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ADVANTAGES OF FISH PROTEIN COMPARED TO OTHER NON-FISH PROTEINS (REVIEW ARTICLE)

Artikel Review, Keunggulan Protein Ikan Dibandingkan Protein Non Ikan Lainnya

Junianto*, Achmad Syauqibik

Fisheries Study Program, Faculty of Fisheries and Marine Sciences, Padjadjaran University

Bandung Sumedang Highway KM.21, Kec. Jatinangor, West Java 45363

*Corresponding Author: junianto@unpad.ac.id

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ABSTRACT

Protein is an essential macronutrient component in fulfilling human nutritional needs. Fish as a source of animal protein has unique nutritional characteristics that make it a potential high-quality food source. This study aims to review the advantages of fish protein compared to non-fish protein through a systematic review method. Data collection used the Google Chrome search engine with keywords fish protein, advantages of fish protein, and non-fish protein on 30 literature published from 2014-2025. Furthermore, the data were analyzed descriptively comparative. The review results show that fish protein content (19.9-58.8%) is higher than non-fish protein (1.59-19.76%), with tilapia and snakehead fish leading (58.8% and 53.17%). The amino acid profile of fish is also superior, indicated by the presence of tryptophan in snakehead fish (0.13%) and striped snakehead (0.14%) which is not detected in non-fish sources. Seahorse shows significant advantages in arginine content (3.55%), valine (3.38%), leucine (4.22%), and lysine (6.8%). It can be concluded that fish protein is superior to non-fish protein, both in terms of quantity and quality, making it an excellent source of animal protein for fulfilling human nutritional needs.

Key words: Amino Acid, Animal Protein, Fish, Nutritional Composition, Protein

ABSTRAK

Protein merupakan komponen makronutrien penting dalam pemenuhan kebutuhan gizi manusia. Ikan sebagai sumber protein hewani memiliki karakteristik nutrisi unik yang menjadikannya potensial sebagai sumber pangan berkualitas tinggi. Penelitian ini bertujuan mereview keunggulan protein ikan dibandingkan protein non-ikan melalui metode systematic review. Pengumpulan data menggunakan mesin pencari google chrome dengan kata kunci protein ikan, keunggulan protein dari ikan, dan protein non-ikan pada 30 literatur yang dipublikasikan tahun 2014-2025. Selanjutnya, data dianalisis secara deskriptif komparatif. Hasil review menunjukkan kandungan protein ikan (19,9-27%) lebih tinggi dibandingkan protein non-ikan (1,59-19,76%). Profil asam amino ikan juga lebih unggul, ditunjukkan oleh keberadaan triptofan pada ikan toman (0,13%) dan ikan gabus (0,14%) yang tidak terdeteksi

pada sumber non-ikan. Kuda laut menunjukkan keunggulan signifikan dalam kandungan arginin (3,55%), valin (3,38%), leusin (4,22%), dan lisin (6,8%). Dapat disimpulkan bahwa protein ikan superior dibandingkan protein non-ikan, baik dari aspek kuantitas maupun kualitas, menjadikannya sumber protein hewani yang unggul untuk pemenuhan kebutuhan gizi manusia.

Kata Kunci: Asam Amino, Ikan, Komposisi Gizi, Protein, Protein Hewani

INTRODUCTION

Fish is a commodity with high nutritional value. This is due to the content of macro and micronutrients that are beneficial to humans. Protein is the largest component in fish which can reach 20% so that fish can be used as a potential food source of animal protein. Some of the advantages of fish are: as a source of essential nutrients, universal in nature, cheap, white meat, and a relatively short production process (Irham *et al.,* 2023).

Protein is a combination of amino acid chains through peptide bonds that play a crucial role in overcoming various problems in the human body. This protein is also the main component of human body cells. The function of this protein is to form enzymes, form hormones, form blood cells, and make antibodies to protect the body from disease to infection (Wulandari, 2020).

Protein sources can be grouped into 2, namely animal protein and vegetable protein. Animal protein is protein that comes from animals. Animal protein can be classified into 2, namely fish protein, which is protein that comes from fish and non-fish protein, which is protein that comes from animals other than fish such as meat, chicken, eggs, milk, etc. While vegetable protein sources are proteins that come from fruits, vegetables, and nuts. This vegetable protein is also classified as non-fish protein (Azhar, 2016).

