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Natural Taurine Extraction of Escolar (*Lepidocybium flavobrunneum*) As Deep Sea Fish from Southern Java Ocean

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Abstract

This study aimed to determine chemical composition and natural taurine content of escolar (*Lepidocybium flavobrunneum*). The proximate analysis was carried out using methods of AOAC. Results showed that escolar's flesh and viscera contained protein at 16,40% and 12,11%, moisture at 63,38% and 76,78%, ash content at 0,59% and 2,52%, and fat content at 18,34% and 7,51%. Extraction of escolar using boiling and steaming method was conducted to produce crude taurine extract. Analysis of taurine content using HPLC method showed that fresh escolar's flesh and viscera contained 44,201 mg/100g and 43,915 mg/100 g taurine. The concentration of taurine obtained by steaming treatment of escolar's flesh and viscera was 112,203 and 128,918 mg/100 g. The concentration of taurine obtained by boiling treatment of escolar's flesh and viscera was 103,324 mg/100 g and 105,230 mg/100 g. Taurine content of crude taurine extract which obtained by steaming method was higher than boiling method. Based on the results, the deep sea fishes have potential as a natural source of taurine.

Keywords: *escolar fish (Lepidocybium flavobrunneum), HPLC, proximate, natural taurine.*

1. Introduction

The Department of Marine and Fisheries mentions that volume of fisheries production in 2012 was increased by 5.81 million tons or by an average of 107% (MMAF 2013). Every year there is an increase in the capture of pelagic waters with a depth of 0-100 m that leads to overfishing. High level of overfishing resulted pelagic fish stocks in the waters to be reduced. Therefore, the need for the new catchment area as an alternative to pelagic waters in the catchment area, namely the deep ocean waters.

In the expedition of Baruna Jaya IV research vessel which did research in the Indian Ocean start from Southern of Java Ocean until Western Sumatra, found 530 species of marine fish, 70 species were recently identified and the scientific name haven't known yet (Suman *et al*. 2006). Several studies in the deep-sea fish have done them, Suman and Badrudin (2010) regarding arrest policies and utilization of resources in marine fish in Indonesia, Damayanti (2005) regarding the use of some of the early studies of deep sea fish in waters west of Sumatra as a source of food and drugs, Suseno *et al.* (2006) showed that the nutrient content and antibacterial potency of deep sea fish in Southern Ocean of Java, as well as taurine content analysis of several marine fish species in the research Suseno *et al.* (2008) among others, *Antagonia capros*, *Diretmoides pauciradiatus*, *Neoscopelus microchir*, and *Zenopsis conchifer*.

Deep sea fish such as escolar (*Lepidocybium flavobrunneum*) is a type of deep sea fish that is consumed by coastal communities Pelabuhan Ratu, Sukabumi. It is usually processed by steamed or boiled by coastal communities. Escolar fish typically consumed during a particular season, which is believed to repair the physiological functions of the body. It is suspected that the escolar fish containing taurine compounds. It is an experience that needs to be investigated empirically and scientifically proven.

Taurine (IUPAC name: 2-aminoethanesulfonik acid) is a non-essential amino acid because it can be synthesized from cysteine and methionine (Welborn and Manahan 1995). Human beings and animals can synthesize Taurine from methionine and cysteine, especially in the liver. Although human beings can synthesize taurine, but taurine found in many animals, mainly in eggs, meat and seafood (Abebe and Mozaffari 2011). Generally, seafood products contain high concentrations of taurine. Taurine concentrations are most numerous in muscles, viscera and brain (Spitze *et al.* 2003). Taurine has been used clinically in the treatment of cardiovascular disease (Oudit *et al.* 2004; Xu *et al.* 2008), hypercholesterolemia (El Idrissi *et al.* 2003), Alzheimer's disease (Louzada *et al.* 2004; Santa-Maria *et al.* 2007), and liver disorders (Gupta 2006).

Based on the results of previous research and empirical experience of society, so it is necessary to do research on the utilization of deep sea fish, especially fish gindara (*Lepidocybium flavobrunneum*) as a source of natural taurine.

2. Materials and Methods

2.1 Materials and Equipments

Main material which used in this study was escolar (*Lepidocybium flavobrunneum*) taken from Southern Java Ocean, Pelabuhan Ratu, Sukabumi - Indonesia. Other materials which used were some material for proximate analysis and taurin content analysis.

Equipments which used in this study were knife, basin, cutting board, digital scale, erlenmeyer glass, filter paper, blender, stove, pan, HPLC Varian 940-LC and some equipments which used for proximate analysis.

2.2 Procedure of the Experiment

The samples were brought to the laboratory at Bogor Agricultural University and stored in the freezer.

After thawing, escolar is filleted, then retrieved the flesh and viscera. Escolar's flesh and viscera blended, then analyzed. Proximate analysis of escolar's flesh and viscera includes moisture, ash, fat and protein. The proximate analysis was carried out using methods of AOAC (2005).

The extraction process of escolar for taurine analysis was made according to the method of the empirical experience of communities Pelabuhan Ratu, and Rahmi (2012) with modified of treatment time. Taurine extraction using two treatments, boiling (100 °C for 75 minutes) and steaming (100 °C for 120 minutes). The solvent used was distilled water. Furthermore, the filtrate from extraction process was then dried using freeze dryer instrument. Dried extract of escolar was analyze to determine taurine content of its sample.

