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Nutritional Content of Catfish Nuggets from Aquaponic Cultivation

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ABSTRACT

Catfish (*Clarias* sp.) has high nutritional content. However, processed products such as nuggets from this fish are still limited in Kupang city. So, the nutritional content of the nuggets is less known. Therefore, this study aims to analyze the nutritional content of catfish nuggets derived from aquaponic cultivation, with proximate analysis. The stages of making catfish nuggets briefly begin with ground meat, then steamed, then coated with breadcrumbs and stored in the freezer. The proximate test obtained was the content of 11.67% protein, 30.139% carbohydrates, 7.82% fat, 48.137% water content, 2.22% ash and 0.014% crude fiber. So, with its nutritional content, catfish nuggets can be used as a substitute for chicken nuggets.

INTRODUCTION

Catfish processed in recent years is increasing, which is characterized by an increase in market demand. This increase has an impact on the increasing number of catfish (*Clarias* sp.) farming activities carried out by the community (Lutfiyanah & Djunaidah, 2020; Sudarmawan *et al*., 2023). One of the most popular aquaculture systems is aquaponics. This system is popular because of the ease of cultivation and the nutritional results obtained are also not much different from fish farming in general (Efendy *et al*., 2022).

Catfish (*Clarias* sp.) has a high protein, carbohydrate, calcium, sodium, and other mineral content (Mobdy *et al*., 2021). This causes the fish to be processed into main meals by various methods (Sari *et al*., 2021). Abon, sausage and crackers are examples of processed catfish products that are widely favored by the public (Kusumaningrum & Sulistiawati, 2024). Apart from that, there are also meatball and nugget dishes made from catfish (*Clarias* sp.) which are increasingly developing (Andayani & Ausrianti, 2021).

One of the most popular processed fish-based products that is easy to make is nuggets (Domili *et al*., 2021). Nuggets are a product that is easy to serve, made from ground meat with a characteristic rectangular shape and a layer of breadcrumbs (Abiala *et al*., 2022; Kristanti & Setiaboma, 2021). Nuggets are a product that is easy to serve, made from ground meat with a characteristic rectangular shape and a layer of breadcrumbs (Giovani *et al*., 2024).

Fish is an alternative to chicken meat in making nuggets. Fish nuggets have the same method as nuggets in general. Only the main ingredient is different, namely fish meat as the basis of the process. Where the use of fish meat can fulfill basic nutritional needs (Aliandrina & Cathrine, 2023; Hamzah *et al*., 2022). The nutritional content of fish nuggets is known to be quite high, making it one of the healthiest foods (Nursia *et al*., 2024). Previous research has shown that fish have been processed into nugget products. These fish include giant catfish (Solichah *et al*., 2022), tuna nuggets (Kusumawardani *et al*., 2023), milkfish nugget (Luthfiyah *et al*., 2021), and other types (Lestari *et al*., 2024).

Grilled or fried fish is still a common fish processing done by the people of Kupang city. Catfish (*Clarias* sp.) into nugget processing is very rarely done, and this causes the nutritional content of the nugget to be unknown. Therefore, this study aims to analyze the nutritional content of catfish nuggets (*Clarias* sp.) derived from aquaponic cultivation, with proximate analysis.

LITERATURE REVIEW

Catfish (*Clarias* sp.) is a freshwater fish that is resistant to extreme conditions and is not difficult to cultivate (Pratiwi *et al*., 2020). This is the reason why catfish (Clarias sp.) is suitable for aquaponic cultivation. In aquaponics, cultured fish will use energy to grow rather than to survive, because the water quality is maintained in this system (Sari *et al*., 2023). In addition, this fish is famous for producing a crispy and savory meat texture when processed (Junianto *et al*., 2023). The nutritional content of catfish (*Clarias* sp.) includes 8.10±0.09% fat, 0.52±0.12% carbohydrate, 1.05±0.14% ash and 19.03±0.46% protein (Mobdy *et al*., 2021).