Protein-forming amino acids are broken down into 2 groups, namely essential amino acids and non-essential amino acids. Essential amino acids are a group of amino acids that cannot be produced in the human body so they must be obtained from outside the body through food or drink, while non-essential amino acids are a group of amino acids that can be produced in the human body. Protein itself consists of 20 different amino acids. The human body cannot synthesize 9 types of amino acids such as isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, valine, and histidine which are called essential amino acids (Umar, 2021).

These essential amino acids are found in fish. Fish contain protein composed of complete essential amino acids and are easily digested by the human body compared to proteins from other non-fish sources. Fish is an excellent source of protein, with a protein content of 10-20 grams per 100 grams. This amount is almost three times the daily protein requirement of the human body, which ranges from 45-46 grams. Consuming fish can help meet protein needs, which are around 15-15% for adults and up to 70% for children. In addition to quantity, fish are also rich in important essential amino acids such as methionine, lysine, and histidine. Compared to other sources of vegetable protein and non-fish protein, the amino acids in fish have a more complete and abundant composition, making it a superior protein choice to meet nutritional needs (Andhikawati et al., 2021). Therefore, this article aims to review the advantages of protein from fish compared to other non-fish proteins.

RESEARCH METHODS

The method used in this study is a systematic review conducted in January-March 2025. The location of the research was carried out at the Fisheries Product Processing Laboratory, with the main tools used including computers, online search tools, data processing software,

and printers. The research materials are in the form of data sourced from 30 research report articles published in the period 2014 to 2025 in indexed national and international journals.

Setiawan & Kautsar (2018), stated that the data used in the systematic review was obtained based on the results of research related to the main theme being reviewed. The research as has been published in the form of journals, proceedings, books, or other forms of research reports. Literature search using the Google Chrome search engine with the keywords fish protein, advantages of protein from fish, and protein from non-fish. The discussion in this article focuses on the nutritional composition of fish; protein composition in fish and non-fish; and amino acid profiles in fish and non-fish. The data obtained were analyzed descriptively comparatively. According to Adhimah *et al.* (2019), comparative descriptive analysis is a method of breaking down the data obtained, then comparing it with other data obtained from primary or secondary sources.

RESULT

Nutritional Composition of Fish

Fishery products, especially fish, rank top in fulfilling nutritional needs due to their comprehensive nutritional composition. Variations in fish nutritional content are influenced by complex internal and external factors. Internal factors include species, sex, age, and reproductive phase of fish, while external factors include the living environment, water quality, and availability of natural food. According to Hafiludin (2015), analysis of fish nutritional composition can be done through several tests such as proximate analysis, fatty acid profile, amino acid profile, and vitamins and minerals. It is interesting to note that every part of the fish, from the meat, skin, bones, to the stomach contents, has a unique nutritional composition.

Fish is a superior source of animal protein, with protein bioavailability 5-15% higher than vegetable protein sources. Containing complete essential amino acids, fish is able to optimally meet human nutritional needs. In addition to protein, fish is rich in fatty acids, especially omega-3 which is found in high-fat fish (>20%). According to Elavarasan (2018), omega-3 fatty acids have significant benefits in increasing intelligence, especially in children. Significant differences are seen in the omega-3 content between marine and freshwater fish, where marine fish naturally have higher levels of omega-3. For freshwater fish, omega-3 content can be increased through feed modification.

Protein Composition in Fish and Non-Fish

Protein is a natural polymer composed of amino acid monomers with the chemical formula COOH-RHNH$_2$, each amino acid is connected to form a linear chain called a peptide bond. Peptide bonds are formed between carboxyl groups or amino groups of adjacent amino acids (Dwiningrum *et al.,* 2023). The composition of protein in fish and non-fish is presented in Table 1.

Table 1. Composition of Fish and Non-Fish Protein

Protein Content in Fish		
Types of Fish	Protein Content	References
Milkfish	23,2 %	Minarseh *et al*., (2021)
Patin	20,39 %	Afrinis *et al*., (2018)
Mackerel	21,4 %	Matondang, (2022)
Tuna	26,3 %	
Salmon	19,9 %	
Pindang	27 %	

Protein Content in Non Fish		
Protein Source	Protein Content	References
Broiler Chicken	19,76 %	Nadia *et al*., (2023)
Chicken Eggs	16,6 %	Sahara *et al*., (2020)
Pork	11,9 %	Maiyena & Mawarnis, (2022)
Beef	18,8 %	
Peanuts	19,1 %	Hartono *et al*., (2018)
Cassava	1,59 %	Laka & Wangge, (2018)
Spinach Leaves	2,3 %	Rianto & Ahmad, (2017)
Tomatoes	1 %	Mardaus *et al*., (2019)

Amino Acid Profile in Fish and Non-Fish

Amino acids act as basic elements in the formation of proteins and support the body's metabolic processes. There are two categories of amino acids: essential (which the body cannot produce and must obtain from food) and non-essential (which the body can produce itself). The quality of a protein is determined based on the composition of amino acids contained in it (Sari et al., 2017). The amino acid profile in fish and non-fish is presented in Table 2.

