

The Effect Of Using Meat And Bones Of Ribbonfish (Trichiurus Lepturus) In Fish Stick Production On Consumer Acceptance

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Abstract: Layur sticks fish (*Trichiurus lepturus*) are one of the diversified processed fish products that are a solution when Layur sticks fish (*Trichiurus lepturus*) have a high abundance in Tanjungbalai City, North Sumatra. The purpose of this study was to determine the effect of Layur fish meat and bones (*Trichiurus lepturus*) on consumer acceptance. The study was conducted at the Fisheries Processing Laboratory, Tanjungbalai Polytechnic. The method used in this study was the Completely Randomized Design (CRD) method with 3 treatments and 3 replications. Treatment 1 (A) 100 grams of Ribbonfish, treatment 2 (B) 150 grams of Layur fish, treatment 3 (C) 200 grams of Ribbonfish. The parameters measured in this study were hedonic tests (appearance, taste, aroma, texture) and proximate testing (water content, ash content, fat, protein, carbohydrate). The results of the study showed that from the hedonic test results of the Layur fish stick (*Trichiurus lepturus*) panelists preferred treatment A with the addition of 100 grams of fish meat and bones. The results of the proximate test of the Layur fish stick (*Trichiurus lepturus*) were water content of 4.93%, ash content of 2.51%, fat content of 31.08%, protein content of 15.20%, carbohydrate content of 46.21%.

Keywords: *Layur fish, Stick, Hedonic, Proximate*

INTRODUCTION

Ribbonfish (*Trichiurus lepturus*) is a commercially important fish species commonly found in coastal waters with sandy substrates, where it forms large schools. Ribbonfish (*T. lepturus*) is one of the fishery products favored by consumers due to its pleasant taste, elastic flesh texture, mild odor, low fat content, and flesh that is easily separated from the bones (Shabrina *et al.*, 2022). Ribbonfish contains high levels of calcium and phosphorus, which contribute to maintaining bone and dental health. In addition, its calcium content helps maintain bone density, thereby reducing the risk of osteoporosis. Calcium is an essential nutrient required for various physiological functions in the human body (Putri *et al.*, 2022).

Tanjungbalai City is one of the regions with a relatively high production of ribbonfish. As a result, ribbonfish is easily obtained and sold at a relatively low price. Currently, ribbonfish is mostly processed using traditional methods, particularly into salted fish. According to Intyas *et al.* (2020), ribbonfish is widely utilized and marketed by local communities in fresh form or processed into dried and salted fish. Efforts to increase the economic value of ribbonfish (*T. lepturus*) are necessary through product diversification. One alternative is the production of ribbonfish sticks, which can be accepted and consumed by various age groups, ranging from children to the elderly. Healthy snack foods are those that are nutritious and free from hazardous substances such as toxins and harmful chemicals (Rahmadani, 2020).

Sticks are a type of snack or dry food product that is prepared by frying. Various stick products are widely available on the market and consumed by people of different age groups (Fatmawati *et al.*, 2022). In addition, consumers are attracted to stick products due to their crispy texture and variety of flavors. Fish sticks have a longer shelf life compared to other wet snacks such as siomay, cilok, meatballs, and similar products (Maidinar *et al.*, 2020).

Good-quality sticks are characterized by a golden-yellow color, a distinctive bakery aroma, a dry and crispy texture, and a savory taste (Silaban *et al.*, 2022). The incorporation of fish into stick products increases their nutritional value, particularly as a source of calcium and animal protein (Siswanti & Agnesia, 2017). Therefore, this study aimed to determine the effect of incorporating ribbonfish (*Trichiurus lepturus*) meat and bones on chemical quality and hedonic acceptance of fish sticks.

RESEARCH METHODOLOGY

2.1 Research Method

This study employed an experimental research method. The experimental design used was a Completely Randomized Design (CRD) consisting of three treatments with three replications. Treatment A consisted of 100 g of ribbonfish, treatment B consisted of 150 g of ribbonfish, and treatment C consisted of 200 g of ribbonfish.

