Albumin and enzyme profiles of dwarf snakehead, *Channa gachua* caught from River Brantas, East Java

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Abstract. Albumin is one of the functional foods needed in the health sector, especially to accelerate the wound healing process, regulate osmotic pressure and as an antioxidant. Snakehead, *Channa gachua* (Channidae) is one of the main albumin sources from freshwater fish. This study aimed to obtain albumin content and enzyme profile data of snakehead at different size. Fish sample was collected from local river-basin and grouped into three different size categories, < 10 cm total length, 10-15 cm, and > 15 cm total length. Proximate and enzyme activities were analyzed based on AOAC methods. Albumin extraction was based on acid solvent extraction. Results of analysis showed that crude protein and lipid content varied between 65.0-71.4%, and 1.08-2.13%, respectively. Crude protein content was significantly increasing at bigger fish size, vice versa with lipid content. The protease and lipase activities varied between 14.31-23.01 µmol g⁻¹ min⁻¹ and 298-423 µmol g⁻¹ min⁻¹, respectively. These both enzyme activities were significantly increasing as fish size increased. However, there was no different of albumin content at fish size < 10 cm and 10 – 15 cm. Protein content and enzyme activities both determine the albumin content of the fish. To gain higher albumin content from snakehead, fish should be harvested at size larger than 15 cm total length.

1. Introduction
Fish is considerably important due to its nutritional value. It contains proteins of good quality due to complete content of essential amino acids. However, it can also be judged for its contribution in the improvement or maintaining human health status. Snakehead, *Channa gachua* (Channidae) is a freshwater and carnivorous fish species usually found in the middle and downstream of the river, estuarine, lake or reservoir. It positioned as one of the top predators, naturally low in catch composition and economically less important. The fish is rarely found in local fish market, and if so, consumers pay less attention due to its unpleasant taste and odor.

Snakehead commonly live at murky water or muddy bottom [1]. The species may survive during dry season, burying themselves into the bottom, breathe in anaerobic condition and withstand temporally in the drought [2]. Characterized as predator and carnivore in nature, the fish feed on various living and non-living objects, such as small fishes, crustaceans, molluscs, worms that burrow in the mud bottom and even terrestrial animal [1]. When consumed, the flash of the fish was tasted with muddy and unfavorable aroma that made it less attractive to fish consumer. There was no information on the relation between this feeding behavior and meat flavor.
Despite its low flavor quality, snakehead was known to contain high albumin [3]. Albumin is one of the functional foods needed in the health sector, especially to accelerate the wound healing process, regulate osmotic pressure and as an antioxidant. Hypoalbuminemia is frequently related to lack of raw materials for protein synthesis (amino acids from foods), liver disorder, and loss of albumin through disposal or excretion [4]. Snakehead, *Channa gachua* (Channidae) is one of the main albumin sources from freshwater fish [5]. The albumin content in the body may related to metabolism that changes at different age, protein content and enzyme activities, especially protease together with lipase. This study aimed to obtain albumin content and enzyme profile data of snakehead at different size. The information may important as strategy to harvest the fish from naturally available source or cultivation.

2. Materials and Method

2.1 Sampling of Fish

A stock of fish catch has been conducted from along the Brantas River during the period of August to November 2017. All the samples were brought by local fishermen who catch the fish using stow net or hand lines. Thirty individuals were selected from the catch and grouped into three size categories, < 10 cm total length, 10-15 cm and > 15 cm of total length. All the samples were chilled at around 0°C using coolbox and ice for around 3 hours of transportation. Following filleting step in the laboratory, about 25 g of fish meat was stored at frozen temperature (-25 °C) prior to further analysis. Size category of the fish was applied as main treatment during experimental setup.

2.2 Proximate and enzyme analysis

Proximate composition of fish sample i.e. protein, lipid, moisture, and ash content were conducted following AOAC method. Moisture was determined by drying process in an oven at 105°C to constant weight. Crude protein determined by the Kjeldhal method after acid digestion. Crude lipid was determination was done by ethyl-ether extraction, Ash was incarcerated in muffle furnace at 600°C. for enzyme activity analysis, fish intestine were homogenized in normal saline at ratio of 1 g sample and 9 ml normal saline and centrifuged at 10,000 x g for 20 min, to obtain a clear supernatant which was analyzed for enzyme activities.

