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Effect of Maggot-Based Feed on Carbohydrate and Protein Content of Catfish Processed Products

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Abstract. The catfish (*Clarias batrachus*) is one kind of fish, which currently has been highly demanded in Indonesia due to the high protein content. Generally, the catfish in Indonesia are fried, grilled and served as “pecel lele”. In order to meet the increasing market demand, the catfish farming should be increased massively but by reducing the production cost, such as using maggot-based feed. However, the carbohydrate and protein content of the processed products based on catfish fed maggot has not been reported to our knowledge. Therefore, here we investigated carbohydrate and protein content of several catfish processed products *i.e.*, smoked catfish, steamed catfish, catfish nugget, and catfish meatball. The results show that among the catfish processed products, the smoked catfish has the highest carbohydrate content but the lowest protein content. On the other hand, the steamed catfish has the highest protein content compared to the other catfish processed products.

1. Introduction

The catfish (*Clarias batrachus*) is a species of freshwater airbreathing catfish native to Southeast Asia [1]. It has slippery, elongated, scaly body, with also long dorsal and fins. It has the ability to use its pectoral fins to keep it upright as it makes a wiggling motion with snakelike movements. This fish normally lives in slow-moving and often stagnant waters in ponds, swamps, streams and rivers, flooded rice paddies or temporary pools that may dry up. Catfish contains high levels of protein and vitamin D. The cultivated catfish contain low omega-3 fatty acids but have high omega-6 fatty acids. In Indonesia, the catfish is generally called as “lele”, and it is the main ingredient in several native dishes. The most popular processed catfish products are fried, grilled and served as “pecel lele”. The number of catfish market demand has been increasing year by year. Therefore, catfish farming should be improved not only by increasing the quantity but also by reducing the production cost. One of the method is by feeding the catfish with food that rich of nutrients such as protein, fat, carbohydrates, vitamins and minerals.

In our previous study, we have investigated the effect of maggot-based feed on the catfish growth [2]. Maggot is the larva of a fly (order *Diptera*). Maggots are used as supplementary feed for growing fishes of about two weeks old from juvenile. Maggot-based animal feed is more than 15 percent



cheaper than other alternatives and has been proven to be highly nutritious and rich in proteins (60-65%), a vital element in every animal feed. The content of lysine, methionine and others is very good for the growth of freshwater fish, especially catfish [3]. In addition, Maggot-based animal feed also speeds up the fermentation process in the digestive tract. The maggot used in this case was grown based on chicken feces [2]. The chickens were bred under various conditions. In addition to the commercial feed, we used herbal ingredients (*i.e.*, ginger and turmeric) and intermittent lighting. In this case, the herbal ingredient was used to substitute the synthetic antibiotics [4]. On the other hand, intermittent lighting is an important parameter in poultry production. It is a strong exogenous factor in controlling many physiological and behavioral processes [5-9]. The results showed that compared to the catfish with maggot-based feed obtained from chickens under 1 hour light followed by 3 hour darkness (1L: 3D) the catfish grew better with maggot-based feed obtained from chickens under 1 hour light followed by 2 hour darkness (1L: 2D). Unfortunately, the investigation on the nutritional content of products based on those catfish has not been reported to our knowledge. Therefore, in this work we made some food products based on the catfish, which has been bred in Ref. 2, such as smoked catfish, steamed catfish, catfish nugget, and catfish meatball. We then analyzed their carbohydrate and protein content.

2. Computational Procedure

In this work, we used catfish obtained in Ref. 2. We bred 100 local catfishes in the soil pond. We fed the catfish with maggot, which was bred from chicken feces. The chickens were fed with commercial feed combined with 0.2% turmeric. They were bred under 1 hour light followed by 2 hour darkness (1L: 2D). The catfish meat were then processed into several products such as such as smoked catfish, steamed catfish, catfish nugget, and catfish meatball.

In order to make smoke catfish product, first we soaked the catfish and cleaned them using salt. Next, we put the catfish on the mounting wire and flip the fish regularly until well done. We used stovetop setup to make steamed catfish; a steel insert-that puts the fish over a pot of boiling liquid and has a lid to keep the steam from escaping with adding some spices. In order to make nugget catfish, first we grind catfish meet with garlic, eggs, pepper, salt, sago flour and water. Next, the nugget dough was shaped and coated with egg, wheat flour and bread flour. After that, we deep-fried it with regular frying oil until the color change until golden brown. On the other hand, in order to make catfish meatball, we added garlic, eggs, sugar, salt, pepper, starch and water. The meatball dough was shaped and boiled. About 100 g of each catfish processed products were then analyzed to determine the carbohydrate and protein content with 3 times repetition. We also carried out Analysis of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT) to determine the correlation between catfish processed products and the nutrient content [10,11]. When we run ANOVA, the results will tell us if there is a difference in means. However, it is not clear which means are different. Therefore, DMRT is a post hoc test to measure specific differences between pairs of means.

