Jurnal Perikanan

Fisheries Journal, 16 (1), 553-561 (2026)
http://doi.org/10.29303/jp.v16i1.1807

NUTRITIONAL ANALYSIS OF FISH FEED MADE FROM SLUM SHELLS *(Placuna placenta)*

Analisis Nutrisi Pakan Ikan Berbahan Baku Cangkang Kerang Simping *(Placuna placenta)*

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(Received August 22nd 2025; Accepted December 28th 2025)

ABSTRACT

Indonesia as an archipelagic country has abundant marine resources, including shellfish with high economic value. One type is the scallop (*Placuna placenta*) which is commonly found on the coast of South Sulawesi, but has not been optimally utilized. The accumulation of shellfish waste in coastal areas can have negative impacts on health and the environment. Utilization of this waste as animal feed is a potential solution because of the high calcium content (50–60%) and phosphorus (30–40%) in scallop shells, so it has the potential as an alternative mineral source in feed formulation. This study aims to analyze the nutritional content of fish feed made from scallop shells (*Placuna placenta*) as an effort to utilize abundant fishery waste in the coastal areas of South Sulawesi. This study used a completely randomized design (CRD) with three treatments, namely the addition of 0%, 10%, and 20% scallop shell flour, each repeated three times. The parameters analyzed included moisture content, ash content, crude fiber, protein, and fat using the proximate test method. The results showed that the addition of scallop shell flour affected the nutritional composition of the feed. The sample with the addition of 20% scallop shell flour has a protein content of 38.09%, fat content of 9.31%, fiber content of 6.65, water content of 8.00 and ash content of 11.19, all parameters meet the quality standards for fish feed according to SNI 9043-4:2022.

Keywords: Scallop, Fish Feed, Proximate, Nutrition

ABSTRAK

Indonesia sebagai negara kepulauan memiliki potensi sumber daya bahari yang melimpah, termasuk kerang yang bernilai ekonomi tinggi. Salah satu jenisnya adalah kerang simping (*Placuna placenta*) yang banyak ditemukan di pesisir Sulawesi Selatan, namun belum dimanfaatkan secara optimal. Penumpukan limbah cangkang kerang di kawasan pesisir dapat menimbulkan dampak negatif bagi kesehatan dan lingkungan. Pemanfaatan limbah ini sebagai pakan ternak menjadi solusi potensial karena kandungan kalsium yang tinggi (50–60%) serta fosfor (30–40%) pada cangkang kerang simping, sehingga berpeluang sebagai sumber mineral alternatif dalam formulasi pakan. Penelitian ini bertujuan untuk menganalisis kandungan nutrisi pakan ikan berbahan baku cangkang kerang simping (*Placuna placenta*) sebagai upaya pemanfaatan limbah perikanan yang melimpah di wilayah pesisir Sulawesi Selatan. Penelitian ini menggunakan rancangan acak lengkap (RAL) dengan tiga perlakuan, yaitu penambahan tepung cangkang kerang simping 0%, 10%, dan 20%, masing-masing diulang tiga kali. Parameter yang dianalisis meliputi kadar air, kadar abu, serat kasar, protein, dan lemak dengan metode uji proksimat. Hasil penelitian menunjukkan bahwa penambahan tepung cangkang kerang simping berpengaruh terhadap komposisi nutrisi pakan. Sampel dengan penambahan 20% tepung cangkang kerang simping memiliki kandungan protein 38,09%, kadar lemak 9,31%, Serat 6,65, Kadar air 8,00 dan kadar abu 11,19 seluruh parameter memenuhi standar mutu pakan ikan menurut SNI 9043-4:2022.