2.3 Extraction of albumin

Extraction of albumin was based on acid solvent extraction. Flesh of snakehead fish at each size category was cleaned and washed in tap water until there was no more blood and mucus, cut to smaller pieces. The flesh was then smoothed using blender and mixed solvent at a ratio 1:1 (100 ml solvent: 100g fish). Sample from each treatment was filtered to separate liquid and dregs. Liquid was separated with its oil by adding 200 ml of hexane solvent then shaken for 30 minutes. After forming two phases, the oil was separated by funnel. Extract liquid was dried in oven at temperature of 60-70°C. The dry extract was measured and analyzed.

3. Results and Discussion

3.1 Fish Composition and Enzymes Activity

Mean concentrate of total protein, lipid, ash and dry matter per fish size category were shown in Table 1. Crude protein varied between 66.26% - 70.14 %. Fish age indicated from the body size affects body composition (p<0.05). The protein content increased as the fish grow bigger. On the contrary, the lipid content decreased at larger fish. Snakehead was known to consume various types of food provided by nature [6]. Fish at bigger size, based on preference, was able to select food that can accumulate higher protein in their body. The second possibility was that larger fish might able to use more fat as their main source of energy resulted in the low-fat content in the body (protein sparring action) [7]. So, to gain more protein content, it is better to harvest this fish at bigger size (> 15 cm length). High protein content of the fish, when followed with high fat content, will lead to the occurrence of rancidity process. As protein quality is also determined by fat content producing snakehead flesh at
size > 15 cm would gain better protein quality. However, this need further scientific proven information. The moisture content is also affecting the protein quality.

**Table 1. Average and standard deviation of fish body composition per length category**

| Fish Size (cm) | Dry Matter (%) | Protein (%) | Lipid (%) | Ash (%) |
|----------------|----------------|-------------|-----------|---------|
| <10            | 14.39±0.25 a   | 66.26±1.23 a| 2.09±0.04 a| 13.52±0.38 a |
| 10-15          | 13.27±0.23 b   | 67.69±1.26 ab| 1.64±0.03 b| 14.90±0.43 b |
| >15            | 11.86±0.20 c   | 70.14±1.30 b| 1.10±0.02 c| 14.93±0.42 b |

Note: the numbers on the same column followed with the same letter are not significantly different (P>0.05).

**Enzyme activities**

Both protease and lipase enzyme activities were presented in Figure 1. The enzyme activities were found to increase as fish grow bigger (p>0.05). Protein content might be the major factor for governing the enzyme activity [8]. As the protein content in the feed increase, this would follow with more active enzyme. The reason for higher protein content at bigger fish size was not very clear. As top predator and carnivorous species, snakehead feed on various food available in nature [9]. As fish grow bigger, they may able to select certain food with higher protein content, and this resulted in more active enzyme.

**Figure 1. Both protease and lipase activities per fish size category**

**Albumin content**

Albumin content per fish size category was presented at Figure 2. The albumin was increased as fish grow bigger. Protein content in the fish might be the major factor determining the albumin content [10]. As part of protein, albumin content would directly relate to protein content. Also, protein would govern the enzyme activity within digestive tract.

Albumin content showed higher content (p>0.05) at size category > 15 cm total length. This means that increase in protein and enzyme activity could provide significant effect in albumin gain at fish size > 15 cm. Lower than that size, the effect was not significant (p<0.05) although the trend already been observed. In this research, the optimal fish size that resulted in highest albumin content was not
evaluated. It may happen that fish size higher than 25 cm will exceed the peak and albumin content will decrease.

![Figure 2. Albumin content per fish size category](image.png)

4. Conclusions
In conclusion, protein content and enzyme activities within *Channa gachua* (Channidae) was found to increase as fish grow bigger. As part of protein, albumin content was highest at fish size higher than 15 cm. To gain higher albumin content from this species, fish should be caught at size more than 15 cm total length.

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