The observed parameters included hedonic tests (appearance, taste, aroma, and texture) and proximate analysis, which comprised moisture content, ash content, fat content, protein content, and carbohydrate content. The formulation of ingredients used in the production of ribbonfish sticks (*Trichiurus lepturus*) is presented in Table 1.

Table 1. Ingredient Formulation for the Production of Ribbonfish Sticks (*Trichiurus lepturus*)

Ingredients	A (g)	B (g)	C (g)
Fish meat	100	150	200
Wheat flour	250	250	250
Tapioca flour	10	10	10
Egg	1 piece	1 piece	1 piece
Margarine	50	50	50
Salt	5	5	5
Shallot	10	10	10
Garlic	10	10	10
Baking powder	½ tsp	½ tsp	½ tsp
Water	10 mL	10 mL	10 mL
Kaffir lime leaves	1 leaf	1 leaf	1 leaf
Cooking oil	2 kg	1 kg	2 kg

2.2 Research Procedure

The procedure for producing fish sticks referred to Siswanti (2017) and consisted of several stages. Initially, the fish meat was separated from the bones (filleting). The fish meat and bones were then steamed using a pressure cooker for 1.5 hours. After steaming, the fish meat and bones were cooled and ground using a food processor to obtain a smooth paste.

The minced fish meat and bones were mixed evenly with wheat flour and tapioca flour. Eggs, margarine, and ground spices were then added to the mixture and stirred until homogeneous. Water was added gradually while mixing until a smooth, non-sticky dough was formed. The dough was sheeted using an ampia machine and cut into stick shapes. Subsequently, the sticks were deep-fried until golden yellow in color and then drained.

2.3 Hedonic Test

The hedonic test was conducted to determine the level of consumer acceptance of the fish stick products. The preference parameters evaluated were appearance, aroma, taste, and texture. The evaluation was carried out by 80 panelists. According to SNI 01-2346-2006, the formula used to calculate the panelists' level of preference for a product is as follows:

$$\bar{X} = \frac{\sum_{i=1}^n x_i}{n}$$

Where:

n = number of panelists

x = quality score given by the panelists / number of panelists

2.4 Proximate Analysis

Proximate analysis conducted in this study included the determination of moisture content, ash content, fat content, carbohydrate content, and protein content, following the methods of AOAC (2005) and Nara *et al.* (2022).

2.5 Data Analysis

Data were analyzed using Analysis of Variance (ANOVA) with the aid of SPSS software. A one-way ANOVA was applied to determine whether the addition of ribbonfish (*Trichiurus lepturus*) at different levels had a significant effect on the quality of fish sticks.

RESULTS AND DISCUSSION

4.1 Hedonic Test

The hedonic test was conducted to evaluate the level of consumer preference for the fish stick products. The preference parameters assessed included appearance, aroma, taste, and texture, evaluated by 80 panelists. The hedonic test is a type of acceptance test in which panelists are asked to express their personal responses regarding their likes or dislikes toward a product (Susiawati *et al.*, 2022). The results of the hedonic test are presented as follows.

a. Color

Color is a very important attribute in determining the quality and degree of acceptance of a food product. It is also one of the main parameters used by panelists in evaluating food products. The results of the color hedonic test of ribbonfish (*Trichiurus lepturus*) sticks are shown in Figure 1.