Kata Kunci: Kerang Simping, Pakan Ikan, Proksimat, Nutrisi

INTRODUCTION

Indonesia is an archipelagic country with two-thirds of its territory covered by sea. This vast marine composition contributes to the diversity of marine products and tourism potential, especially for coastal communities. Scallops are a marine product with economic value, both for their meat and shells (Abubakar *et al*., 2021). Scallops are a key fishery commodity due to their significant potential and high economic value. Statistics from the Ministry of Maritime Affairs and Fisheries (KKP) for 2020 show that the volume of shellfish production was approximately 87,000 tons, and this figure is projected to increase to 137,000 tons by 2024. One type of shellfish with potential for further development is the scallop (*Placuna placenta*). This shellfish is widely distributed along Indonesian beaches, particularly in South Sulawesi, which has a coastline of 1,937 km2 (DKP SulSel, 2015). The existence of scallops, better known as "japing" by the local community, is not yet popular and has not received attention. Furthermore, these shells can injure fishermen's feet due to their sharp edges. The abundance of shells scattered around the coast of South Sulawesi, both living and dead, requires a solution to their utilization. In addition to being a raw material for crafts, scallop shells also have potential nutritional content (Khairiyah *et al*., 2022). The accumulation of shell waste around coastal settlements can have various negative impacts on public health. These impacts include skin disorders, environmental pollution, and respiratory disorders. The solution to processing shell waste is to utilize it as feed. Calcium is one of the minerals found in scallop shells. Based on research by Khairiyah *et al*., (2022), it was stated that the mineral composition of the three size classes showed a similar composition pattern. Where calcium content was the largest percentage, namely 50-60% in all three size classes, followed by phosphorus content at 30-40%. The relatively high calcium content in scallop shells is the basis for conducting research related to the use of scallop shell flour as an additive in feed formulations to assess its nutritional content.

RESEARCH METHOD

Time and Location

This research was conducted from May to August 2025. Feed production took place in Tokka Hamlet, Bontomarannu Village, Moncongloe District, Maros Regency. Chemical testing, including moisture content, ash content, crude fiber, protein, and fat, was conducted at the Pangkep State Agricultural Polytechnic and the Integrated Laboratory of the Balik Diwa Institute of Maritime Technology and Business, Makassar.

Method

This study used five parameters to assess the nutritional content of feed: water content, ash content, crude fiber, protein, and fat. Moisture content was measured using an oven drying method at 105°C in accordance with SNI 01-2354.2-2006. Ash content was determined by burning the sample in a furnace at 550°C for 8 hours until a white or gray residue was obtained (SNI 01-2354.1-2006). Crude fiber, which reflects cellulose and lignin content and affects feed digestibility by livestock, was analyzed based on SNI 01-2891-1992 by heating the sample with a 1.25% sulfuric acid solution and 3.25% sodium hydroxide, followed by filtering, drying, and weighing the residue. Protein content was determined by the Kjeldahl method (SNI 01-2354.4-2006), which involves sample destruction with concentrated sulfuric acid at a temperature of about 410°C until the solution is clear, ammonia distillation after the addition of NaOH, capture in boric acid, and titration with HCl; protein content was calculated from total nitrogen multiplied by a conversion factor. Fat content was determined by the organic solvent extraction method (SNI 01-2354.3-2006), in which the sample was extracted at the boiling point of the solvent for about 8 hours, the solvent was evaporated, and the fat was weighed gravimetrically.

Research tools and materials

The tools used in this research to make feed included an oven, blender, and pelletizer. Meanwhile, the tools used to test nutrition included a desiccator, tongs, a horn spoon, an ashing furnace, a Kjelda flask, an Erlenmeyer flask, a burette, an electric heater, a condenser, a round-bottom flask, a measuring cylinder, a volumetric pipette, a measuring pipette, a fat flask, a Soxhlet/fat extraction apparatus, and a porcelain cup.

The materials used in this research to make feed included fish meal, fine bran, vitamins, scallop shell meal, and vitamins. The materials used to test nutrition included H2O2, H2SO4, methyl red indicator, NaOH, 4% H3BO3, 0.2 N HCl, bromcresol green indicator, 20% potassium iodide solution, 4N sulfuric acid, 1% starch indicator solution, 0.1N sodium thiosulfate solution, and diethyl ether.

