

NUTRITION ANALYSIS AND CONSUMER ACCEPTANCE OF FLOATING FISH SHAKE CAKE (*Decapterus Sp.*)

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Abstract

Indonesia possesses great potential in the fisheries sector, yet its utilization in functional food products remains limited. Layang fish (*Decapterus sp.*) is a high-quality source of animal protein that has not been optimally used in traditional snacks. This study aims to analyze the nutritional value and consumer acceptability of kue kembang goyang (traditional flower-shaped snack) with the addition of layang fish. The research employed an experimental laboratory method using a Completely Randomized Design (CRD) with three treatments: without layang fish (control), with 20%, and 30% layang fish addition, each tested in three replications. Proximate analysis (moisture, ash, protein, fat, and carbohydrate content) was conducted to determine the nutritional profile, while a hedonic test involving 30 untrained panelists was used to assess color, aroma, taste, and texture. The results are expected to show that the addition of layang fish improves the protein and mineral content without reducing consumer acceptability. This innovation is expected to contribute to the development of nutritious, locally based food products and support the preservation of traditional Indonesian snacks.

Keywords: acceptance; *Decapterus Sp.*; shake-up flower cake; nutrition

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INTRODUCTION

Indonesia is an archipelagic country with many natural resources, especially in the field of fisheries. This potential includes ecosystems rich in biodiversity both in inland and marine waters. As a result, Indonesia's fisheries industry has a great opportunity to continue to grow and make the most of its potential. With sustainable management of this sector, the welfare of coastal communities can be improved as well as national food security. In addition, with proper utilization, the fisheries sector can become an economic driving force that contributes to exports, the processed marine products industry, and the diversification of fishery products. Innovative efforts in the processing and distribution of fishery products can also encourage healthier and more sustainable consumption patterns among the community, (Pramestika *et al.*, 2023).

Fish is one of the most common animal protein-based foods and is easy to find in different types of distribution and trade locations. Fish protein ranges from 18 to 20 percent made up of eight types of essential amino acids, including sulfur-containing amino acids, such as lysine and methionine cysteine. Fish nutrition is essential for maintaining and repairing body tissues and for the growth and development of the human body. Flying fish (*decapterus sp.*), one of the fish species rich in antioxidants, has a high content of animal protein, which is excellent for human health, (Muchtart *et al.*, 2023).

Flying fish has a nutritional content that includes water content ranging from 51.69% to 62.32%, ash content of around 0.07% to 1.28%, and a high amount of protein, which is

between 25.94% to 30.73%. In addition, flying fish (*decapterus sp*) also contains a low amount of fat, which is around 1.37% to 1.82%, making it suitable for consumption as a healthy food. In addition to macronutrients, flying fish also contain essential amino acids such as lysine by 2.31%, which play an important role in the process of building body proteins and regenerating cells. In addition, this fish contains non-essential amino acids such as glutamic acid by 3.93%, which gives it a distinctive taste and plays a role in various metabolic functions of the body, (Mardiah *et al.*, 2022).

The level of public consumption of flying fish is relatively low, one of the reasons is the lack of knowledge about how to process flying fish and its nutritional benefits for body health. This happens even though the production of flying fish is very high. Therefore, efforts are needed to develop and implement various fish processing methods to increase the attractiveness and consumption of flying fish among the community (Dewi Pido *et al.*, 2022). Flying fish (*Decapterus sp*) is a very potential food source choice to support the nutritional needs of the community. In addition to its nutritional benefits, kite fish also has promising prospects to be developed as a fishery commodity. However, for the benefits to be felt optimally, appropriate processing efforts are needed (D Sormin *et al.*, 2021). One of the alternatives to the use of flying fish is by processing it into food, one of which is goyang flower cake, (Febrianti *et al.*, 2023).

