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Amino Acid and Taurine Changes of Indian Mackarel Due to Frying Process

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Abstract

Indian mackerel (*Rastrelliger kanagurta*) is one of the popular protein sources consumed in Indonesia. The fish processing is commonly performed by frying method. This study was determined to find out amino acid and taurine changes of indian mackerel due to frying process. Amino acid and taurine content were detected by HPLC which consist of four stages, protein hydrolysation, drying, derivatisation, and sample injection. The indian makarel which fried at temperature 180°C for 5 minutes were still good for compsumtion if seen from the amino acid content. The indian makarel were decrease amino acid to 8.86%, but frying process made a significant loss of taurine content to 69.87%.

Keywords

Amino Acid, Frying, *Rastrelliger kanagurta*, Taurine

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1. Introduction

Indian mackerel (*Rastrelliger kanagurta*) or also known as Banyar is one popular type of fish consumed by people of Indonesia. The fish is popular because it has a delicious taste of the meat, easily available in the market, as well as high economic value. Production of man mackerel fisheries in Indonesia tends to increase each year. Production mackerel man in 2010 amounted to 17799 tonnes, in 2011 amounted to 19688 tons, and increased by 124.7% in 2012, which reached 44 240 tonnes (CTF 2013).

Mackerel men have fairly high protein content. Salama *et al*. (2004) suggest that the levels of male puffer fish meat protein ranged from 15.52% to 19.74%. Fish protein composed of essential amino acids and non-essential complete, including taurine which is the functional compound. Kamiya *et al*. (2002) states that the amino acids work repairing damaged tissue after injury, protect the liver from toxic substances, lower blood pressure, regulate cholesterol metabolism, encourages the secretion of growth hormone, and reduces ammonia levels in the blood.

Processing mackerel man for consumption is generally done through the frying process. This process aims to perform heating, cooking, and drying using cooking oil as the medium of heat. Frying process will yield a product with a crunchy texture. Frying is generally done at a temperature of 175-195°C (Aladedunye and Przybylski 2009). Azri (2014) mentions that the mackerel man (*Rastrelliger kanagurta*) undergoing the process of frying at 180°C for 5 minutes, decreased omega-3 content of 80% and an increase of 140.66% cholesterol.

Frying process is also expected to lead to changes in amino acids and taurine mackerel man. Oluwaniyi et al. (2010) reported that deep frying frying process at temperatures between 175 to 200°C for less than 15 minutes can reduce the content of amino acids herring (Clupea harengus) amounted to 5.71% and mackerel (scomber scombrus) amounted to 3.67%. Dragnes *et al.* (2009) suggest that

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taurine content of fish was reduced as a result of various treatment processes, such as drying, curing and salting. Information on the effect of frying process on the content of amino acids and taurine mackerel man in Indonesia is still unknown, therefore the necessary research on the effects of frying process on the content of amino acids and taurine mackerel man. This study aimed to analyze the changes in amino acid and taurine on mackerel man due to the frying process.

2. Materials and Methods

Materials and tools

The raw materials used are mackerel male and commercial cooking oil. Materials used in the testing and the amino acid taurine, among others, OPA (ortoftalaldehida), methanol, merkaptoetanol, Brij, Carrez reagents, buffers, sodium chloride, borate buffer, danzil chloride solution, and methylamine hydrochloride.

Frying process using a deep fryer single tank-type type electic FRY-EZL1. The tools used in the analysis of amino acids and taurine are oven, syringe, pipette micro, analytical balance, Millipore 0.45 micron filter paper, and High Performance Liquid Chromatrography (HPLC) with the type of ICI and ODS.

Research methods

The study begins by sampling in VAT Palabuhanratu, Sukabumi. Samples were prepared to produce the fillets skin on. Fresh fish fillets and fry pulverized until homogenous. Fried beef fillet size, the average length of 8.50 cm, 2.50 cm wide and 0.8 cm thick. Frying process carried out in the deep fryer oil contains as much as 4 liters and was heated at 180°C. Fish fry for 5 minutes, then cooled at room temperature. Fresh fish and fried meat analyzed amino acid content and taurinanya. And taurine amino acid composition was determined by HPLC (shimadzu) method which refers to the standard AOAC (2005).