Research Design

The experimental design used was a Completely Randomized Design (CRD) experiment with 3 treatments and 3 repetitions to obtain 9 experimental units and using the experimental laboratory method or trial method. Experimental research is research where treatments are used to find the effect of certain treatments on treatments under regular conditions. The sampling technique used in this study was purposive sampling, namely by taking samples intentionally according to the required sample requirements or criteria. The composition of the ingredients for making scallop shell feed refers to research (Haq *et al*., 2023) which was modified by the addition of scallop shell flour. Sample A (Fish feed with the addition of 0% scallop shell flour), Sample B (Fish feed with the addition of 10% scallop shell flour) and Sample C (Fish feed with the addition of 20% scallop shell flour)

Data analysis

The results of the proximate analysis of fish feed are presented in diagram form to demonstrate differences in nutritional composition between treatments. The data were then analyzed descriptively by comparing the parameters of water, protein, fat, ash, and crude fiber content. This analysis aims to provide an overview of the nutritional quality of the resulting feed.

RESULTS

The results of the research on fish feed made from scallop shells (*Placuna placenta*) can be seen in Table 1.

Tabel 1 Results of chemical tests on fish feed made from scallop shells (*Placuna placenta*)

Parameters	Sample A	Sample B	Sample C	SNI 9043-4:2022
Moisture Content	11.22	9.90	8.00	Max 12%
Ash Content	7.30	9.31	11.19	Max 13%
Crude Fiber	7.89	7.13	6.65	Max 8 %
Protein	30.29	33.59	38.09	Min 35 %
Fat	8.08	8.39	9.31	Min 5 %

a. Water Content

The results of the water content test on fish feed made from scallop shells (*Placuna placenta*). Can be seen in Figure 1.

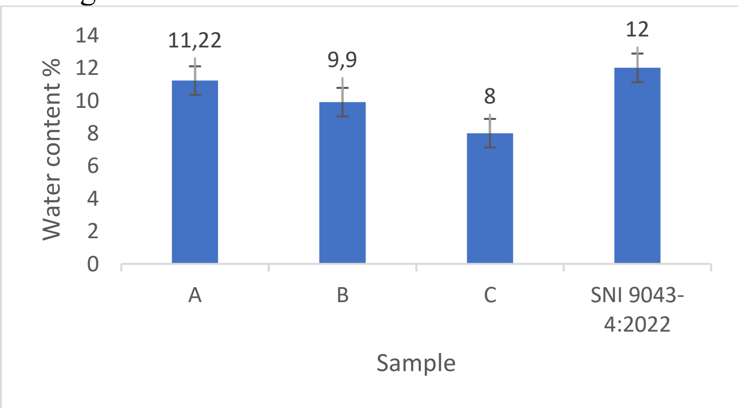

Figure 1 Results of testing the water content of fish feed made from scallop shells *(Placuna placenta)*

Based on the results of chemical tests of the water content of fish feed in Figure 1, it shows that the highest increase in water content was in treatment A (0% without the addition of scallop shell flour) of 11.22%. Followed by treatment B (10% addition of scallop shell flour) of 9.9% and the lowest in treatment C (20% addition of scallop shell flour) of 8.00%.

b. Ash content

The results of the ash content test on fish feed made from scallop shells (*Placuna placenta*) can be seen in Figure 2.

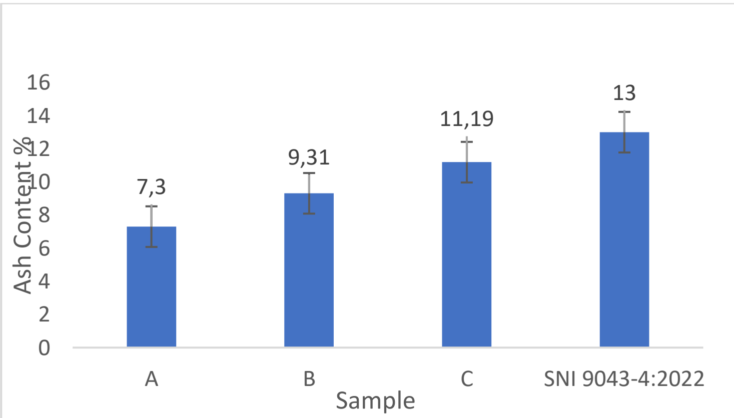

Figure 2. Results of testing the ash content of fish feed made from scallop shells (*Placuna placenta*)