Kembang goyang is a type of traditional Indonesian cake that is included in the category of snacks or snacks. This cake originated from the Betawi people and its spread spread along with the migration of the Betawi population and their descendants. The name "kembang goyang" is taken from the manufacturing process, where the dough is shaken using a flower-shaped mold attached to the stalk. Quality rocking flower cake has several characteristics, including a golden yellow color, dry and crispy texture, and sweet taste. This combination makes this cake not only delicious, but also visually appealing, so it is often served in various traditional events and celebrations (Nurchayani *et al.*, 2021). The raw materials for making the shake flower cake with ingredients such as rice flour, tapioca flour, sugar eggs, salt, water, and thick coconut milk. Per 100 grams of shake flower cake, it is known to have a low nutritional content: 51.88% carbohydrates, 5.18% protein, 2.36% fiber, 0.11 mg of vitamin B15, 1.12 mg of vitamin E, and 342.8 cal. It is hoped that the nutritional content of the shake flower cake will be better by adding flying fish, (Pujilestari *et al.*, 2021).

Shaking flower cake has limited nutritional content, especially in terms of protein and healthy fats. This provides an opportunity to develop shake flower cakes with higher nutritional added value through the addition of protein-rich foods such as fish. The combination of abundant local ingredients such as flying fish with traditional snacks such as shake flower cake is a promising form of food product innovation. This innovation not only aims to increase the nutritional value of the cake, but also contributes to the preservation of traditional culinary heritage that is increasingly displaced by modern and fast food. The addition of flying fish meat to the dough of shake kembang cake is expected to increase the protein and essential fatty acid content of the final product. This is relevant considering that people's needs for healthy and nutritious food are increasing over time, (Safitri *et al.*, 2024).

Previous research conducted by Muchtar *et al.*, 2023 on the fortification of milkfish bone meal (*chanos chanos*) in shake flower cake obtained results, namely the protein content of shake flower cake was 5.03-5.38%. By utilizing the protein content of flying fish meat, it is hoped that it can add nutritional value to the shake flower cake product. Based on this background, this study aims to evaluate customer acceptance of rocking flower



cakes with flying fish meat and nutritional content. (*Decapterus* sp). This research is expected to produce comprehensive information on the potential development of functional food products based on local ingredients, as well as make a real contribution to improving community nutrition and strengthening the marine resource-based economy. Therefore, this innovation can serve as an alternative solution to overcome people's nutritional problems and to keep traditional Indonesian food alive.

METHOD

This research was carried out in April-May 2025 which included product manufacturing and hedonic tests at the Balik Diwa Maritime Institute of Technology and Business Makassar, as well as chemical analysis at the Fisheries Product Biochemistry Laboratory of the Pangkep State Agricultural Polytechnic. The study used a Complete Random Design (RAL) with three treatments and three repeats, namely A (control without the addition of kitefish), B (addition of 20% of kitefish), and C (addition of 30% of kitefish), so that nine experimental units were obtained. The main ingredients used include fresh flying fish (*Decapterus* sp), rice flour, wheat flour, cornstarch, eggs, coconut milk, and sugar, while the analytical chemicals include H_2SO_4 , NaOH, H_3BO_3 , HCl, methyl red indicators, potassium iodide, sodium thiosulfate, and diethyl ether. Production equipment consists of digital scales, blenders, cake molds, pans, stoves, and grease paper, while laboratory analysis uses Kjeldahl flasks, Soxhlet tools, ovens, decifiers, porcelain cups, and titration equipment. The independent variable in this study is the level of addition of flying fish as fortification material, while the bound variable includes nutritional content and consumer acceptance of shake flower cake products. Fish samples were obtained through purposive sampling techniques from the Paotere Makassar Fish Auction Site (PPI). Proximate analysis which includes water content, ash, protein, fat, and carbohydrates was carried out using the standard gravimetric method, Kjeldahl, Soxhlet, and titration according to the procedures recommended by AOAC (2016), Sudarmadji et al. (2010), and Winarno (2008). The data obtained were statistically analyzed using One Way ANOVA with the help of the SPSS application, and the differences between treatments were further tested using the Tukey test at a confidence level of 95%, (Rahman, 2007; Hadinoto, 2018).