Catfish nuggets are made from catfish meat that goes through a grinding process, then heated and frozen, so that it becomes a frozen dish that is easy to serve and ready to eat (Junianto *et al*., 2022). The basic ingredients used in making fish nuggets are catfish meat, breadcrumbs, garlic, carrots, eggs, flavoring, tapioca flour, pepper and several other ingredients (Sari *et al*., 2021). The stages of making nuggets start from the spices provided are ground, then the fish meat is ground. Next, it is processed with the finished spices and other complements. Once formed, the dough is cooked using the steam method. The nuggets are then cut and coated with breadcrumbs before being frozen in the freezer. That way, the nuggets can be fried immediately when they are going to be consumed (Gorintha & Pratiwi, 2023).

Previous research showed that 13.77%, 14.70% and 15.55% of protein was contained in catfish nuggets that were treated with the addition of various concentrations of wheat flour (Tumion & Hastuti, 2017). This is in line with the results of the catfish nugget sample with the addition of durian seed flour (*Durio zibethinus* murr), as much as 19.51% protein, 38.34% carbohydrates, 12.88% fat and 1.30% ash content (Mursali & Yusuf, 2021). However, it is different in the research of catfish nuggets with a mixture of moringa leaves (*Moringa oleifera*), where only 8.63% protein. While the carbohydrate and fat content is still within the normal range of 31.25% and 18.24%, respectively (Vidayana *et al*., 2020).

METHODOLOGY

In this study, the tools used were analytical scales, blenders, graters, pans, baking sheets, stoves, cutting boards, bowls and knives. The materials used included catfish (*Clarias* sp.), breadcrumbs, spring onions, carrots, ice cubes, tapioca flour, pepper, eggs, wheat flour, salt, oil and sugar. Catfish (*Clarias* sp.) were obtained from aquaponic cultivation at the NBS (Nunbaun Sabu) Village cultivators in Kupang, East Nusa Tenggara.

Making catfish nuggets includes the process of washing the fish, where the fish is cleaned and only the meat is taken. Ingredients such as spices and others are then weighed according to the measurements and ground. The fish meat is then ground until smooth and mixed with the ground spices. The ingredients are then stirred with grated carrots, tapioca flour, ice water and chopped spring onions. Furthermore, the dough that is formed is cooked by steaming. When it is cooked, the dough is removed and left to cool so that it is easy during the cutting process with a rectangular shape. Next, the dipping dough is prepared with basic ingredients of wheat flour, egg white and ice cubes that are mixed. The last stage, the nuggets are coated with breadcrumbs which are a characteristic of a nugget, before being frozen for 30 minutes in the freezer.

The finished nuggets were analyzed for nutritional content with a proximate test at the Animal Husbandry Laboratory of Nusa Cendana University. There are several methods used in the proximate test. The Kjeldahl method is done for protein test, where the sample will be deconstructed and distilled, so that the distillate is titrated to the end point. The by difference method is done for carbohydrate test, where the results are obtained by subtracting 100% of the ash content, water content, fat content and protein

content. Thermogravimetric method is carried out for the test of ash content and water content, where the measurement of ash content with the sample is heated and then put in a desiccator to weigh the final weight, while the measurement of water molecules is done by removing water molecules through heating so that the difference in sample weight can be calculated. The Soxhlet method was conducted for the fat test, where the sample was put into the Soxhlet extraction tool and refluxed.

RESEARCH RESULT

Proximate test shows the nutritional content of catfish nuggets which can be seen in Figure 1. The values of protein, carbohydrate, fat, water, ash and crude fiber are 11.67%, 30.139%, 7.82%, 48.137%, 2.22% and 0.014% respectively.

