Physicochemical Characteristic of Snakehead Fish (*Channa Striata)* Protein Dispersion Syrup as Food Supplement

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Abstract: This study aimed to determine the physicochemical characteristics of the syrup dispersion product. This research was devided into two stages. The first stage was the process of making snakehead fish protein concentrate and dispersion syrup. The second stage was analysis of physicochemical characteristics. The results of proximate analysis showed that the syrup dispersion contained 63.69% of moisture, 0.31% of protein, 0.06% of fat, 10.97% of carbohydrates, 0.01% of ash. In this study, 16 free amino were detected and glisin showed significantly the highest content (406.9 4± 3.62 mg/kg). Six minerals were quantified in syrup dispersion (Na, K, Ca, Mg, Mn and P). The albumin content in snakehead fish dispersion syrup was 1054.53 μg /g. The result of physical analysis showed that the particle size was 665.3 nm.

1 INTRODUCTION

Snakehead fish is a type of freshwater fish that contains high enough macro and micronutrient components so that it is very beneficial for nutrition and public health (Bonga, 2006). Asikin (2018) reported that the protein content of snakehead fish weighing above 900 g has a protein content of 63.59% and an albumin content of 17.85%. Snakehead fish has a high albumin content and has various functions for health. Albumin is a globular protein that is soluble in water, salt and acid solvents (Asikin, 2018). Albumin plays a role in boosting immunity, as an antioxidant, and accelerates wound healing. Prastari et al. (2017) reported that snakehead fish protein hydrolyzate had antihyperglycemic potential.

Besides containing protein, snakehead fish also contains collagen. The collagen content of snakehead fish is lower than that of livestock, which is around 3-5 percent of the total protein (Rosmawati et al., 2018). Low collagen causes snakehead fish meat to be easier to digest. Snakehead fish are found in various parts of Indonesia. Some potential areas for snakehead fish production are Tempe Lake in South Sulawesi, Barito River in Kalimantan and Lake Sentani in Jayapura. Although snakehead fish has great potential and high protein content, snakehead fish is rarely consumed by the public, because it smells fishy and has a snake-like head (Widodo et al., 2015). The abundance of snakehead fish production is an opportunity for the development of various kinds of snakehead fish processed products such as craker (Setiawan et al., 2013), soy sauce (Prasetyo et al.,2012), cookies (Tawali et al., 2018) and Abon (Sulthoniyah et al., 2012).

The development of science and technology encourages the use of snakehead fish to be more advanced. Apart from being processed food, snakehead fish is also included in functional food and can also be used as a supplement for nutritional fulfillment. Several studies have been developed such as processing into supplements (Rahmaniar et al., 2020) and processed health food products based on snakehead fish protein concentrate (Asfar et al., 2014).

Snakehead fish protein syrup is intended to correct nutritional deficiencies and maintain adequate nutritional intake. This research utilized snakehead fish which was processed into snakehead fish protein concentrate flour and added honey. The final product in this study is a liquid or syrup dispersion form. The purpose of this study was to determine the proximate composition, albumin content, amino acid profile, mineral content, and particle size of the product.

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2 MATERIALS AND METHOD

2.1 Materials

Snakehead fish were purchased from the fish local market in Antang, makassar, Indonesia. The fish was kept on ice at fish:ice ratio of 1:1 (w/w) and transported within 1 h to the Laboratory Department of Food Science and Technology, Hasanuddin University. Honey were purchased from Giant Supermarket. CMC (carboxymethyl cellulose), benzoate, glycerin, tutty frutty flavor, and water were purchased from CV.Sentana (Makassar, Indonesia).

2.2 Formulation and Production of Snakehead Fish Syrup

The syrup preparation procedure was performed according to the method of Rahmaniar et al., (2020). First the snakehead fish are washed and weeded. Weeding is done by moving the entrails, gills and fins of the fish. The snakehead fish that has been cleaned are then put into the steamer pan and then cook with the steaming process. The steaming process was carried out for 30 minutes. Fish that has been steamed, then separated between the bones and skin from the meat. The meat separation process was done manually. The fish meat was dried using a blower oven (OVL-12, Agrowindo, Indonesia) at 60ºC for 10 hours, until the moisture content was below 10%. Fish meat that has been dried was ground using a dics mill (AGC-21, Agrowindo, Indonesia) equipped with a 100 mesh sieve. The result of this process will be obtained snakehead fish protein concentrate flour.

Table 1: Snakehead fish syrup dispersion formulation.