Based on the results of the chemical test of the ash content of fish feed in Figure 2, it shows that the highest increase in ash content was in treatment C (20% addition of scallop shell flour) of 11.19%. Followed by treatment B (10% addition of scallop shell flour) of 9.31% and the lowest in treatment A (0% addition of scallop shell flour) of 7.3%.

c. Crude Fiber

The results of chemical tests of crude fiber in fish feed made from scallop shells (*Placuna placenta*) can be seen in Figure 3.

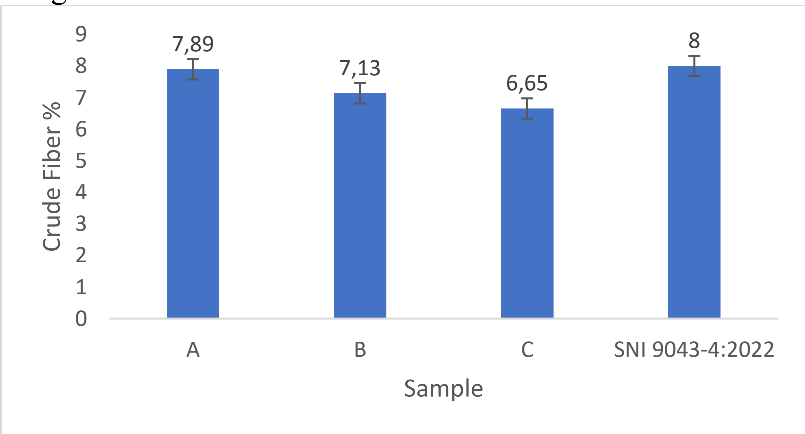

Figure 3 Results of testing the crude fiber of fish feed made from scallop shells (*Placuna placenta*)

Based on the results of the chemical test of crude fiber of fish feed in Figure 3 Figure 2 shows that the highest increase in crude fiber was in treatment A (0% without the addition of scallop shell flour) of 7.89%. Followed by treatment B (10% addition of scallop shell flour) of 7.13% and the lowest in treatment C (20% addition of scallop shell flour) of 6.65%.

d. Protein

The results of protein tests on fish feed made from scallop shells (*Placuna placenta*) can be seen in Figure 4.

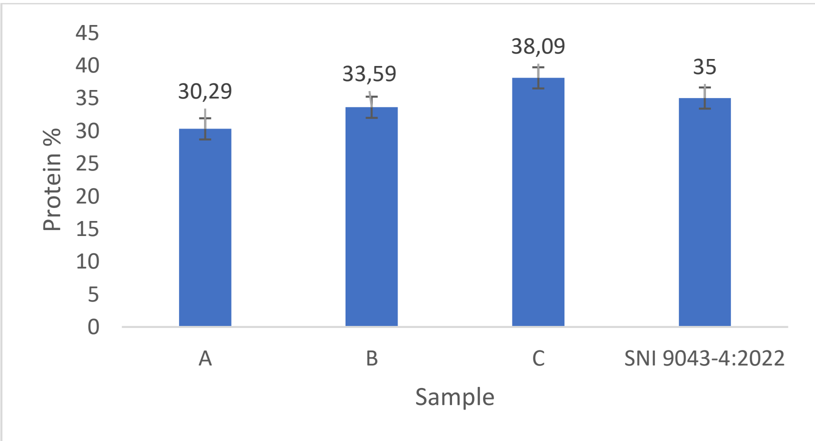

Figure 4 Results of protein testing of fish feed made from scallop shells (*Placuna placenta*)

Based on the results of the fish feed protein test in Figure 4, it shows that the highest protein increase was in treatment C (20% addition of scallop shell flour) of 38.09%. Followed by treatment B (10% addition of scallop shell flour) of 33.59% and the lowest in treatment A (0% addition of scallop shell flour) of 30.29%.

e. Fat

The results of the chemical test of fat in fish feed made from scallop shells (*Placuna placenta*) can be seen in Figure 5.