Table 2. Amino Acid Profile in Fish and Non-Fish

Asam Amino	Types of Fish					Types of Non Fish				
	Toman[1]	snakehead fish[1]	Seahorses[2]	Milkfish[3]	Flying Fish Eggs [4]	Cow[5]	Goat [6]	Duck Eggs [7]	Koro Beans[8]	Soybeans [9]
Essensial										
Histidine	0,4%	0,41%	1,36%	0,56%	0,89%	6,57%	0,57%	-	0,45%	1,15%
Threonine	0,83%	0,84%	1,89%	0,42%	1%	2,17%	0,89%	-	0,83%	1,33%
Arginine	1,26%	1,06%	3,55%	0,25%	1,42%	2,57%	1,35%	-	1,21%	-
Methionine	0,67%	0,53%	1,77%	0,25%	1,59%	3,24%	0,54%	-	0,2%	0,63%
Valine	0,97%	0,91%	3,38%	0,38%	3,35%	3,08%	0,97%	-	1,03%	1,69%
Phenialanine	0,81%	0,73%	2,33%	0,36%	1,21%	2,72%	0,82%	-	1,01%	1,83%
Isoleucine	0,95%	0,88%	2,64%	0,35%	1,65%	2,88%	0,93%	0,58%	0,97%	1,66%
Leucine	1,58%	1,42%	4,22%	0,78%	2,87%	1,81%	0,53%	1,3%	1,4%	2,76%
Lysine	1,93%	1,54%	6,8%	0,67	0,98%	3,57%	1,79%	0,38%	1,42%	2,28%
Tryptophan	0,13%	0,14%	-	-	-	-	-	-	-	-
Total	9,53%	8,46%	27,94%	3,77%	14,96%	28,6%	8,39%	2,26%	8,52%	13,33%
Non-Essensial										
Aspartic Acid	2,06%	1,79%	5,1%	0,74%	2,55%	4,01%	1,8%	-	2,32%	-
Glutamic Acid	3,15%	2,85%	9,13%	1,39%	5,38%	9,68%	3,29%	-	2,54%	-
Serine	0,74%	0,58%	1,99%	0,24%	2,71%	9,91%	0,78%	-	0,94%	-
Glysine	0,88%	0,71%	6,77%	0,24%	1,67%	0,73%	1,13%	-	0,87%	-
Alanine	1,14%	1,02%	5,46%	0,8%	2,94%	2,1%	1,22%	-	0,72%	-
Tyrosine	0,67%	0,62%	1,5%	0,29%	0,89%	3,42%	0,71%	-	0,97%	-
Proline	-	-	-	0,43%	3,12%	-	-	-	-	-
Cysteine	-	-	-	0,16%	1,01%	-	-	-	-	-
Total	8,64%	7,57%	29,95%	4,29%	20,27%	29,84%	8,93%	0%	8,36%	0%
Total Amino Acids	18,17%	16,03%	57,89%	8,06%	35,23%	58,44%	18,32%	2,26%	16,88%	13,33%

Description:
1. Fitriyani *et al*., (2020)
2. Sari *et al*., (2017)
3. Hafiludin, (2015)
4. Azka *et al*., (2015)

5. Sinlae *et al*., (2015)
6. Mirdhayati *et al*., (2014)
7. Ginting *et al*., (2017)
8. Puryana & Antarini, (2018)
9. Kudełka *et al*., (2021)

DISCUSSION

Protein Composition in Fish and Non-Fish

Based on Table 1, salted fish has a very high protein content of 27%, higher than non-fish protein sources such as broiler chicken which is only 19.76% and beef with 11.9% (Maiyena & Mawarnis, 2022; Matondang, 2022; Nadia *et al*., 2023). This shows that salted fish can be a very good source of animal protein in meeting nutritional needs. The high protein content of salted fish shows that the right method with the right temperature and time can optimize protein acquisition.