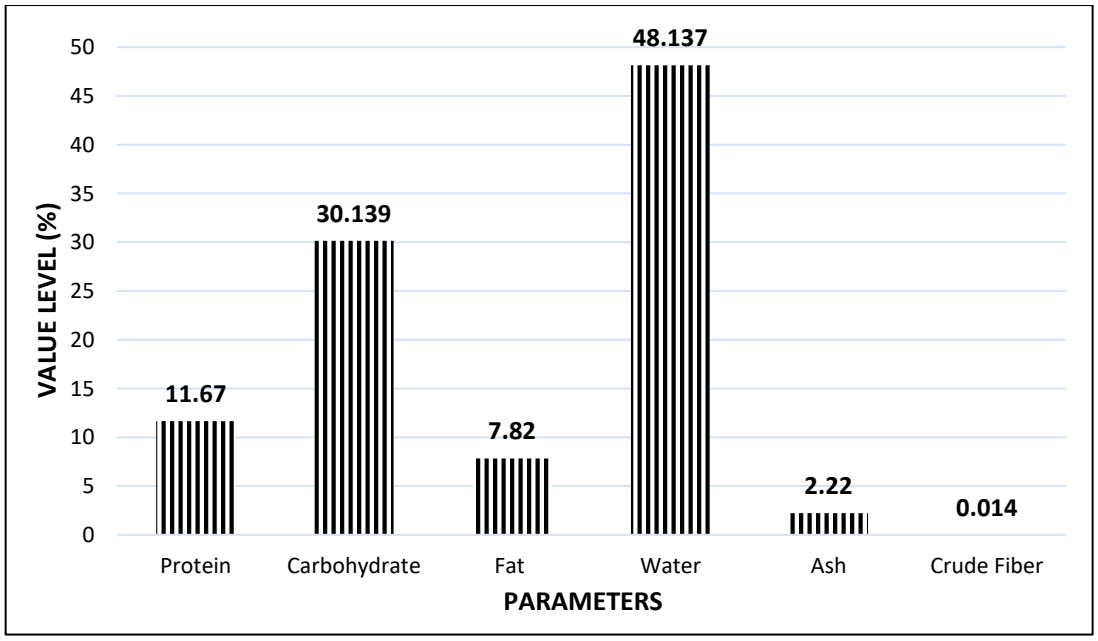

Figure 1. Nutritional Value of Catfish Nuggets

DISCUSSION

Proximate analysis is a chemical test on a product, which aims to identify the nutrients contained in the product. This test will outline the nutrients contained, such as protein, fat and others (Muza'ki *et al.*, 2022; Sinay & Harijati, 2021). Nuggets vary in content, depending on the main ingredients and mixtures used. Nugget is generally made from chicken meat, which based on SNI 01-6683-2002, contains a minimum of 12% protein, a maximum of 60% moisture content, a maximum of 25% carbohydrates and a maximum of 20% fat (Astuti & Auliyah, 2024). Different standards for fish nuggets, which contain a maximum of 15% water content, 2.5% ash, 15% fat and a minimum of 5% protein. This is in accordance with the nutritional values listed in SNI 7758: 2013 (Ayu *et al.*, 2020).

The results of the research related to catfish nuggets from aquaponic cultivation showed a protein content of 11.67%. This value is still within the fish nugget standard based on SNI 7758: 2013 and is almost close to the range of protein values in SNI 01-6683-2002 regarding chicken nugget content. Previous

research related to protein in catfish nuggets also showed almost the same value of 10.61% (Djonu *et al*., 2021). The high value of protein contained in catfish nuggets is influenced by the amount of meat used. This is in accordance with the results obtained, where nuggets without the addition of other ingredients, contain 10.38% protein (Vidayana *et al*., 2020). In addition, the use of tapioca flour can also affect the protein content in the nuggets (Giovani *et al*., 2024). Protein content is also affected by the processing of meat by heating methods. Protein in steamed fish meat is different from fried fish. Frying fish meat will reduce protein levels more than steaming (Ciptawati *et al*., 2021). This happens because during the heating process with higher temperatures, it will cause damage to the protein (Safitri *et al*., 2023).

