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Proximate and Mineral Composition of Cuttlefish (Sepia sp)

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ABSTRACT

Cuttlefish as a type of Cephalopoda, as other Cephalopods are thought to also have a large nutritional component. Cuttlefish (Sepia sp) Is a type of cephalopod that is well known and popular with the community. There are approximately 100 cuttlefish species in the world. The proximate, nutrient and mineral analyses were conducted on the head and mantle of cuttlefish (Sepia sp). Proximate analysis showed of cuttlefish bone contained 13,16±0,10 -13,51±0,68% protein, 0,69±0,14% - 0,89±0,14 % ash, 0,77±0,00% - 0,79±0,00% fat, 83,65±0,43% - 84,06±0,08% water and 1,12±0,33% - 1,36±0,97% carbohydrate. Amino acid analysis revealed cuttlefish contained essential and nonessential amino acid with arginine (0.97%) and glutamate (0.81%) was the highest in the head, respectively, while lysine (0.7%) and glutamate (0.7%) was the highest in the mantle, respectively. Lipid of cuttlefish contained high Percentage of Polyunsaturated Fatty Acid (PUFA) with a high content of DHA (17.5–20.5%). The C16:0 and C18:0 were the most abundant saturated fatty acid in the head and mantle. Mineral analysis showed high contents of sodium, phosphorus, potassium and calcium, with sodium content being the highest (1532.7-1610.4 mg/kg). Zinc and copper were the dominant trace minerals in both portions. This study showed that cuttlefish contain essential nutrients for human good health with high in protein and mineral content. Proximate analysis, nutrition and minerals were carried out on cuttlefish shells (Sepia sp). Amino acid analysis revealed that cuttlefish contained essential and nonessential amino acids with arginine (0.97%) and glutamate (0.81%) each highest in the head, while lysine (0.65%) and glutamate (0.7%) is the highest in the mantle. each. Cuttlefish lipids contain a high percentage of polyunsaturated fatty acids (PUFA) with high DHA content (17.5-20.5%). C16: 0 and C18: 0 are the most saturated fatty acids in the head and coat. Mineral analysis shows high content of sodium, phosphorus, potassium, and calcium, with the highest sodium content (1532,7-1610,4 mg / kg). Zinc and copper are the dominant trace minerals in both parts. This study shows that cuttlefish contain important nutrients for human health with high protein and mineral content.

Keywords : Cuttlefish, Proximate Compotision, Mineral

I. INTRODUCTION

Indonesian marine ecosystem is rich with natural resource and biodiversity and appears as “epicentre” of marine tropical biodiversity (Veron, 1995). Highly variation in type of island and archipelago is the reason for this large biodiversity (Gray, 1997). Cephalopods landings and consumption have been increasing worldwide during the past decades. Cephalopod landings and consumption have been increasing worldwide during the past decades. The main reason for this in-creasing demand is that cephalopods are a good protein and lipid source (Kreuzer, 1984; Sinanoglou & Miniadis-Meimaroglou, 1998,2000; Zlatanos, Laskaridis, Feist, & Sagredos, 2006), thus a highly nutritious food that represents an alternative to over exploited fish resources. Cuttlefish is an important species of marine invertebrates consumed both in the world and our country. Cuttlefish, which has recently been captured in various amounts ranging from 11,000 to 15,000 tons annually throughout the world, occupies an important place among cephalopoda (FIGIS, 2004). Cephalopods including cuttlefish, squid and octopus are among an important marine resource since they are rich in taste and have few inedible parts. The connective tissue of cephalopods is highly developed compared to fish in general. Its body contain low level of lipid, however omega-3 polyunsaturated fatty acid presented the majority of the total lipid (Ozyurt et al., 2006; Thanonkaew et al., 2006; Phillips et al., 2002). Sepia sp is demersal species that inhabits the continental shelf. It is widely distributed in Indo-West Pacific, from China to the Philippines, Indonesia and Pakistan. It is a commercial species in Gulf of Thailand, South and East China Seas and Japan (Jereb and Roper, 2005). The nutritional composition of cuttlefish has been reported by some researchers (Thanonkaew et al., 2006; Villanueva et al., 2004; Ozyurt et al., 2006; Phillips et al., 2002). However, this composition could vary among species due to geographical differences of fishing grounds. In addition, compositions can vary with body part or organ. Therefore, this study was conducted to evaluate the chemical properties and nutritional composition of the cuttlefish head and mantle.