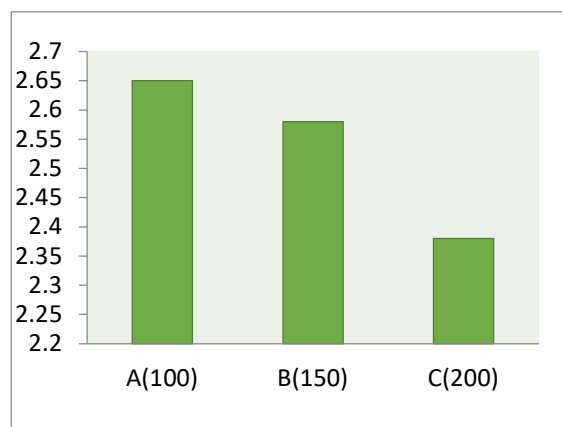


Figure 1. Color Hedonic Test of Ribbonfish (*Trichiurus lepturus*) Sticks

Based on the results of the study, the highest hedonic score was observed in Treatment A (100 g), with a score of 2.66, while the lowest score was found in Treatment C (200 g), with a score of 2.39. This difference was due to the variation in the amounts of fish meat and bones among Treatments A, B, and C. The color of the ribbonfish (*Trichiurus lepturus*) sticks produced was yellowish-brown, making them an appealing snack for consumers. According to Wardah *et al.* (2022), although higher nutritional content can be achieved, the color of fish sticks tends to be less appealing at higher concentrations. This is attributed to the high calcium content, which can cause turbidity in the solution. The brown color is also due to melanoidin compounds, which result from the reaction between reducing sugars and proteins during cooking (Fera *et al.*, 2019). In addition to protein, the color of fish sticks is influenced by calcium content; the higher the calcium concentration in the food, the darker the resulting color (Sari, 2019).

b. Aroma

The aroma of a food product can be evaluated through the sense of smell and plays a crucial role in determining consumer acceptance (Fera *et al.*, 2019). The results of the aroma hedonic test of ribbonfish (*Trichiurus lepturus*) sticks are presented in Figure 2.

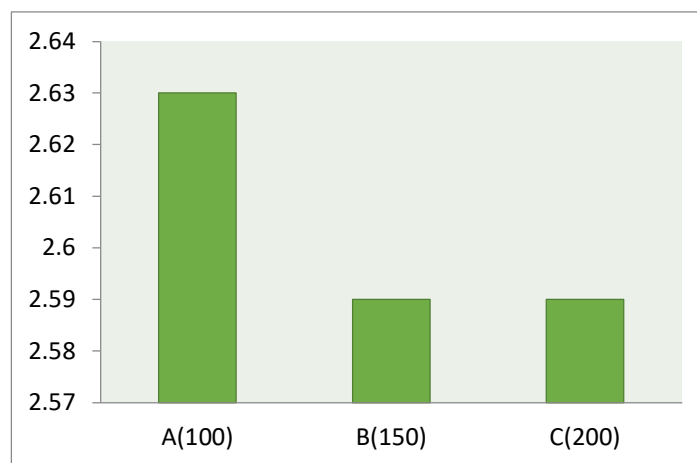


Figure 2. Hedonic Test of Aroma of Ribbonfish (*Trichiurus lepturus*) Sticks

The aroma scores of ribbonfish (*T. lepturus*) sticks showed that the highest score was observed in Treatment A (100 g) with a score of 2.68, followed by Treatment B (150 g) with a score of 2.66, and the lowest score was in Treatment C (200 g) with a score of 2.58. This variation occurred due to differences in the amount of fish meat and bones added to the sticks, resulting in differences in aroma among the products. This finding aligns with Susiawati *et al.* (2022), who reported that variations in aroma arise from protein breakdown into amino acids, particularly glutamate, which can enhance the characteristic aroma in processed products such as crackers, sticks, and amplang.

c. Taste

Taste is a key factor in determining consumer acceptance of food products. It is primarily evaluated through the sense of taste. The taste attribute plays an important role in product selection by consumers because even if the product has high nutritional content, it will not be accepted if the taste is not pleasing. Consequently, efforts to improve public nutrition will not be achieved, and the product may not be marketable (Winarno, 2004). The results of the taste hedonic test of ribbonfish sticks are presented in Figure 3.