RESULT AND DISCUSSION

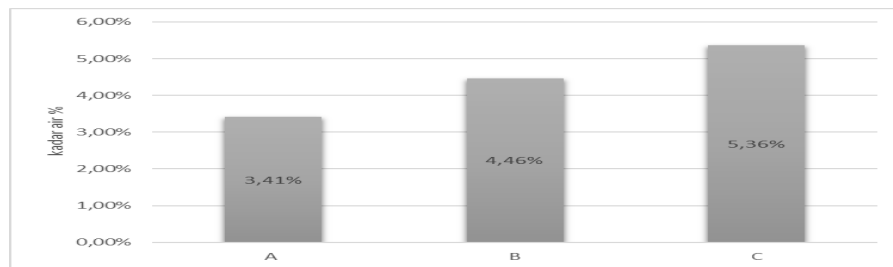
Water content

Moisture content is one of the important chemical quality parameters in food products, because it directly affects the texture, crunch, storage stability, and shelf life of the product. In fish-based food products, the moisture content is also closely related to the composition of raw materials and the proportion of fish meat used in the formulation. The addition of flying fish (*Decapterus* sp.) to the shake flower cake is suspected to affect the moisture content of the product, considering that fish has a relatively high-water content. Therefore, a moisture content analysis was carried out to determine the effect of variations in the addition of flying fish on the chemical characteristics of the resulting shake flower cake.

Figure 1:



Results of testing the moisture content of the floating fish (*Decapterus sp*) shake flower cake.



Source: research results

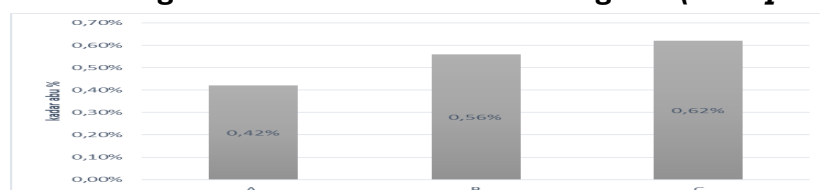
Based on the results of the chemical test of the moisture content of the floating fish shake cake in Figure 1 with different treatments, the highest moisture content is found in Sample C at 5.36%, followed by Sample B at 4.46%, and the lowest in Sample A at 3.41%. This can be explained by the natural nature of fish that has a high moisture content, especially in the meat that is used as a mixed ingredient. The water component in fish is mostly stored in muscle tissue, and when added to the dough, it contributes to the total moisture content of the product, (Kurniati et al., 2020).

The results of the ANOVA test corroborated these findings, with a significance value of < 0.001 and an F value of 46.630, indicating that there was a significant difference in moisture content between treatments. This indicates that the variety of adding flying fish has a real influence on the moisture content of the shake flower cake.

Ash Content

Ash content is an important parameter in food chemistry analysis that is used to describe the total mineral content in a product after the process of burning organic matter. Ash content values are often used as indicators of nutritional quality, especially related to the presence of essential minerals derived from main raw materials and additives (AOAC, 2016). In processed fish-based products, ash content tends to increase along with the increase in the proportion of fish meat because fish is a source of minerals such as calcium, phosphorus, and iron (Effendi, 2012). Therefore, ash content testing in the floating fish shake flower cake was carried out to determine the effect of variations in the addition of fish on the mineral content of the product. The results of the ash content test for the floating fish (*Decapterus sp*) shake flower cake (*Decapterus sp*) are presented in Figure 2:

Figure 2:
Results of testing the ash content of the floating fish (*Decapterus sp*).



