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Chemical Characteristics of Traditional Aquatic Products Collected from Wet Market in Banten Province, Indonesia

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Abstract: Traditional aquatic products is popular products consumed by people because of its simple processing, longer shelf-life and complete nutrition. Traditional aquatic products have complete nutrition. These aquatic products need to be tested for nutrition composition and food safety. The study aims to determine chemical characteristics of traditional aquatic products (salted fish with and without boiling, shredded fish, fish cracker and jerked fish) originated from Banten Province, Indonesia, include chemical composition, lead, mercury and formalin content. The result showed that the highest water content was found in salted fish (threadfins) (52.25%), the highest ash content was found in salted redtail scad fish with boiling (18.05%), the highest protein content was found in salted redtail scad fish without boiling (38.17%), the highest fat content was found in shredded fish (26.38%) and the highest carbohydrate content was found in fish cracker in all types. Lead, mercury and formalin content were not detected in all studied products.

Key words: Formalin · Lead · Mercury · Proximate Composition · Traditional Aquatic Products

INTRODUCTION

Indonesia is the country dominated by waters area. One of province in Indonesia that has marine waters area is Banten Province. Banten Province is known as one of province producing fishes. In 2006, fisheries production in Banten Province is amounted to 57.743,46 ton [1]. That fish is sold in the raw material, so that selling still have low economic value.

Fisheries product has high perishable characteristic. Quality deterioration is caused by chemical and microbial activity. Chemical reaction involves enzymatic and oxidation reaction. Microbial activity involves role of spoilage bacterial causing fish quality decline. Inhibition of deterioration can be done by cooling treatment or some processing treatment such as heating treatment and chemical compound (natural or synthetic) addition.

Processing of aquatic product is post-harvest activity holding important role in agribussiness and agroindustrial field. In Indonesia, fisheries processing product commonly still done by traditional processing. Its products are called as traditional aquatic products. The traditional product can adequate protein intake for people. Traditional aquatic product is popular products consumed by people, so they need to be tested for nutrition and food safety characteristics.

The study aims to determine chemical composition, lead, mercury and formalin content of some traditional aquatic products originated from Banten Province, Indonesia.

MATERIALS AND METHODS

Materials: The main materials were traditional products collected from wet market in Banten Province, such as fish cracker A, fish cracker B, fish cracker C, fish cracker (big size), shredded fish, jerked fish, salted fish (redtail scad) with boiling, salted fish (redtail scad) without boiling, salted fish (threadfins). Other materials were chemicals for analysis.

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Determination Of Moisture And Ash: Moisture content was determined by drying samples in an air circulation oven for 8 h at 100°C. Samples for ash determination were heated in a furnace at 550°C for 6 h to constant weight as described in AOAC [2].

Determination Of Fat Content: To produce a homogeneous sample, the muscle or by product from each product were minced using a blender (Philip) for 4 min. The minced samples were placed in plastic cups (diameter 3.5 cm). Sample (150 g) was extracted by a combination solvent, which was chloroform: methanol (1:2). After 10-15 minutes of extraction, another same quantity of chloroform was added as well as distilled water for 1 minute. The extracted sample was filtered and the filtrate (solvent containing extracted lipid) was centrifuged. The lower phase was collected using Pasteur pipette. The lower phase contained lipid and evaporation was performed to separate the solvent from lipid. Lipid content was determined gravimetrically.

Determination Of Lead: Lead was analyzed according to Kendrikse *et al.* [4]. The oil sample was evaporated in a suitable graphite furnace. Calibration of the atomic absorption spectrometer was carried out using standard solutions of organo-compound of lead at a wavelength of 283.3 nm. First all samples and standard working solution shake vigorously in the electric oven at 60±2°C. Then 5.00 g sample, 5.00 g standard working solution and 5.00 g blank oil were individually weighted into placing for each 20 ml polyethylene or polypropylene capped bottles together with 5.00 g matrix modifier and then mixed thoroughly. The samples were measured by injecting 20 µl of the solution, into the graphite furnace with a platform connected to an atomic absorption spectrometer set at a wavelength of 283.3 nm, for absorbance reading. Three standard working solutions, namely 0.020 mg Pb/kg, 0.050 mg Pb/kg and 0.100 mg Pb/kg, were daily prepared by diluting the 10 mg/kg stock solution with blank oil. The peak height on the recorder-chart was measured and a calibration curve was plotted for the sorption of the three standards corrected for the blank, against their respective metal contents. The metal content (lead) of the sample was read from the calibration curve.