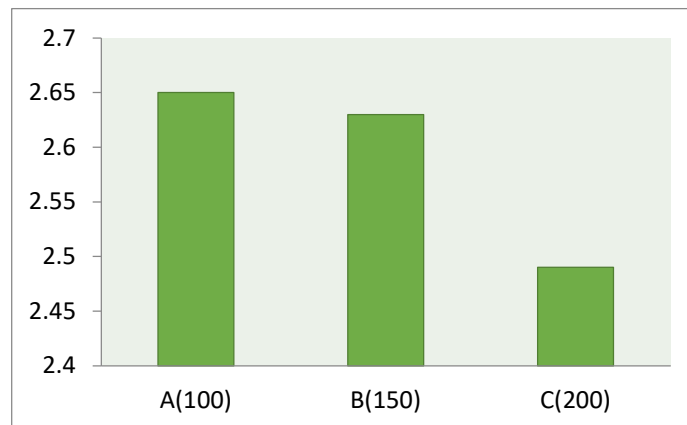


Figure 3. Hedonic Test of Taste of Ribbonfish (*Trichiurus lepturus*) Sticks

The taste scores of ribbonfish (*T. lepturus*) sticks indicated that the highest response was observed in Treatment A (100 g) with a score of 2.70, followed by Treatment B (150 g) with a score of 2.64, and the lowest in Treatment C (200 g) with a score of 2.48. The taste of the ribbonfish sticks was neither salty nor bitter, making the product well-liked by consumers, especially for treatments containing added fish meat and bones. This finding aligns with Nara *et al.* (2022), who reported that the type of fish did not significantly affect the taste score of fish bone sticks. This is because protein is closely related to the flavor-forming components in food; the higher the protein content, the more savory the product (Fera *et al.*, 2019).

d. Texture

The texture of a food product largely depends on the ingredients used, particularly its protein content. Food texture can be evaluated by biting, chewing, and swallowing (Noviyanti *et al.*, 2016). Texture can also be defined as the physical characteristics of a food product, including its tendency to break, crumble, or disintegrate easily. Each food has a different texture, and panelists evaluate texture based on these properties (Fajaria *et al.*, 2020). The results of this study showed that the texture of the products influenced the hedonic response for all treatments. The findings are presented in Figure 4.

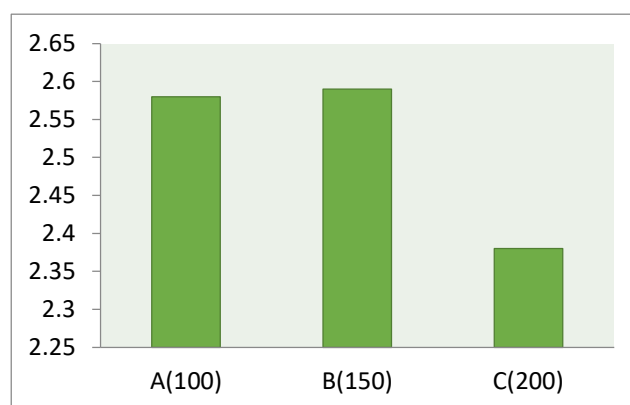


Figure 4. Hedonic Test of Texture of Ribbonfish (*Trichiurus lepturus*) Sticks

The texture scores of ribbonfish sticks indicated that the highest score was observed in Treatment A (100 g) with a score of 2.66, followed by Treatment B (150 g) with a score of 2.57, and the lowest in Treatment C (200 g) with a score of 2.40. The sticks in Treatment A were crispy and soft, which made them more preferred by the panelists compared to Treatments B and C.

This is because the texture of Treatment A was crunchier than the other treatments. The crispiness of a product is influenced by its moisture content, which is a critical factor as most moisture originates from fish meat and bones. In addition, texture is affected by the ingredient ratios, protein content, fat content, and processing method (Sari, 2019).