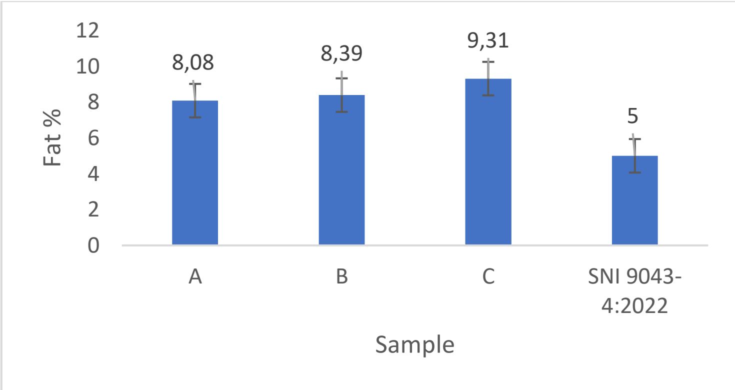

Figure 5. Results of testing fish feed fat made from scallop shells (*Placuna placenta*)

Based on the results of the fish feed fat test in Figure 5, it shows that the highest increase in fat was in treatment C (20% addition of scallop shell flour) of 9.31%. Followed by treatment B (10% addition of scallop shell flour) of 8.39% and the lowest in treatment A (0% without addition of scallop shell flour) of 8.08%.

4. DISCUSSION

a. Water content

Water content is one of the main factors used to assess the quality of fishery products, including fish feed. Water content in feed directly affects product quality, particularly in terms of microbiological stability, durability during storage, and distribution efficiency. Based on the results of the water content test shown in Figure 4.1, it can be seen that sample C has the lowest water content, at 8.00%. This value indicates that feed from sample C has advantages in terms of longer shelf life and better quality stability during the storage process. The decrease in water content in this feed is due to the addition of scallop shell flour. According to (Supartini 2022), scallop shell flour is rich in calcium (around 17-62%), which is a mineral with very low hygroscopic properties (does not attract or bind large amounts of water). Therefore, the addition of this flour does not increase the water content; instead, it tends to absorb and inhibit water absorption during the mixing process.

b. Ash content

Based on the results of the ash content test shown in Figure 4.2, it was found that the highest ash content was found in sample C, which was 11.19%. Meanwhile, the ash content in sample B was 9.31%, and sample A was 7.30%. The difference in ash content between these samples indicates the influence of the composition of the raw materials used in the feed production. The high ash content in samples B and C was caused by the addition of scallop shell flour in the feed formulation. The high ash content in shellfish is caused by two main factors: the availability of food in the environment where the shellfish live and the shellfish's natural ability to absorb and store minerals from their environment (Silaban, 2025). Shellfish are filter feeders, meaning they obtain food by filtering fine particles in the water, including plankton, plant debris, and other organic materials containing various minerals. These minerals, such as calcium, magnesium, and phosphorus, are then stored in the body and especially in the shell. According to Bhara *et al*. (2018), the more abundant the nutrients and minerals in the aquatic environment, the higher the ash content of the shellfish. This is because shellfish naturally absorb minerals from the water and available food, then deposit them in their body tissues and shells. This ash content is an indicator that the shellfish lives in waters rich in nutrients and minerals. Therefore, a high ash content is not a negative thing; it actually indicates that the shellfish has an abundant mineral content, which can be utilized for various purposes, including as a raw material for fish feed rich in calcium and other minerals.