II. MATERIAL AND METHODS

A. Materials

Fresh cuttlefish samples (Sepia sp) were obtained from CV. Reski Bahari Makassar, South Sulawesi, Indonesia. Samples are placed in ice and transported to Pangkep State Polytechnic of Agricultural. The length, width and height of 30 shells chosen at random, are measured. After biometric measurements are carried out, the cuttlefish is weighed, cut into a coat and the head is weighed. Each part of the powder by combining the sample and stored in ice until analysis. This preliminary study was conducted in July 2018 at the Processing Workshop, Department of Fisheries Product Processing Technology, Pangkep State Polytechnic of Agricultural. Information is obtained through interviews with company employees, sellers or collectors (suppliers) and consumers.

B. Methods

1) Proximate Analysis

The proximate composition was determined according to AOAC (2005) methods. Crude protein content analyzed using the Kjeldahl method; crude lipid content referred to the Soxhlet method; while ash content through ash samples over-night at 550°C. Moisture content was by drying samples overnight at 105°C until constant weight was achieved,as well as carbohydrate content was calculated by differences.

2) Mineral Analysis

Minerals component were evaluated from solution obtained by first wet-ashing the samples and dissolving the ash with de-ionized water and concentrated hydrochloride acid in standard flask. The solution was analysed for minerals content using Atomic Absorption Spectrophotometer (Shimadzu type AA 7000). Phosphorus was determined colorimetrically using spectrophotometer as described by Reitz et al. (1987).

III.RESULTS AND DISCUSSION

The results obtained included: handling and processing cuttlefish shells as well as mineral and proximate analysis. Handling and Processing of cuttlefish shells Handling cuttlefish shells (Sepia sp) obtained from CV. Reski Bahari Makassar is day and 150 kg of waste produced. The cuttlefish shell is still not optimally utilized. Cuttlefish shells are usually used as food supplements for bird nutrition. In addition, cuttlefish shells have been used as biomaterials (Tathe et.al. 2010; Pendra et al., 2009; Nurzakiah et al., 2011). All paragraphs must be indented. Cuttlefish are of high economic value and are widely consumed by Asians, especially Japan, Korea, the Philippines, Malaysia, Taiwan (Suwignyo et al. 2002), and Thailand (Thanonkaew et al. 2006). One animal food source that is rich in nutritional content is seafood. Seafood is rich in protein, with a balanced amino acid composition and high content of polyunsaturated fatty acids. Some seafood species also contain most of the 90 types of natural minerals (Laurenco et al. 2009). PUFA from Chepalopoda ranged from 40.1-59.8% (Okuzumi and Fujii 2000). According to Thanonkaew et al. (2006), Sepia pharaonis contained PUFA of 54.9% in the head and 50.3% in the head coat section (body).

A. Characteristics of Cuttlefish

Cuttlefish used in this study have the characteristics of a short body, a hard back because there is a skeleton in a shell made of lime. The shell is oval, sharp and white. Cuttlefish also has 8 short arms and 2 long tentacles that serve as a tool to catch prey, and on the inside of the body there are internal organs in the form of heart, liver, gills, kidneys, and blackish colored ink bags acting as a cuttlefish defense tool fight prey. His back was blackish spots. The cuttlefish color is generally brownish white. A special feature that distinguishes it from other cuttlefish is the presence of 5-6 suckers at the tentacle club which has been modified so that it is larger than other suction devices and the shell forms an angle like the letter V so that it is identified as cuttlefish (Sepia sp). Cuttlefish can be seen in Figure 1.

Figure 1. Cuttlefish Characteristics of cuttlefish size and weight can be seen in Table 1.

Table 1. Size of Cuttlefish Morphometrics

Parameter	Nilai
Lenght (cm)	12,70 ± 1,30
Width (cm)	5,59 ± 0,53
Thickness (cm)	1,95 ± 0,40
Whole weight (cm)	59,43 ± 10,91

Based on Table 1, it is known that cuttlefish has an average length of 12.70 cm, an average width of 5.59 cm, an average thickness of 1.95 cm and an average intact weight of 59.43 grams. The cuttlefish length is measured from the part of the hand that is short (anterior) to the tip of the cuttlefish, the cuttlefish width is measured from the left side of the cuttlefish to the right side of the cuttlefish), cuttlefish thickness is measured from the highest part of the body to the bottom of the cuttlefish. This calculation is done by a ruler, but the weight of the cuttlefish is obtained by weighing it with a digital scale. The results of this study are different from the results of a study by Bello (2006) which states that the size of the male coat length ofepia Sepia elegans female is 3.07-6, 37 cm weighing 3.9-27.4 grams. The difference in size and weight of cuttlefish can be influenced by growth. There are two factors that influence the growth of cephalopods, namely abiotic factors and biotic factors. Abiotic factors include temperature, salinity, oxygen and light, while biotic factors include food, competition, social interaction, gender, size, stocking density and age (Forsythe et al. 2002).