3. Results and discussion

Table 1 shows the carbohydrate and protein content of catfish processed products in percent (%). The processed products are smoked catfish, steamed catfish, catfish nugget, and catfish meatball. The top row show the carbohydrate and protein content of raw catfish obtained from Ref. 12 and 13. The data shown in here are for 3 times repetition together with their average amount. In the same column, means followed by same letter are not significantly different at the 5% level by DMRT ($P > 0.05$) [10].

Our results show that in the case of carbohydrate content, it increases in the order of catfish meatball, catfish nugget, steamed catfish, and smoked catfish. The carbohydrate contents are shown to be ca. 12.853, 13.689, 13.744, and 15.317% for catfish meatball, catfish nugget, steamed catfish, and smoked catfish, respectively. Since it has been reported that the carbohydrate content in 100 g of catfish are 0.3

grams [12], it indicates that there are carbohydrate lost after processing method. Based DMRT analysis, there is a relationship between the carbohydrate content in various catfish processed product and the processing method ($P > 0.05$).

On the other hand, in the case of protein content, it increases in the order of smoked catfish, catfish meatball, catfish nugget, and steamed catfish. The protein contents are shown to be ca. 2.810, 2.996, 4.571, and 5.207% for smoked catfish, catfish meatball, catfish nugget, and steamed catfish, respectively. A study reported that the fresh catfish has a high protein ca. 17.7 - 26.7% [13]. As we have expected, the protein content reduced due to the processing method. Therefore, similar with the carbohydrate content, based on DMRT analysis, there is a relationship between the protein content in various catfish processed product and the processing method ($P > 0.05$).

8

Table 1. The carbohydrate and protein content of catfish processed products (%). In the same column, means followed by same letter are not significantly different at the 5% level by DMRT ($P > 0.05$) [10]. The top row show the carbohydrate and protein content of raw catfish obtained from Ref. 12 and 13.

Catfish processed products	Repetition	Carbohydrates (%)	Protein (%)
Fresh catfish [12,13]		30	17.7 - 26.7
	1	15.323	2.741
Smoked Catfish	2	15.205	3.261
	3	15.424	2.428
	Means	15.317^a	2.810^b
Steamed Catfish	1	13.73	4.809
	2	13.694	5.036
	3	13.808	5.776
	Means	13.744^b	5.207^a
Catfish Nugget	1	12.717	4.350
	2	13.057	4.736
	3	12.784	4.626
	Means	12.853^c	4.571^a
Catfish Meatball	1	13.651	2.753
	2	13.896	3.236
	3	13.520	2.998
	Means	13.689^b	2.996^b

The decreasing protein in our study is mainly due to the damage caused by processing method. According to Kabahenda *et al.*, [14], a certain high temperature fumigation will lead to denaturation and degradation of proteins. It will reduce the function and essential amino acids. The fumigation can be done with low or high temperature, such as at 30-50°C or at 50-90°C, respectively [15]. The nutritional content of each fish will differ depending on internal and external factors. Internal factors such as fish species, sex, age, and fish reproductive phase. On the other hand, the external factors are the factors that exist in the fish environment or its habitat such as availability of food and the quality of the waters where fish live [16].

4. Conclusion

Our food choices each day affect your health — how we feel today, tomorrow, and in the future. The nutrients in the foods we eat support the activities of day-to-day living, protect our cells from environmental damage and repair any cellular damage that might occur. Carbohydrates play as fuel in our body. Whereas protein rebuilds injured tissue and promotes a healthy immune system. The catfish (*Clarias batrachus*) is one kind of fish, which currently has been highly demanded in Indonesia due to the high protein content. Currently, it is very popular that farmers fed catfish with maggot. Not only due to the low price but also due to the highly nutritious content which is very good for the growth of catfish. For human consumption, not only feed materials, how to cook the catfish itself must be considered. In this work, we bred 100 local catfishes in the soil pond. We fed the catfish with maggot, which was bred from chicken feces. The chickens were fed with commercial feed combined with 0.2% turmeric. They were bred under 1 hour light followed by 2 hour darkness (1L: 2D). The catfish meat were then processed into several products such as such as smoked catfish, steamed catfish, catfish nugget, and catfish meatball. Our results show that in the case of carbohydrate content, it increases in the order of catfish meatball, catfish nugget, steamed catfish, and smoked catfish. On the other hand, in the case of protein content, it increases in the order of smoked catfish, catfish meatball, catfish nugget, and steamed catfish. Based on the DMRT method, it shows that the carbohydrates and proteins contents of various catfish processed product depend on the processing method ($P > 0.05$).

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