Source: research results

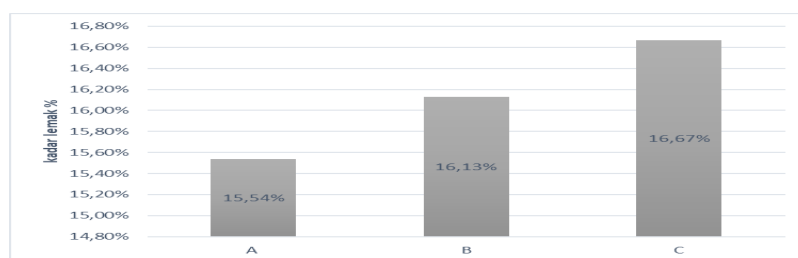


Based on the results of the chemical test of the ash content of the shake flower cake in Figure 4.2 with different treatments, Sample C has the highest ash content (0.62%), followed by Sample B (0.56%) and Sample A (0.42%). This increase in ash content indicates that the greater number of kitefish is added, the higher the mineral content in the product. This is in accordance with the statement (Halid et al., 2023) that ash content reflects the total minerals contained in a food. This result was strengthened by ANOVA statistical analysis which showed an F value of 19.750 and a significance of 0.002 ($p < 0.05$), which means that there was a significant difference in ash content between treatment groups. This shows that the increase in ash content does not occur by chance but is a direct result of the treatment of adding flying fish in the dough of shake flower cake.

Fat Content

Fat content is one of the important chemical parameters in assessing the quality and nutritional value of food products, especially processed fish-based products. Fat acts as a source of energy, a carrier of fat-soluble vitamins, as well as a determinant of sensory characteristics such as taste and texture of products (Craig et al., 2017). In processed products containing fish, the fat content is influenced by the type of fish, the proportion of fish meat added, and the processing process used. Flying fish (*Decapterus* sp) is known to have a varied fat content and contributes to an increase in the fat content of processed products (Effendie, 2002). Therefore, a fat content analysis was carried out to evaluate the effect of variations in the addition of flying fish on the fat content of shake flower cakes. The results of the fat content test of the floating fish (*Decapterus* sp) shake flower cake are presented in Figure 3:

Figure 2:
Results of testing the fat content of the floating fish (*Decapterus* sp) shake flower cake.



Source: research results

Based on the results of the chemical test of the fat content of the shake flower cake in Figure 4.4 with different treatments, Sample C again shows the highest number (16.67%), followed by Sample B (16.13%) and Sample A (15.54%). This increase in protein levels is in line with the basic characteristics of fish as a source of animal protein with high biological value (Tamsil et al., 2023). This shows that the higher the concentration of fish added, the greater the fat content in the final product. The results of statistical analysis using the one-way ANOVA test showed that there was a significant difference between the treatment of fat content, with a value of $F = 32.126$ and a significance (p) = 0.000. This

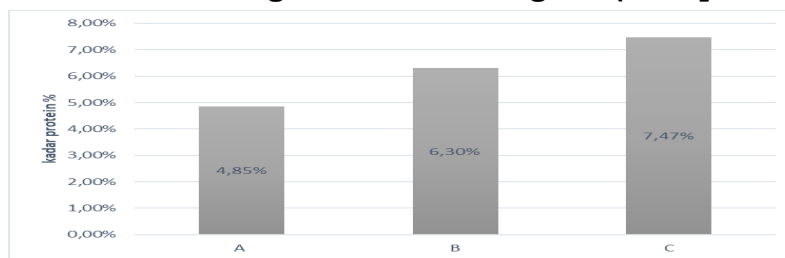


means that the variation in the amount of added flying fish has a real effect on the fat content of the shake flower cake ($p < 0.05$).

Protein Content

Protein is the main nutritional component that greatly determines the nutritional quality of food products, especially processed fish-based products. Fish is known as a source of animal protein with high biological value because it contains essential amino acids that are complete and easily digestible by the human body (Effendie, 2002; Craig et al., 2017). The addition of fish to traditional food formulations has the potential to increase protein content and improve the functional value of the product. Therefore, protein content analysis was carried out to evaluate the extent to which variations in the proportion of the addition of flying fish (*Decapterus sp*) influenced increasing the protein content of shake flower cake as a fish-based food product. The results of the protein content test of the shake flower cake of flying fish (*Decapterus sp*) were presented in Figure 4:

Figure 3:
Protein content testing results of floating fish (*Decapterus sp*).