Carbohydrate testing on catfish nuggets from aquaponic farming resulted in a value of 30.139%. This value exceeds the maximum content of chicken nuggets listed in SNI 01-6683-2002. In the process of making nuggets by steaming, it will still maintain the carbohydrate content contained. It is different when processed with frying, it will cause changes in carbohydrate values (Sulistyoningsih *et al*., 2019). In this study, high carbohydrates can occur due to the use of flour in nuggets. Previous studies have shown the effect of flour seen in the results of carbohydrate content of 31.65% in catfish nuggets (Vidayana *et al*., 2020). In fish nuggets, the use of tapioca flour with other mixtures will affect the carbohydrate content, which will be higher (Lekahena, 2016).

Analysis of the fat content in catfish nuggets from aquaponic cultivation shows a range that falls within the SNI 7758:2013 range, which is 7.82%. This result is almost the same as previous research, where catfish nuggets showed a fat content of 8.62%. One of the things that affects the fat content of a product is the use of various additional ingredients in the nugget dough (Djonu *et al*., 2021). In other studies, it was also added that the fat content in catfish (*Clarias* sp.) is higher than mackerel (*Scomberomorus* sp.) based on proximate tests (Pasaribu *et al*., 2024). In making nuggets, freshwater fish is one of the main raw materials which has a higher fat content than other fish (Vidayana *et al*., 2020). Even this content will increase if the nuggets have gone through the frying process. This happens because of the hidden oil from the oil absorbed in the nuggets (Astuti & Auliyah, 2024).

Proximate test shows the water content in catfish nuggets from aquaponic cultivation is 48.137%. This value is still in accordance with SNI 7758:2013. This result is also almost the same as previous research on catfish nuggets, where there was 52.21% water content (Putri *et al*., 2023). The addition of flour is known to result in changes to the moisture content contained. When flour is used in large quantities, the moisture content of the nuggets will decrease (Anam *et al*., 2023). A significant decrease was seen in the water content in fresh, steamed and fried catfish (*Clarias* sp.) meat. Fresh meat has 69.64% water content, decreasing to 69.48% after steaming and to 37% when fried. This is due to the high temperature when the fish meat is fried (Ciptawati *et al*., 2021).

The ash content of 2.22% was seen in the proximate test results on catfish nuggets from aquaponic cultivation. This value is still considered safe based on SNI 01-6683-2002. The ash content is related to the mineral content in a product

(Hafid *et al.*, 2017). This component in a product will be affected by the addition of tapioca flour. The ash content value will decrease along with the addition of tapioca flour to the processed product (Barus *et al.*, 2022). Apart from that, adding spices and salt will also affect the ash content, due to the minerals contained therein (Mursali & Yusuf, 2021). This is in accordance with previous research, where there is 2.81% ash content contained in catfish nuggets. The difference in ash content is caused by the presence of minerals in the spices used (Sulistyoningsih *et al.*, 2019).

Testing of crude fiber in catfish nuggets from aquaponic cultivation yielded a value of 0.014%. In SNI, the range of crude fiber values is not listed, and is an added nutritional value of a product (Fazil *et al.*, 2022). In previous research, different results were shown, where catfish nuggets contained 1.88% crude fiber (Putri *et al.*, 2023). As with several other parameters, different results on crude fiber content are caused by the type of additional ingredients given. For example, the use of corn flour will increase the crude fiber value in catfish nuggets to 1.22% (Widoretno *et al.*, 2023).

CONCLUSIONS AND RECOMMENDATIONS

Catfish meat can act as the main ingredient to replace chicken meat, in the nugget processing process. This is because the nutritional content obtained from the proximate test shows good results according to standards and is considered safe. In this study, catfish nuggets from aquaponic cultivation showed 11.67% protein, 30.139% carbohydrate, 7.82% fat, 48.137% water content, 2.22% ash and 0.014% crude fiber. Thus, with its nutritional content, catfish nuggets can be used as a substitute for chicken nuggets.

ADVANCED RESEARCH

This research is still limited to the nutritional content based on the proximate test of several parameters. Further research is expected with more complete parameters related to the nutritional content of catfish nuggets.

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