_2\text{O}_3]}{\text{Sample Weight (mg)}} \times 1000$$

2.3. Water content

Analysis of water content can be done using drying in the oven, with the following procedure. The first step oven is conditioned at 105°C until the condition stable. Then put the empty weighing bottle into oven for 2 hours. After that, the empty weighing bottle was transferred to desiccator for 30 minutes until it reached room temperature. Empty weighing bottles are weighed as the value of empty weight (A). After that, add sample of fish floss 2 g into weighing bottle, then weigh as the value of the weight for weighing bottle and sample (B). The weighing bottle filled with sample was put into oven at 105°C for 24 hours. The last step, the weighing bottle was transferred to desiccator and allowed to stand for 30 minutes, then weighed as the value of weight for weighing bottle and sample after being in the oven (C). To determine water content can use the formula:

$$\% \text{Water Content} = \frac{B - C}{B - A} \times 100\%$$

Description:
A = empty weighing bottle (g)
B = weighing bottle and sample before oven (g)
C = weighing bottle and sample after oven (g)

2.4. Statistical analysis

The research data were then analyzed using the SPSS 23. Result Data from organoleptic test were analyzed using the Kruskal Wallis test at level of 5%. To get the best treatment of all parameters, it was analyzed using the de Garmo method. Result data from peroxide value and water content continue with Tukey’s further test to showed that there were significant differences between treatments.

3. Results and discussion

3.1 Organoleptic

The treatment of adding banana blossom to fish floss with concentrations of 30%, 50% and 70% of the weight of tuna refers to the research of Hardoko et al. [14]. The concentrations used in previous studies were 10%, 20%, 30%, 40% and 50% with the best treatment results being 50%. To determine the best treatment from the addition of banana blossom to fish floss using a hedonic test with 30 panelists. The results of the hedonic test were then processed with kruskal Wallis SPSS 23. Based on the results of statistical tests, the results were not significantly different (P-Value>0.05) for the appearance and scent parameters, and the results were significantly different (P-Value<0.05) for the parameters. texture and taste. The best formula results based on these four parameters were a concentration of 70% with an appearance value of 5.178; fragrance 4.922; texture 5.078; taste 4.944 and with an overall acceptance of 5.233. Organoleptic characteristics of fish floss with the addition of banana blossom can be seen in Table 2.

| Banana Blossoms | Appearance | Scent | Taste | Texture | Overall |
|-----------------|------------|-------|-------|---------|---------|
| 0               | 5.022±1.190$^a$ | 4.789±1.311$^a$ | 4.978±1.349$^{ab}$ | 5.3±1.336$^a$ | 5.278±1.263$^a$ |
| 30              | 4.7±1.517$^a$  | 4.656±1.431$^a$ | 5.022±1.151$^{ab}$ | 4.767±1.477$^b$ | 4.811±1.332$^b$ |
| 50              | 5.044±1.160$^b$ | 4.911±1.002$^b$ | 4.622±1.097$^b$ | 4.644±1.211$^b$ | 4.944±1.053$^{ab}$ |
| 70              | 5.178±1.176$^{ab}$ | 4.922±1.201$^a$ | 5.078±1.052$^a$ | 4.944±1.360$^{ab}$ | 5.233±1.102$^{ab}$ |
Based on the results of the Kruskal Wallis test, the addition of banana blossom to fish floss had no significant effect (P-Value> 0.05) on appearance parameters. The highest appearance value was found at a concentration of 70% at 5.178 and the lowest value was found at a concentration of 30% at 4.7. This shows that the panelists have almost the same level of preference for the appearance of all concentrations of banana blossom addition. The appearance of the entire concentration of the addition of the banana blossom is brown. There was no significant difference in the color of fish floss because all samples of fish floss underwent the same processing process, namely deep frying. Where the frying process can change the color of the fish flesh and banana blossom to brown.

Based on the results of the Kruskal Wallis test, the addition of banana blossom to fish floss had no significant effect (P-Value> 0.05) on the scent parameters. The highest scent value was found at a concentration of 70% at 4.922 while the lowest value was found at a concentration of 30% at 4.656. This shows that the panelists have almost the same level of preference for the scent of all concentrations of banana blossom addition. The increase in the addition of banana blossoms did not affect the scent of fish floss. This indicates that the scent of the tuna is strong enough to cover the scent of the banana blossom.

Based on the results of the Kruskal Wallis test, the addition of banana blossom to fish floss had a significant effect (P-Value <0.05) on texture parameters. The highest texture value was found at a concentration of 70% of 5.078. This shows that this product is somewhat favored by the panelists. While the lowest value was found at a concentration of 50% of 4.622. Panelists had a neutral preference for the product at this concentration. Concentrations of 0%, 30% and 70% have a higher acceptance rate than the concentration of 50%. This shows that the panelists liked the shredded texture at all concentrations except 50%. Banana blossom increases the fibrous texture of fish floss, because in general, fish floss is less fibrous.

Based on the results of the Kruskal Wallis test, the addition of banana blossom to fish floss had a significant effect (P-Value <0.05) on the taste parameters. The highest taste value was found at a concentration of 70% at 4.944. This shows that this product is somewhat favored by the panelists. While the lowest value was found at a concentration of 50% of 4.644. Panelists had a neutral preference for the product at this concentration. Concentrations of 0% and 70% have a higher acceptance rate than concentrations of 30% and 50%. This shows that the panelists prefer the shredded taste at concentrations except 0% and 70%. This taste is caused by the addition of spices in the manufacture of fish floss.