Determination Of Mercury: Mercury was analyzed according to AOAC [2]. Sample (5.0 g) was weighed and digested by 25 mL of 18M sulphuric acid, 20 mL of 7M HNO_3 and 5-6 boiling chips in the presence of 1 mL of 2% sodium molybdate solution for 1 hour. After that, heat was removed and the sample was let to stand for 15 minutes. An amount of 20 mL HNO_3-$HClO_4$ (1+1) was added through the condenser and circulating water was turned off. Sample was vigorously boiled until white fumes appeared in the flask. Heating was continued for 10 minutes. Sample was then cooled and added with 10 mL swirling water in flask. Again, boiling was continued for 10 minutes. Heat was removed and the condenser was washed by 15 mL portions of water. The solution was cooled at room temperature. Digested sample with water was completely transferred to 100-mL volumetric flask and diluted to volume with water. About 25 mL aliquot of sample was transferred to another digestion flask and the volume was adjusted to about 100 mL with diluting solution (300 mL water added by 58 mL HNO_3 and 67 mL H_2SO_4 and diluted to 1000 mL with water). An air pump (set to approximately 2 L air/min) was connected to the flask containing diluted aliquot added with 20 mL of *reducing solution* (50 mL H_2SO_4 was mixed with 300 mL water, room-cooled then added with 15 g NaCl, 15 g hydroxylamine and 25 g $SnCl_2$ and diluted to 500 mL) and absorbance was measured by AAS after the aliquot was passed through a filter flask of magnesium perchlorate. Aeration was held for 3 minutes to obtain maximum absorbance at wavelength 253.7 nm. Mercury standard solutions were daily prepared fresh by diluting stock solution (1000 ìg/mL, obtained from 0.1354 g $HgCl_2$ dissolved in 100 mL water) with 1M H_2SO_4. Reagent blank and standard curve was prepared by adding 0, 0.2, 0.5, 1.0 and 2.0 ìg Hg to a series of digestion flasks. Diluting solution was added to each flask and then added by reducing solution. Absorbance was measured similar to that carried out for the samples and was plotted against ìg of mercury to produce the standard curve.

Determination of Formalin: The samples of products were cut into small pieces and 30 g samples were homogenized with 60 ml of 6% w/w TCA. The mixture was filtered through a Whatman No. 1 filter paper (Whatman, Maidstone, England) and the filtrate was adjusted to pH 7.0 with 30% w/w KOH and stored in ice for 1 h. The test was performed by mixing 5 ml of the standard solution, TCA, fish extracts, 2 ml Nash's Reagent and then the mixture was heated in water bath at 60°C for 30 min. The absorption at 415 nm was immediately measured by UV/vis spectrophotometer (Thermo Fisher Scientific, Waltham, MA).

RESULTS AND DISCUSSION

Chemical Composition: Chemical composition in several traditional aquatic products originated from Banten Province can be seen in Table 1. The result showed that the highest water content was presented in salted fish (threadfins) 52.25%. The study of Dewi [6] showed that moisture content of boiled and dried salted anchovy was 62.80%. The moisture content of salted fish from *Hydrocynus* spp. was 60.30% [7]. The moisture content of dry salted fish (NaCl 20%) was 69.77% [6]. Unlusayin [8] stated that after being boiled in salt solution, fish flesh still had a high water content, since salt concentration was very light. Water could not be pressed out of the flesh. Salted fish was food product consumed by people. Salting is a traditional method of processing fish in many countries of the world. It is often used in combination with drying and salting the fish, which can remove water and lower the water activity (water which is available for supporting microbial growth which causes the spoilage) [7].

The lowest water content was presented in shredded fish (7.34%). Huda *et al.* [9] prepared shredded fish with moisture content which was about 8.6-%-12.15%. In Indonesia the SII-0368-85 standard for shredded fish requires that the moisture content of shredded fish product should be lower than 7%. Shredded fish is one of diversification of aquatic product which has dry texture and distinctive flavor and it is made by boiling, crushing, giving seasoning, frying and pressing. The production treatment makes shredded products to have low water content. The water content is affected by several factors: different production process and the different characteristics of product. The water content of each product determine durability of product to the microbial and enzyme activity causing deterioration. Low water content in the product will inhibit the microbial and enzyme activity, so it will affect the shellf life of product.