4.2 Proximate Analysis

Based on the results of the hedonic test, Treatment A was the most preferred by consumers. Therefore, Treatment A was selected for proximate analysis of ribbonfish (*Trichiurus lepturus*) sticks. The proximate composition was determined through analysis of moisture content, ash content, protein content, fat content, and carbohydrate content. The results of the proximate analysis of ribbonfish sticks are presented in Table 2.

Table 2. Proximate Composition of Ribbonfish (*Trichiurus lepturus*) Sticks

Ribbonfish Stick	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Carbohydrate (%)
Treatment A	4.93	2.51	31.08	15.20	46.28

Based on the results of the study, the moisture content of the ribbonfish (*Trichiurus lepturus*) sticks was 4.93%. The moisture content of the sticks is influenced by the amount of fish meat and bones used, as fish naturally contain high levels of water. Moisture content is a critical factor that determines the freshness and shelf life of food products, since high moisture can accelerate the growth of bacteria, molds, and yeasts (Winarno, 2007). Therefore, moisture analysis is necessary to determine the water content in a product. According to Fera *et al.* (2019), the moisture content of snakehead fish sticks ranged from 1.46% to 3.37%, which was likely due to the absence of additional fish meat and the use of more flour. Similarly, Sari (2019) reported that moisture content in fish sticks is affected by the amount of fish meat and bones used, as the water-holding capacity is closely related to protein content in the food ingredients.

The ash content of ribbonfish sticks was 2.51%. According to SNI standards, the maximum ash content should not exceed 1%. The higher ash content observed in this study may be due to insufficient kneading during dough preparation, resulting in a less homogeneous mixture (Istanti, 2005). In the production of ribbonfish sticks, both fish meat and bones are used as the main ingredients. Handayani and Kartikawati (2014) also reported that the more bones added, the higher the ash content in the final product.

The fat content of ribbonfish sticks was 31.08%. According to SNI 01-2886-2000 regarding extruded snack foods, the maximum fat content is 30% for products cooked without oil and 38% for products cooked using oil. Therefore, the fat content of ribbonfish sticks in this study is within the acceptable range for consumers. This is consistent with Sari (2019), who reported fat contents of snakehead fish sticks ranging from 23.75% to 35.13%, which meets the required quality standards.

The protein content of ribbonfish sticks was 15.20%. According to SNI 2000 standards for fish sticks, the minimum protein content is 5%. Thus, the ribbonfish sticks show a significant increase in protein content. The protein content measured in this study is higher than the maximum protein content of Nilem fish sticks reported by Iqbal *et al.* (2016), which was 12.72% with the addition of 15% Nilem fish eggs, whereas snakehead fish sticks can reach up to 39.13% protein. The measured protein content is influenced by the amount of water lost (dehydration) during processing; the greater the water loss, the higher the measured protein content (Iqbal *et al.*, 2016).

The carbohydrate content of ribbonfish sticks was 46.28%. This is consistent with Siswanti (2016), who reported 54.30% carbohydrate content in mackerel fish sticks, and with Fera *et al.* (2019), who found a high carbohydrate content of 71.56% in snakehead fish sticks. Carbohydrates serve as a primary energy source for the human body. According to Fera *et al.* (2019), each gram of carbohydrate consumed provides approximately 4 kcal of energy, which is then used by the body to support various physiological functions such as breathing, heart and muscle contraction, as well as physical activities like exercise and work.

CONCLUSION

Based on the results of this study, it can be concluded that the different treatments of ribbonfish (*Trichiurus lepturus*) sticks had a significant effect on color and texture, whereas taste and aroma were not significantly affected. From the hedonic test, panelists preferred Treatment A, which contained 100 g of fish meat and bones. The proximate composition of ribbonfish sticks (Treatment A) was as follows: moisture content 4.93%, ash 2.51%, fat 31.08%, protein 15.20%, and carbohydrate 46.28%.

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