Source: research results

Based on the results of the chemical test, the protein content of the shake flower cake in Figure 4.4 with different treatment obtained a different average. The results showed that Sample C had the highest protein content (7.47%), followed by Sample B (6.39%) and Sample A (4.85%). This confirms that the higher the proportion of fish used in the formulation, the greater its contribution to increasing nutritional value, especially its protein content, (Muslimin et al., 2024).

The significance of the increase in protein levels was confirmed through the ANOVA statistical test, which resulted in an F value of 142.410 with a significance value of < 0.001 . This value shows that there are very significant differences between the treatment groups, so it can be concluded that the addition of flying fish does have a real impact on the protein levels produced. This indicates that the differences between treatment groups are not caused by chance, but by the effects of the treatment itself.

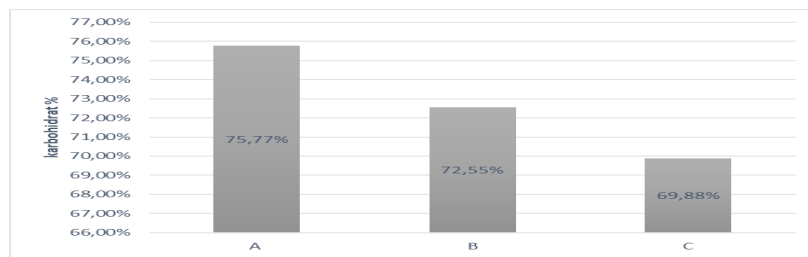
Carbohydrate

Carbohydrates are the main source of energy in flour-based food products and play an important role in determining the physical characteristics and energy value of a food product. In traditional processed products such as shake flower cakes, the carbohydrate content generally comes from flour raw materials used as the main component of dough.



The addition of high-protein foods, such as fish, can affect the chemical composition of products by reducing the relative proportion of carbohydrates due to ingredient substitution (Winarno, 2008; Halid et al., 2023). Therefore, carbohydrate content analysis was carried out to determine changes in the energy composition of products due to variations in the addition of flying fish (*Decapterus* sp). The results of the carbohydrate content test of the floating fish (*Decapterus* sp) shake cake are presented in Figure 5.

Figure 4 :
Carbohydrate test results of floating fish (*Decapterus* sp).



Source: research results

Based on the results of the chemical test of the carbohydrate content of cactus crackers in Figure 4.5 with different treatments obtained different averages, carbohydrates are obtained from the calculation by reducing the content of water, ash, protein, and fat from 100%. Sample A showed the highest carbohydrate content (75.77%), followed by Sample B (72.55%) and Sample C (69.88%). This decrease can be explained by a reduction in the proportion of key ingredients containing carbohydrates, such as flour, due to the addition of fish meat in the dough formula. With the increase in the number of fish, the relative portion of flour in the total composition of the ingredients becomes smaller.

CONCLUSION

The addition of flying fish (*Decapterus* sp.), both in the form of meat and flour, has been shown to significantly increase the nutritional value of shake flower cakes, which is shown by an increase in water content, ash content, protein content, and fat content in the treatment with a higher percentage of fish addition. An increase in ash content reflects an increase in mineral content, while an increase in protein and fat levels shows a real contribution of flying fish as a source of high biological nutritional value. The results of statistical analysis showed that most of the proximate parameters were significantly influenced by the treatment of adding kitefish, so the difference that occurred was not due to a coincidental factor. In addition to improving chemical quality, the addition of flying fish also contributes positively to the sensory quality of the product, especially in the smell and taste attributes, which are considered preferable by the panelists to products without the addition of fish. Thus, the use of flying fish as a fortification material is not only able to improve nutritional quality, but also improve consumer acceptance, so that it has the potential to be developed as an innovation in value-added traditional food products.



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