Ingredient	Content
Snakehead fish flour	2.5%
CMC	0.6%
Glycerin	5%
Honey	23.75%
Flavor tutty frutty	0.62%
Benzoate	0.06%
Water	Ad 100%

The process of making snakehead fish protein syrup dispersion begins by preparing the ingredients that will be used in the formulation process. The formulations of the ingredients used are presented in Table 1. The process of mixing the ingredients is carried out in several stages. The first stage is mixing CMC, glycerin, and honey until homogeneous using a hand blender (Oxone-292, Indonesia). The second stage is mixing the snakehead fish protein concentrate flour and benzoate. The last step is adding water. Furthermore, the whole material is homogenized.

2.3 Physicochemical Analysis

The proximate composition was determined according to AOAC (2005) methods. Moisture content was determined using the air oven method and protein content was determined using the Kjedahl method. Fat content was measured with the Soxhlet method and ash content was determined using the dry ashing method. Carbohydrate content was calculated by difference.

Albumin content was analyzed according to the method of Romadhoni et al (2016). Amino acid profile analysis using Ultra Performance Liquid Chromatography (UPLC), analysis of mineral composition using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP OES), and particle size using PSA.

2.4 Statistical Analysis

All experiments were performed in duplicate and the results are expressed as the means ± standard deviation (SD). The data were analyzed using the Statistical Package for Social Sciences (IBM® SPSS® Statistics for Windows version 26).

3 RESULT DISCUSSION

3.1 Proximate and Albumin Composition

The results of the proximate composition are presented in Table 2. Moisture content is the highest in proximate composition, followed by carbohydrates and protein. Ash value was low compared to other contents. The albumin content detected in the results was 1054,52 μg/g. The albumin content was obtained from the protein extract in snakehead fish. Albumin has the potential to improve the health of hypoalbumin patients as human serum albumin (. Mustafa et al. (2012) reported albumin in snakehead fish extraction can significantly increase albumin levels in hypo patients and accelerate the wound healing process of patients after surgery. Albumin plays the role as binding and transport substance, osmotic pressure regulation, inhibition of platelet formation and anti-thrombosis, increasing cell permeability, and as antioxidants (Mustafa et al., 2012).

Table 2: Proximate and albumin composition of snakehead fish syrup dispersion.

Component	Content
Moisture (%)	63.69 ± 0.49
Protein (%)	0.31 ± 0.02
Ash (%)	0.01 ± 0.01
Lipid (%)	0.06 ± 0.01
Carbohydrate (%)	10.97 ± 0.54
Albumin (µg/g)	1054,52 ± 6.30

3.2 Amino Acids

Amino acid profile of snakehead fish protein syrup dispersion is presented in Table 3. In this study, 8 essential amino acids (Gly,Ser,Glu,Ala,Arg,Asp,Tyr, and Pro) and 8 non-essential amino acid were detected. Total amount of essential amino acids and non essential amino acids were 1766,16 ± 38.04 mg/kg and 962,90 ± 14.77 mg/kg. Considering the total free amino acid content, glycine showed significantly the highest amount(406.94±3.62mg/kg), followed by glutamate and alanin. The amino acid composition in each food protein plays a role in various physiological activities of the human body and is influential in maintaining good health. Amino acids play a role in the synthesis of a wide variety of proteins with important functions including oxygen carriers, vitamins, CO2, enzymes, and structural proteins (Santos et al., 2011).

Table 3: Amino acid profile of snakehead fish syrup dispersion.

Amino Acid	Content (mg/kg)
Glycine	406.94 ± 3.62
Serine	148.24 ± 1.02
Glutamate	324.28 ± 16.0
Alanine	263.32 ± 1.83
Arginine	116.06 ± 2.66
Aspartate	260.45 ± 11.01
Tyrosine	38.17 ± 0.70
Proline	208.68 ± 3.11
Total (Essential)	1766,16 ± 38.04
Phenylalanine	139.92 ± 2.58
Isoleucine	89.53 ± 1.4
Valine	111.92 ± 2.03
Lysine	211.01 ± 1.99
Leucine	162.81 ± 2.73
Threonin	144.26 ± 2.02
Histidine	78.79 ± 1.99
Methionie	24.65 ± 0.07
Total (non-essential)	962,90 ± 14.77

3.3 Minerals

Minerals composition of snakehead fish protein syrup dispersion is summarized in Table 4. As shown in Table 4, six minerals were quantified in syrup dispersion, including five macro minerals (Ca, Mg, P, K and Na) and one trace mineral (Mn). P (208.63 ± 2.90 mg/kg) was the major mineral present in snakehead fish protein syrup dispersion, followed by Ca (96.05 ± 1.97 mg/100g) and Na (70.67±0.66 mg/100g).