B. Cuttlefish Chemical Composition

1) Proximate Analysis

The chemical compositions of both head and mantle of cuttlefish are shown in Table 2. The head portion contained more moisture and ash content, however contained less carbohydrate than the manttle portion. These result are similar with S. pharaonis which reported by Thanonkaew et al. (2006). Cuttlefish S. recurvirostra contained 13% of protein, similar with which reported Thanonkaew et al. (2006) on S. pharaonis, however it is still lower compared to Sepia arabica (Papan et al., 2011). According to Lee (1994), cephalopods is composed of 18% protein and leaving only 3% of body mass for other biochemical compounds needed for life. Cephalopods have 20% more protein, 80% less ash, 50-100% less lipid and 50 - 100% less carbohydrate when compared to fish. This author also stated that cephalopod mantle does not store lipid or its storage is below 1% of it wet weight.

Based on Table 2 it is known that in the calculation of the wet base, the water content of both the head and body is the highest content possessed by cuttlefish, which is about 84%, then the protein content is 13-14%. The level of ash and fat is the smallest content in the cuttlefish body. Ash is 0.7–0.9% and fat is 0.8%. The carbohydrate content calculated by difference is 1.1-1.4%. The value of the chemical composition produced in this study has a value similar to the results of a study conducted by Thanonkaew et al. (2006). Chemical composition of cephalopoda depending on species, growth stage, season and anatomical area of Cephalopods (Thanonkaew et al. 2006).

Table 2. Proximate analysis of cuttlefish (%)

Test	Head (%)	Mantle (%)
Moisture	84,06±0,08	83,65±0,43
Ash	0,89±0,14	0,69±0,14
Protein	13,16±0,10	13,51±0,68
Fat	0,77±0,00	0,79±0,00
Carbohydrate (%)	1,12±0,33	1,36±0,97

a) Water Content

Cuttlefish has a higher percentage of water content than ash, protein, fat and carbohydrate levels. Head water content is higher than the body, ie head 84.06 ± 0.08% and body 83.65 ± 0.43%. Thanonkaew et al. (2006) stated that the cuttlefish water content (Sepia pharaonis) was 84.42 ± 0.13 g / 100 g wet base, while the body had a smaller value of 82.78 ± 0.05 g / 100 g wet base. The difference in water content values between this study and the study of Thanonkaew et al. (2006) can be caused by differences in species, habitat, season, age, and gender. Head water content has a higher value than the body, meaning that the head has more free water than the body. The high level of free water on cuttlefish can cause cuttlefish to be easily damaged (highly perishable) if not handled properly (Winarno 2008).

b) Ash Content

The percentage of ash content on a wet basis of cuttlefish body is 0.69 ± 0.14% and the head part is 0.89 ± 0.14%. This result is smaller than the research of Tanonkaew et al. (2006) which is the content of cuttlefish ash (Sepia pharaonis) section head 1.29 ± 0.02 g / 100 g wet base and body parts 1.20 ± 0.24 g / 100 g wet base. High and low ash levels are caused by differences in the type of organism and the environment of the organism. Each organism has a different ability to regulate and absorb metals, this will affect the ash content in the material. The ash content can be used to indicate the presence of minerals in a material. The head has higher ash content than the body, this may indicate that the head contains more minerals than the body.

c) Fat Content

Fat percentage on a wet basis of cuttlefish body parts is 0.79% and head parts are 0.77%. Cuttlefish fat produced in this study is greater than the fat produced by Thanonkaew et al. (2006) i.e. head 0.52% and body 0.47%, but this fat content is smaller than fat reported by Okuzumi and Fujii (2000) namely the squid mantle section (Loliulus beka) 1.7% and the head part 1.4%. The difference in fat levels produced in this study with the study of Thanonkaew et al. (2006) and Okuzumi and Fujii (2000) can be caused by differences in eating habits, differences in digested food and availability of food in habitat. Fat content is also influenced by species, body size, sex, environmental temperature, water depth, salinity, spawning season, and food (Love 1970 referred to in Mukholik 1995). Fat content generally decreases in the dry season, but the water content is high, whereas in the rainy season the fat content increases due to the availability of many foods, but the water content decreases (Hadiwiyoto 1993). The body fat content is higher than the head because it is suspected that fat in cuttlefish accumulates in the skin or under the skin. The fat content of squid decreases when the squid skin is exfoliated (Okuzumi and Fujii 2000).