Based on the results of the Kruskal Wallis test, the highest overall acceptance value was found at a concentration of 70% at 5.233. This shows that this product is somewhat favored by the panelists. While the lowest value was found at a concentration of 30% of 4.811. Panelists had a neutral preference for the product at this concentration. Banana flower concentrations of 0% and 70% had a higher acceptance rate than concentrations of 30% and 50%. But overall the data shows that the panelists can well accept all fish floss products in terms of appearance, texture, scent and taste. This can be seen from the overall acceptance value ranging from 4.811-5.278 where this value indicates that the panelists prefer fish floss with the addition of banana blossom.

Fortification of banana blossom into food products can affect the sensory and acceptability. Previous research related to the quality of fish floss with banana blossom as the main ingredient and the results can be concluded that the use of banana blossom in making shredded is included in the good category [16]. Shredded banana chicken meat has a good acceptability [17]. A similar study related to banana blossom fortification in the manufacture of fish floss from small tuna (Euthynnus affinis) was also conducted by Kartikaningsih et al. [18]. The results of the sensory evaluation, the sample added with banana flower significantly increased the acceptability for all the assessed attributes. So from this research, banana blossom can be used as a fortificant in the manufacture of fish floss.

3.2 Peroxide value

Based on the results of the study, the peroxide value in fish floss with the addition of concentrations of 0%, 30%, 50% and 70% banana blossom was 0.59 meq/kg; 0.45 meq/kg; 0.74 meq/kg; and 0.58 meq/kg. The results of the ANOVA test (P-Value> 0.05) showed that there was no significant effect of the concentration of the addition of banana blossom on the peroxide value of fish floss. The best value for peroxide value is found in the treatment with the addition of 30% banana flower concentration, which is 0.45 meq/kg. However, there was no significant difference in the treatment of 30%, 50% and 70% for the peroxide number. The maximum limit of peroxide value according to the Indonesian National Standard [19] is 1 mg/kg, therefore all treatments still meet the standard of peroxide value. The peroxide value of fish floss can be seen in Figure 2.
The peroxide value is an index of the amount of fat or oil that has been oxidized. The peroxide value is very important for the identification of the oxidation state of the oil. Oils containing unsaturated fatty acids can be oxidized by oxygen to produce a peroxide compound [20]. In addition to causing a rancid odor, free radicals can also be formed due to oxidation which has the effect of damaging cells and body tissues. This is because free radicals are highly reactive [21].

In this study, the 30% treatment had a lower peroxide value than the other treatments and increased gradually in the 50% and 70% treatments. A high peroxide value indicates that the oil has been oxidized. The 30% treatment was fried the first time so that the condition of the oil was still good (not oxidized) while in the second and third fryers, 50% and 70% of the oil had been oxidized. According to [22] the low peroxide value can be caused by the rate of formation of new peroxides is smaller than the rate of degradation into other compounds.

The results of the analysis of the peroxide number tend to increase, with more repetitions of frying. This is an indicator that the oil has undergone oxidation and hydrolysis during frying. The number of peroxides at a certain limit will give an undesirable scent, even a negative effect on human health. [21] stated that the occurrence of oxidation resulted in a rancid odor in oils and fats. Oxidation begins with the formation of peroxides and hydroperoxides. The next stage is the breakdown of fatty acids accompanied by the conversion of hydroperoxides into aldehydes and ketones and free fatty acids.

### 3.3. Water content

Based on the results of the study, the water content in fish floss with the addition of a banana flower concentration of 0%, 30%, 50% and 70% was 8.33%; 26.67%; 23.33%; and 13.33%. The results of the ANOVA test (P-Value>0.05) showed that there was no significant effect of increasing the concentration of banana blossom on the water content of fish floss. The best water content value was found in the treatment with the addition of 0% and 70% banana flower concentrations, namely 8.33% and 13.33%, respectively. However, no significant difference was found in the 30% and 50% water content treatments. The maximum water content limit value according to SNI [19] is 7%, therefore all treatments still meet the quality requirements. The water content of fish floss can be seen in Figure 3.
Water is an important component in food, because it can affect the acceptability, appearance, freshness, texture and taste of food. The increase in water content in foodstuffs can cause damage, both due to chemical reactions and the growth of spoilage microbes [23]. High water content can cause the product to be more easily damaged, due to the presence of destructive microorganisms that utilize the amount of water in the product for growth [24]. The water content in the resulting floss is influenced by the processing process, namely at the frying stage, because the water contained in the ingredients evaporates or comes out when the ingredients are fried. This is because the free water contained in the material is directly evaporated by the heat of the pan and oil as an intermediary medium, so that some of the free water contained in the material network can evaporate or be reduced [25]. The increase in the percentage of substitution of banana blossom into floss reduces the water content of the floss. This indicates that the banana blossom facilitates the drying process of floss which is thought to be related to the increased fiber (carbohydrate) content in the banana blossom. The addition of salt and sugar can also reduce the water content in fish floss, because salt and water have water binding properties in food ingredients.

4. Conclusion
The best fortification of banana blossom is 70% with organoleptic score of appearance 5.178; scent 4.922; texture 5.078; and taste 4.944. The peroxide value in the tuna floss product with 70% banana blossom concentration is 0.578 meq/kg and water content 13.33%.

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