Minerals play an important role in maintaining the body's acid-base balance (Duran et al., 2010). Minerals are also an important element in the skeleton of bone and tooth structure and maintain osmotic pressure (Mendil et al., 2010). Minerals are not only a role for nutritional needs, but also contribute to the taste of food and play a role in catalytic reactions and metabolic reactions in foodstuffs, and can affect the texture of food (Ersoy et al., 2010). According to AKG (2019) in a regulation of the Ministry of Health in Indonesia, mineral contents (Ca, K, Na) of snakehead fish protein syrup dispersion is much smaller than recommended daily allowance (RDA) for children and adult (18–29 years old male and female). Thus, this result showed that snakehead fish protein syrup dispersion cannot be used as a mineral source of Ca, K, and Na in the diet.

Table 4: Mineral composition of snakehead fish syrup dispersion.

Mineral	Content
Ca (mg/100g)	96.05 ± 1.97
Mg (mg/kg)	6.53 ± 0.12
Mn (mg/kg)	0.93 ± 0.90
P (mg/kg)	208.63 ± 2.90
K (mg/100g)	43.81 ± 0.47
Na (mg/100g)	70.67 ± 0.66

3.4 Particle Size

The particle size distribution in a sample can be determined using the principle of laser diffraction, which is a particle size analyzer (PSA) instrument. This tool generates and transmits laser light which passes through the sample solution in the cuvette. Light will be scattered and absorbed, depending on the size, refractive index and number of particles in the sample (Edén et al. 2016, Oort et al. 2016). The results are presented as size distribution curves.

Based on the test results with the PSA (Particle Size Analyzer), the mean particle size was 665.3 nm. The results obtained from this study are nanoparticle size because the size is still below 1000 nm. Nanoparticles are particles measuring 10-1000 nm (Mohanraj and Chen, 2006). The particle size data obtained are the distribution of intensity, number and volume, it can be assumed to describe the overall condition of the sample. Particle size distribution using Particle Size Analyzer based on volume, number, and intensity can be seen in Figures 1, 2, and 3.

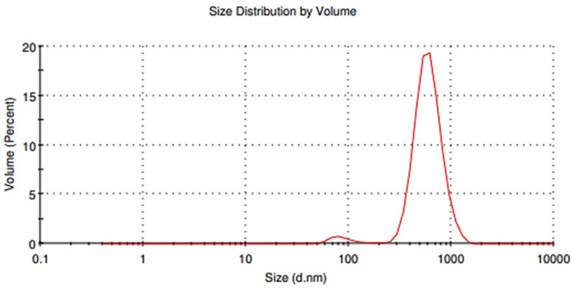

Figure 1: Size distribution by volume.

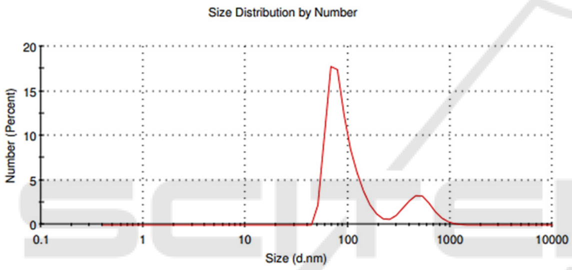

Figure 2: Size distribution by number.

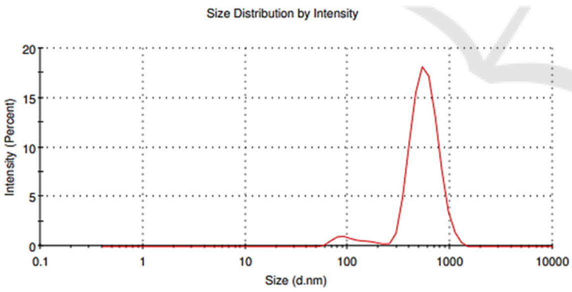

Figure 3: Size distribution by intensity.

4 CONCLUSIONS

The results showed that the amino acid glycine showed the highest amount significantly among the others (406.94 ± 3.62mg / kg). There are six minerals identified in the dispersion syrup (Ca, Mg, Mn, P, K and Na) and the most abundant mineral was P (208.63 ± 2.90 mg/kg). The result of physical analysis showed that the particle size was 665.3 nm.

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