HPLC separation and determination of taurine in crude taurine powder were carried out according to the method of McConn (2012) with minor modifications. Approximately some sample (g) was poured into a 25 mL aquabidest and degassed by sonicating for thirty minutes and filtered. The derivatization procedure was the same for the standards and the samples. Into a test tube, 1,0 mL of sample, 2,0 mL of the carbonate buffer, 0,5 mL of methyl sulfoxide (DMSO) and 0,1 mL of 2,4-dinitrofluorobenzene (DNFB, Acros) were pipeted. The solution was shaken for 30 s and placed in a 40 °C water bath for 15 min. At the end of the 15 min, 6,5 mL of the phosphate buffer was added to the mixture. The instrument was operated at a flow rate of 0,5 mL/min with a sample injection volume of 20 µL. An isocratic elution of 80:20 (v/v) of the phosphate buffer/acetonitrile was used. The detection wavelength was 360 nm with a UV-Vis detector.

3. Results and Discussions

3.1 Chemical Composition

The chemical composition of escolar (*Lepidocybium flavobrunneum*) can be determined by proximate analysis and it is shown in Table 1.

Tabel 1. Chemical composition of Escolar (*Lepidocybium flavobrunneum*)

Parameter (%)	**Escolar**	
	Flesh	**Viscera**
Ash	0,59±0,007	2,52±0,268
Moisture	63,38±0,000	76,78±0,254
Protein	16,40±0,629	12,11±0,650
Fat	18,34±0,905	7,51±0,049

The ash contents of flesh and viscera escolar are 0,59%±0,007 and 2,52%±0,268. This results are not much different when compared with research conducted by Pattaravivat *et al.* (2008) 0,8%, Karl and Rehbein (2004) 0,8-0,9%, and Suseno *et al.* (2006) 0,43-3,93%.

Santoso et al. (2007) stated that the differences in the mineral content on aquatic organisms are generally influenced by food absorption power of various substances that are suspended in the water where it lives. Organism's ability to absorb various substances suspended is influenced by several factors such as environmental conditions, size of organisms, species, pH and starvation conditions of the organism.

The moisture contents of flesh and viscera escolar are 63,38%±0,000 and 76,78%±0,254. This results are not much different when compared with research conducted by Pattaravivat *et al.* (2008): 63,20%, Karl and Rehbein (2004): 61-65%, and Suseno *et al.* (2006): 70,28-86,30%. Nybakken (1992) explains that the water content in the body's systems of deep sea fish has increased with increasing depth.

The protein contents of flesh and viscera escolar are 16,40%±0,629 and 12,11%±0,650. The results of research Pattaravivat *et al.* (2008), Karl and Rehbein (2004), and Suseno *et al.* (2006) showed that the protein contents of deep sea fish around 16-18%. The least amount of available food leads to reduced food intake for deep sea fish, thus the nutrient content, especially protein becomes relatively lower (Nybakken 1992).

The fat contents of flesh and deep sea fish escolar are 18,34%±0,905 dan 7,51%±0,049. The results of research Suseno *et al.* (2006) and Pattaravivat *et al.* (2008) showed that the fat contents of deep sea fish were around 7-22,08%. Based on the results, escolar known as a fish that contain high levels of fat compared to the other deep sea fish. Fatty acid content of each species is different. It is because of several factors such as gender, age, species, geographic region of fish caught and size (Osibona 2011).

3.2 Taurine Content

The taurine content of raw escolar, and crude taurine extract which obtained by steaming and boiling method are shown in Table 2.

Table 2. Taurin content of Escolar (*Lepidocybium flavobrunneum*)

Treatment		**Taurine content**	
		mg/kg	**mg/100 g**
Raw	Flesh	442,01	44,201
	Viscera	439,15	43,915
Steaming	Flesh	1122,03	112,203
	Viscera	1289,18	128,918
Boiling	Flesh	1033,24	103,324
	Viscera	1052,30	105,230

Results of this study showed that the highest taurine content in steaming extraction treatment from escolar's viscera and flesh at 128,918 and 112,203 mg/100 g. Taurine content of boiling extraction treatment from escolar's viscera and flesh at 105,230 and 103,324 mg/100 g. Based on these results showed that extraction by steaming can increase of taurine content than boiled and raw treatment.

The taurine content of some deep sea fish such as *Zenopsis conchifer* of 34,54 mg/100 g, *Diretmoides pauciradiatus* of 31,51 mg/100 g, *Antigonia capros* of 29,7 mg/100 g, and *Neoscopelus microchir* of 25,4 mg/100 g (Suseno *et al.* 2008). Some deep sea fish studied had higher taurine content than oily fish (skipjack) with concentration of 3 mg/100 g, but had taurine content lower than Japanese oyster (1178 mg/100 g) (Okuzumi and Fujii 2000).

Most animal tissues contain high concentrations of taurine, particularly muscle, viscera and brain, whereas higher plants contain no measurable taurine. Generally, seafood products were found to contain the highest concentrations of taurine (Spitze *et al.* 2003). Heating may also provide a desirable taste, destruction of components, browning reactions, racemization and loss of water soluble compounds are some detrimental effects of heat treatment (Meade *et al.* 2005). The advantages of thermal processing in food include killing pathogens, inactivation of antinutrient enzymes and an increase in digestibility and bioavailability (Finley *et al.* 2006). Taurine concentration can vary greatly between the parts and the location of sample obtained (Larsen *et al.* 2007).

4. Conclusion

Chemical composition content of escolar's (*Lepidocybium flavobrunneum*) flesh and viscera was 16,40% and 12,11% for protein, 63,38% and 76,78% for moisture, 0,59% and 2,52% for ash, and 18,34% and 7,51% for fat content. Based on these results, it showed that extraction by steaming can increase the value of taurine content than boiled and raw treatment.

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