Overall, fish has a higher protein content compared to non-fish protein sources. Salted fish ranks highest with a protein content of 27% (Matondang, 2022), followed by tuna at 26.3% (Matondang, 2022), and then mackerel at 21.4% (Matondang, 2022). Meanwhile, the highest non-fish protein source only reached 19.76% which was found in broiler chickens (Nadia *et al*., 2023). This significant difference shows the superiority of fish as a source of protein in the human diet.

Based on Table 1, it is clear that fish protein generally has a higher content compared to non-fish protein sources. The average protein content in fish ranges from 19.9% to 27%, while non-fish protein sources only range from 1.59% to 19.76%. This significant difference shows that fish is a more efficient source of animal protein compared to non-fish protein sources. Minarseh *et al*. (2021) in their study found that milkfish has a total protein content of 23.2%, both from monoculture and polyculture ponds, making it a good source of protein for human consumption.

The advantages of fish protein are not only in terms of quantity but also quality. According to Matondang (2022), fish such as tuna with a protein content of 26.3% have complete essential amino acids and are easily digested by the human body because of their low fiber content compared to proteins from other non-fish. Research by Afrinis *et al.* (2018), also revealed that catfish with a protein content of 20.39% has a good amino acid profile and high biological value. This makes fish protein more effective in meeting the body's nutritional needs compared to non-fish protein sources such as peanuts which have a protein content of 19.1% (Hartono *et al.,* 2018) but with a less complete amino acid profile.

When compared to non-fish animal protein, fish protein also has the advantage of lower fat content. Maiyena & Mawarnis, (2022) stated that beef and pork with protein content of 11.9% and 18.8% respectively have higher saturated fat content compared to fish. Meanwhile, vegetable protein sources such as cassava with a protein content of only 1.59% (Laka & Wangge, 2018) cannot be used as the main source of protein in the diet. This further emphasizes the importance of fish as a source of high-quality protein that is healthier for human consumption.

Amino Acid Profile in Fish and Non-Fish

Based on Table 2, the amino acid profile in fish species appears superior to amino acids in non-fish species, especially in seahorse amino acids. The superior amino acids in seahorses are arginine (3.55%), valine (3.38%), leucine (4.22%), lysine (6.8%), aspartic acid (5.1%), glycine (6.77%), and alanine (5.46%). Seahorses show an arginine content of 3.55%, much higher than non-fish sources such as goats (1.35%) and jack beans (1.21%). This superiority is

significant because arginine plays an important role in protein synthesis, wound healing, immune function, and the release of growth hormones. Arginine also functions as a precursor to nitric oxide which helps dilate blood vessels and increase blood flow. Research by Sari et al. (2017) confirmed that the high arginine content in seahorses contributes to a better biological value of protein compared to non-fish protein sources.

The valine content in seahorses reaches 3.38%, higher than goat meat (0.97%), jack beans (1.03%), and soybeans (1.69%). As a branched chain amino acid (BCAA), valine plays an important role in tissue repair, muscle growth, and blood sugar regulation. The superior valine content in seahorses makes it a superior protein source for muscle tissue maintenance and repair. According to Sari et al. (2017), the high valine content in seahorses provides a more effective biological value of protein for body protein synthesis.

Seahorses have a leucine content of 4.22%, far exceeding leucine in duck eggs (1.3%), jack beans (1.4%), and soybeans (2.76%). Leucine is the most important BCAA for muscle protein synthesis and recovery. Leucine also plays a role in regulating blood sugar levels and producing growth hormones. The superiority of leucine in seahorses makes it an optimal protein source for growth and maintenance of muscle mass. Sari et al. (2017) emphasized that the high leucine content in seahorses contributes significantly to the overall quality of fish protein.

The lysine content in seahorses reaches 6.8%, very high compared to non-fish protein sources such as beef (3.57%), goat meat (1.79%), and soybeans (2.28%). Lysine plays an important role in collagen formation, calcium absorption, antibody production, and hormone synthesis. Lysine deficiency can cause anemia, growth disorders, and reproductive problems. The superiority of lysine content in seahorses makes it a superior protein source for growth and development. In their research, Sari *et al.* (2017) concluded that the high lysine content in seahorses provides superior nutritional value compared to other protein sources.