c. Crude fiber

Based on the results of the crude fiber test shown in Figure 4.3, it was found that sample C had the lowest crude fiber content compared to the other samples, at 6.60%. This decrease in crude fiber is suspected to be directly related to the composition of the raw materials used, particularly the amount of fine bran added to the feed formulation. In samples B and C, the amount of fine bran used was indeed less than in sample A. Fine bran is known to be one of the main sources of crude fiber in feed, so the less bran added, the lower the crude fiber content. This is in line with research by Putra & Andriani (2017), which stated that if the bran formulation is reduced, the crude fiber contribution from the bran to the feed also decreases. The crude fiber content in feed is very important to pay attention to because it affects the fish digestive process. Crude fiber is the part of plant material that cannot be digested by fish digestive enzymes, such as cellulose and lignin. If the crude fiber content is too high, the process of nutrient absorption, especially protein, becomes less efficient. This is because excess crude fiber will inhibit the activity of enzymes in the digestive tract and slow the process of absorption of essential nutrients.

d. Protein

Protein is a macronutrient that is crucial for the survival and growth of fish. According to Nurliana (2015), protein plays a primary role as a building block for body tissues, including muscles, enzymes, and hormones, and as a backup energy source when needed. The higher the protein content in the feed, the better the quality, as protein directly supports growth, repairs damaged tissue, and maintains fish health.

Based on the protein content test results shown in Figure 4.4, the highest protein content was found in sample C, at 38.09%, followed by sample B at 33.59%, and sample A at 30.29%. This difference indicates a significant influence of the composition of the raw materials used in the feed formulation. The increase in protein content in samples B and C compared to sample A was due to the increased proportion of scallop shell flour substitution in each treatment. According to A'yuni (2019), the protein in scallop shell flour can react with other substances in the feed, such as sodium hydroxide, to form water-soluble proteinate compounds, thereby increasing protein availability for livestock.

e. Fat

Lemak Fat is one of the primary nutrients essential for fish growth and survival. It serves as a high-calorie energy source, enabling fish to utilize it for various daily activities, such as swimming, foraging, avoiding predators, supporting growth and maintaining disease resistance. Furthermore, fat acts as a transport medium for fat-soluble vitamins (vitamins A, D, E, and K), helps maintain cell membrane structure, and provides an energy reserve that can be used when food or other energy sources are limited. Fats and oils are the largest and most important components of the lipid group, which constitutes a major component of the diet of living organisms (Mahruf, 2020).

Based on the test results shown in Figure 4.5, the highest fat content was found in sample C at 9.31%, followed by sample B at 8.39%, and sample A at 8.08%. All fish feed samples met the requirements stipulated in Indonesian National Standard (SNI) 9043-4:2022, which stipulates a minimum fat content of 5% in fish feed. This means that, in terms of fat content, the feed from these three samples is considered suitable and meets applicable quality standards. The increase in fat content in sample C was due to the increased addition of scallop shell flour (*Placuna placenta*). Scallop shells can be processed into fine flour, and several studies have shown that this flour has special properties that are beneficial in food processing. One of these is its ability to act as an emulsifying agent or stabilizer of fat-water emulsions (Zhang *et al*., 2020).

CONCLUSION

This study shows that the addition of scallop shell flour (*Placuna placenta*) in fish feed has a positive effect on the nutritional quality of the feed. The higher the percentage of scallop shell flour used, the lower the water and crude fiber content, and the higher the ash, protein, and fat content of the feed. The feed formulation with 20% scallop shell flour (sample C) is the most optimal and in accordance with the established SNI because it provides a combination of low water content, high protein content, sufficient fat, and abundant minerals, so it can support maximum fish growth and extend the shelf life of the feed.

ACKNOWLEDGEMENT

The author would like to thank the Balikpapan Maritime Technology and Business Institute for their support and facilities throughout this research. He also thanks Ms. Tri Widayati Putri, S.Si., M.Si., for her assistance and guidance throughout this research. He also thanks his parents, friends, and all those who assisted in data collection, analysis, and preparation of this article, ensuring the successful completion of this research.

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