d) Protein

Protein is the second most abundant component found in cuttlefish after water. Protein level analysis was carried out to roughly determine the protein content of cuttlefish. The protein content on a wet basis of cuttlefish is 13.51 ± 0.68% and the head portion is 13.16 ± 0.10%. This value is different from the results of the study by Thanonkaew et al. (2006) that is on a wet basis of coat protein content 14.91 ± 0.61 g / 100 g and head content 11.90 ± 0.14 g / 100 g. Differences in protein levels between the results of this study and the results of the study by Thanonkaew et al. (2006) can be caused by differences in habitat, age, food, metabolic rate and rate of movement. Protein content is higher in the body than the head, but this protein content has no significant difference between cuttlefish body parts (Okuzumi and Fujii 2000).

e) Carbohydrate

The analysis of cuttle carbohydrates is carried out as little as the difference. Carbohydrates produced in this study, on a wet basis, cuttlefish body parts were 1.36 ± 0.97% and head parts were 1.12 ± 0.33%. Carbohydrates inside cuttlefish does not contain fiber, mostly in the form of glycogen and also contains glucose, fructose, sucrose and monosaccharides and other disaccharides (Okuzumi and Fujii 2000). The difference in carbohydrate results between this study and the study of Thanonkaew et al. (2006) allegedly due to differences in water content contained in the material. Decreasing the water content in the material will be followed by an increase in other nutrient content proportionally Glycogen as an energy reserve will be used by animals to supply energy for body tissues when they move (Nasoetion et al. 1994).

2) Mineral Analysis

Mineral composition: The mineral content of S. recurvirostra is presented in Table 3. Sodium (15321610 mg/kg body weight) was found as the major component of mineral both in the head and mantle, followed by phosphorus and potassium. Lourenco et al. (2009) found that the main elements of common cephalopods were S, Cl, K, Na, P, Mg and Ca. Meanwhile, in hatchlings and juveniles of the cephalopod species showed a high content in S Villanueva and Bustamante (2006). Regarding the trace element, Zn and Cu were the dominant trace mineral in both head and mantle andthis result is similar with Thanonkaew et al. (2006).

Table 3. Mineral composition of cuttlefish (mg/kg body weight)

Mineral	Head	Mantel
Na	1610, 42 ±301, 47	1532, 69 ±366, 92
Mg	60, 02 ±2, 79	64, 87 ±9, 33
Ca	197, 86 ±8, 07	186, 23 ±8, 61
K	210, 72 ±2, 99	277, 48 ±1, 12
P	439, 26 ±16, 20	569, 67 ±37, 68
Fe	6, 77 ± 0, 22	4, 03 ±0, 53
Zn	21, 42 ± 0, 71	19, 62 ±1, 06
Cu	11, 82 ± 0, 06	5, 70 ±0, 15
Se	0, 06 ± 0, 01	0, 02 ±0, 01
Cd	0, 15 ± 0, 02	0, 04 ±0, 01
Pb	ND	ND
Hg	ND	ND

Cephalopods are known as carnivorous and active predators. As they have very high feeding rates, most part of the elements can be assumed to be incorporated by the diet. The absorption of minerals from seawater also could take place by osmotic uptake through the gills and the body surface as the cephalopods live in hypoosmotic environment. Minerals also absorbed by digestive gland as they swallow massive quantities of sea water during and after feeding (Wells and Wells, 1989). Minerals are required for the maintenance of normal metabolic and physiological functions of living organisms. The main functions of essential elements in the body include the formation of skeletal structure, maintenance of colloidal systems, as well as regulation of acid base equilibrium. They are important components of hormones, enzymes and structural proteins (Lall, 2002; Villanueva and Bustamante, 2006). Sodium, potassium and chloride maintain homeostasis and the acid-base balance, while phosphorus and calcium are required for the formation of skeletal structure of the body (Lall, 2002). Copper and zinc are firmly associated with metal-dependent enzyme. Zn is involved in numerous protein functions such as the carbonic anhydrase and is efficiently absorbed and strongly retained in S. officinalis both from the food and seawater pathways (Villanueva and Bustamante, 2006). Level of cadmium of S. recurvirostra was low in both the head and the mantle, while lead and mercury were not detected. Cd, Pb and Hg were among element that could be harmful for organism (Nurjanah et al., 1999). Cephalopods are considered to be a vector for the transfer of cadmium to top marine predators (Bustamante et al., 1998; 2002). The digestive gland exhibited the highest cadmium accumulation compared with others organ, with food is likely the primary pathway bioaccumulation (Raimundo and Vale, 2008; Bustamante et al., 2002).

IV. CONCLUSION

This study revealed that cuttlefish contain essential nutrients for human good health with high in protein and mineral content, but low in lipid content. The body of cuttlefish contained high level of PUFA and various kinds of amino acid. Both head and mantle portions of cuttlefish comprised different trace minerals at varying concentrations.

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