3. Results and Discussion

3.1. Amino Acid Content of Indian Mackerel Fish

Amino acids mackerel and fried fresh man detected is 15 species consist of nine essential amino acids and 6 non-essential amino acids. Essential amino acids are detected in men mackerel are arginine, phenylalanine, histidine, leucine, isoleucine, methionine lysine, threonine, and Valina. Non-essential amino acid found in puffer fish is alanine, aspartate, glutamate, glycine, serine, and tyrosine. The content of amino acids in meat mackerel and fried fresh men are presented in Table 1.

Table 1. Amino acid content Indian mackerel fresh and fried.

Amino acid	Fresh (g/100g)	Fried (g/100g)	Reduction (%)
Non-esensial			
Alanina	4.12±0.27	3.55±0.24	13.83
Aspartat	6.97±0.17	6.38±0.30	8.46
Glutamat	10.88±0.24	9.82±0.60	9.74
Glisina	3.04±0.15	2.83±0.27	6.91
Serina	2.44±0.03	2.28±0.09	6.56
Tirosina	2.57±0.07	2.33±0.09	9.34
Sistein	Td	Td	-
Prolin	Td	Td	-
Total	30.02	27.19	9.43
Esensial			
Arginina	4.21±0,15	3.90±0.24	7.36
Fenilalanina	2.91±0,10	2.73±0.15	6.19
Histidina	3.19±0,01	2.97±0.24	6.90
Leusina	5.55±0,13	5.03±0.27	9.37
Isoleusina	3.76±0,11	3.40±0.15	9.57
Lisina	6.29±0,07	5.45±0.36	13.35
Metionina	2.10±0,07	2.04±0.03	2.86
Treonina	3.10±0,10	2.95±0.12	4.84
Valina	3.99±0,10	3.70±0.18	7.27
Total	35.10	32.17	8.35
Total AA	65.12	59.36	8.86

Amino acids mackerel and fried fresh man detected is 15 species consist of nine essential amino acids and 6 non-essential amino acids. Essential amino acids are detected in men mackerel are arginine, phenylalanine, histidine, leucine, isoleucine, methionine lysine, threonine, and Valina. Non-essential amino acid found in puffer fish is alanine, aspartate, glutamate, glycine, serine, and tyrosine.

Amino acid content mackerel men decreased by 8.86%. The decline of essential amino acids was by 8.34% and non-essential amino acid at 9.43%. Amino acids decrease caused by the high temperatures used during the frying process. Meat processing with the use of high temperatures can cause denaturation, that is changing the structure of proteins into simpler (Purwaningsih *et al*. 2013). The amino acid content of fried material partially converted into melanoid pigment, so the amount in food is reduced (Astiana 2012).

Amino acids mackerel man most reduced after frying is alanine and lysine. Both the amino acid is an amino acid and a reactive role in the formation of the Maillard reaction. This reaction formed between reducing sugars and amino acid group that causes brown color in fried foods (Winarno 2008). Glutamic acid is the most abundant amino acids contained mackerel man. Fresh mackerel man glutamic acid of 10.88 g / 100 g and fried mackerel man amounted to 9.82 g / 100 g. Glutamate is the most abundant amino acids are metabolized in the body, in addition to the high levels of glutamic acid on fresh fish and fried caused by deamination of the amino acid glutamine into glutamic acid (Murray *et al*. 2003). Methionine is an amino acid at least on fresh fish and fries

(2.10 g / 100 g and 2.04 g / 100g).

Oluwaniyi *et al.* 2010 reported a comparison of the amino acid content of mackerel (*S. scombrus*) fresh, fried, boiled, and roasted (Table 2). The treatment process is generally carried out using a high temperature. Pengorengan process carried out in the oil to a temperature between 175-200°C for 15 minutes, boiling water is done in a 100°C for 10 minutes, and the roasting is done over charcoal with a temperature of 145 ° C for 15 minutes. Amino acids decrease fried mackerel higher when compared to the male puffer fish fry because of the time difference is used. The longer frying time, the greater the reduction in amino acid content. Boiling and roasting showed increased amino acid content proportionately. Boiling and roasting is a treatment process that is better when compared to frying and because it uses lower temperatures and faster time.