Seahorses contain 5.1% aspartic acid, higher than beef (4.01%), goat meat (1.8%), and jack beans (2.32%). Aspartic acid plays a role in amino acid metabolism, the urea cycle, DNA synthesis, and nervous system function. This amino acid is also important for ammonia detoxification and energy production. The superior aspartic acid content in seahorses makes it a more effective source of protein for metabolism and nerve function. Sari et al. (2017) found that the high aspartic acid in seahorses contributed to a more comprehensive non-essential amino acid profile.

The glycine content in seahorses reaches 6.77%, much higher than beef (0.73%), goat meat (1.13%), and jack beans (0.87%). Glycine plays an important role in collagen synthesis, central nervous system function, and the production of the antioxidant glutathione. This amino acid also has anti-inflammatory effects and helps produce creatinine for muscle energy. The superior glycine content of seahorses makes them a superior protein source for healthy skin, joints, and the nervous system.

Seahorses have an alanine content of 5.46%, far exceeding the content in beef (2.1%), goat meat (1.22%), and jack beans (0.72%). Alanine plays a role in glucose metabolism, nitrogen transport between tissues, and strengthening the immune system. This amino acid also functions as an energy source for muscles, brain, and central nervous system. The superior alanine content in seahorses makes it a more effective source of protein for energy production and metabolism.

Based on Table 2, it can be seen that snakehead fish and snakehead fish have tryptophan content of 0.13% and 0.14% respectively, while in non-fish types such as cows, goats, duck eggs, jack beans, and soybeans, no tryptophan content was detected. The superiority of tryptophan in snakehead fish (*Channa micropeltes*) is that it has a content of 0.13% which is not found in non-fish protein sources. Tryptophan is an essential amino acid that plays an

important role as a precursor to serotonin which helps regulate mood, sleep, and appetite. The presence of tryptophan in snakehead fish makes it a potential source of animal protein to help maintain the balance of neurotransmitters in the brain and support cognitive function. According to Fitriyani *et al.* (2020), the amino acid composition of snakehead fish, which includes 16 types of amino acids including tryptophan, provides more complete nutritional value than non-fish protein sources.

Snakehead fish (*Channa striata*) showed a tryptophan content of 0.14%, slightly higher than snakehead fish and not found in non-fish protein sources. Tryptophan in snakehead fish plays an important role in body protein synthesis, serotonin formation, and melatonin which regulates the sleep cycle. The superiority of tryptophan in snakehead fish makes it an effective source of protein for nervous system function and maintaining hormonal balance. This is in accordance with the fact that snakehead fish has the potential as a source of high albumin and essential amino acids, including tryptophan which contributes to the overall quality of fish protein.

Based on Table 2, proline in flying fish eggs has a fairly high content (3.12%), while in milkfish it was also detected at a level of 0.45%. The advantage of this proline is its ability to help form collagen and maintain tissue integrity. Proline plays an important role in the development of fish embryos and provides nutritional benefits for the human body, especially for skin and joint health (Azka *et al.,* 2015). Interestingly, proline was not detected in several non-fish species which shows the superiority of flying fish eggs and milkfish as sources of this amino acid.

Cysteine in flying fish eggs has a content of 1.01% and in milkfish 0.16%. The advantage of cysteine is its role as an antioxidant and structural protein builder. Cysteine forms disulfide bonds that are very important for the structural stability of proteins and plays a role in antioxidant defense through the formation of glutathione (Hafiludin, 2015). In flying fish eggs, cysteine supports embryonic development and the immune system, providing added value compared to other non-fish protein sources that do not contain significant amounts of cysteine as in Table 2.

CONCLUSION

Based on the review article, fish protein shows significant advantages over non-fish protein, both in terms of quantity and quality. Quantitatively, fish protein content (19.9-27%) is much higher than non-fish protein sources (1.59-19.76%). In terms of quality, fish protein has a more complete amino acid profile, including the presence of tryptophan in snakehead fish (0.13%) and snakehead fish (0.14%) which is not detected in non-fish protein sources. Seahorses show advantages in the content of essential amino acids such as arginine (3.55%), valine (3.38%), leucine (4.22%), and lysine (6.8%), as well as non-essential amino acids such as aspartic acid (5.1%), glycine (6.77%), and alanine (5.46%) which play an important role in various physiological functions of the human body. The advantage of fish protein is also that it is easily digested by the human body because its fiber content is lower than that of other non-fish protein sources. The superiority of protein composition and amino acid profile in quantity and quality makes fish a superior source of animal protein to meet human nutritional needs compared to other non-fish proteins.

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