The testing process amino acids mackerel using Ion Exchange Chromatography (IEC), whereas the male puffer fish using High Performance Liquid Chromatography (HPLC). Differences in testing methods cause some types of amino acids that are not detected in mackerel man, namely tryptophan, proline, Cysteine, aspargarina, and glutamine. The process of acid hydrolysis on testing the amino acid tryptophan by HPLC alleged damage and Cysteine, so it is not detected, while glutamine and asparagine will undergo deamination into glutamic acid and aspartic acid (Murray et al. 2003).

3.2. The Content Taurine Indian Mackerel Fish

Fresh mackerel man contains taurine 444 mg / 100 g and mackerel fry 134 mg / 100 g (bk). The content of taurine is down by 69.82%. The decline is caused by the frying process. Dragnes et al. (2009) explains that taurine is an amino acid that is soluble in water. Taurina on material apart and dissolve in water in the material, carried away by water vapor when the material is processed using a high temperature so that its content is reduced.

Fish is a potential source of taurine. Taurine found in many types of cod, mackerel, salmon, tuna albakor, rays, and sharks (Susanto and Fahmi 2012). Lund (2013) explains that taurine belongs to the class of non-essential amino acids containing sulfur, but does not belong to the group of proteins because they do not have a carboxyl group to form a peptide bond. Taurina function as a regulator of blood pressure and prevent muscle fatigue. Tanruina content of various fish species are presented in Table 3.

The content of taurine mackerel and fried fresh man (bb) lower than tuna (176 mg / 100 g) and stingray (149 mg / 100 g) and higher when compared with salmon (60 mg / 100 g), fish ten (32 mg / 100 g), and haddock (28 mg / 100 g) (Gormley et al. 2007). The difference is thought to be caused by differences in the species, age, diet, habitat, and season. Spitze et al. (2003) suggest that taurine content in tissues of marine animals is higher when compared to land animals, while taurine content in plants is almost undetectable.

Table 2. Amino acid content scomber fish fresh and after processing the results Oluwaniyi *et al.* (2010) (g / 100g).

Amino acid	Fresh	Fried	Boiled	Grilled
Non-Esential				
Alanine	5.22	5.34	5.20	5.54
Aspartat	9.05	10.11	10.72	11.61
Glutamate	13.91	14.59	14.99	14.32
Glisine	5.49	5.40	5.27	5.06
Serine	4.83	2.20	4.83	5.03
Tirosine	3.42	2.86	3.51	3.43
Sistein	1.02	0.48	0.95	0.66
Proline	5.13	4.21	3.69	4,58
Total	48.07	45.19	49.16	50.23
Esential				
Arginine	7.07	3.73	6.99	7.15
Fenilalanine	4.41	3.55	5.41	5.17
Histidine	3.41	2.33	3.29	3.24
Leusine	6.86	5.31	6.93	7.03
Isoleusine	4.77	2.91	4.67	4.63
Lisine	8.02	5.89	7.88	8.26
Metionine	2.48	1.73	2.39	2.35
Treonine	4.24	2.93	3.92	4.67
Valine	5.41	3.17	5.30	5.30
Total	46.67	31.55	46.78	47.80
Total AminoAcid	94.73	76.72	95.94	98.01
Change (%)	-	-19.01	1.28	3.47

Table 3. Taurine content and several tyep of fish (bb).

Type Biota	Taurin Content (mg/100 g)
Indian Mackerel	104
Tuna[1]	176
Pari[1]	149
Salmon[1]	60
Halibut[1]	32
Haddock[1]	28

Statement: [1]Gormley *et al*. (2007)

4. Conclusion

Frying process resulted in changes in amino acids and taurine mackerel man. Fried mackerel man at a temperature of 180°C for 5 minutes still good to eat when viewed from the amino acid content. Mackerel men only decreased amino acid content of 8.86%, but the frying process causes a decrease in taurine content of mackerel were quite large, reaching 69.87%.

Testing with other methods need to be performed to detect a more complete amino acid, such as with the addition of

alkaline hydrolysis method or by using Ion Exchange Chromatography (IEC).

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