The result showed that the highest ash content was presented in salted fish (redtail scad) with boiling (18.05%), followed by salted fish (redtail scad) without boiling (14.75%) and salted fish (threadfins) (52.25%). Dewi [6] reported that the ash content of boiled and dried salted fish was 1.28%. Bakhiet and Khogalie [7] reported that ash content of salted fish was 14.1%. Their result were different, it was caused by different raw material which was used in each of study.

Ash content of salted fish higher than ash content of the other products. Huda *et al.* [9] stated that the higher ash content in salted fish could be related to the incorporation of soft bone during preparation. Raw material used for making all salted fish products was all part of fish body included bone, so the mineral content in the bone contribute to the high ash content in the product. The bone composition is mineral, mainly calsium (Ca) and phosphorus (P). The previous result opposite with the ash content in fish cracker and shredded product. The raw material used for making fish cracker was only fish flesh, so it caused the low content of ash. Ash content showed amount of mineral (organic compound) presented in the product.

Table 1 showed that the highest protein content was presented in salted fish (redtail scad) without boiling (38.17%), followed by salted fish (redtail scad) with boiling (35.10%), shredded fish (33.54%) and jerked fish (30.77%). Dewi [6] reported that protein content of boiled and dried salted anchovy was 29.60%. Bakhiet and Khogalie [7] reported that protein content of salted fish was 17.6%. Huda *et al.* [9] reported that protein content of shredded fish was 27.65%. According to SII-0368-85 (Indonesian standard), protein content in shredded fish should be more than 15%. The different protein content is caused by different factor, i.e. raw material and product formulation.

The result showed that the highest fat content was presented in shredded fish (26.38%). Huda *et al.* [9] reported that fat content of shredded fish was about 18.31%-31.14%. According to standard of SII-0368-85, fat content of shredded fish should be lower than 30%. The high fat content is caused by product formulation, it is also caused by characteristic of raw material. Another factor causing high fat content in shredded fish was also affected by frying treatment as a consequence of oil absorption during frying. It was different with lower fat content in salted fish. The low fat content was caused by production process reducing presence of fat in the product, such as boiling and heating. Chukwu and Shaba [10] stated that fat may exude with the moisture evaporation and it was extended by heat treatment, in this case is drying and boiling. Pace *et al.* [11] added that decreasing fat content in salted fish due to physical losses facilitated by the breakdown of tissue cells during salting, followed by the heating effect of sundrying.

Fish cracker is traditionally produced by means of starch gelatinization which is achieved throuh steaming. Fish cracker is made by forming a dough frim a mixture of

Table 1: Proximate result of traditional aquatic products

Products	Water (%)	Ash (%)	Protein (%)	Fat (%)	Carbohydrate (%)
Fish Cracker A	12.28±0.1	2.11±0.04	5.56±0.69	0.71±0.11	79.35±0.64
Fish Cracker B	13.37±0.13	2.94±0.58	2.89±0.17	0.50±0.07	80.32±0.81
Fish Cracker C	12.47±0.14	2.20±0.45	4.25±0.02	0.53±0.11	80.56±0.40
Fish Cracker (Big Size)	12.73±0.03	1.88±0.40	5.52±0.5	0.64±0.03	79.24±0.10
Shreded fish	7.34±0.03	4.94±1.72	33.54±0.2	26.38±0.06	27.81±1.89
Jerked fish	20.83±0.24	8.33±0.49	30.77±5.34	2.68±0.07	37.40±5.02
Salted Fish (redtail scad) (with boiling)	38.76±0.32	18.05±0.36	35.10±0.97	7.36±0.10	0.74±0.39
Salted Fish (redtail scad) (without boiling)	35.38±0.05	14.75±0.56	38.17±0.21	10.72±0.07	1.00±0.79
Salted Fish (threadfins)	52.25±0.37	12.22±0.39	24.02±1.27	7.98±0.10	3.55±1.39

Table 2: Lead and mercury content of traditional aquatic products

Products	Pb content (ppm)	Hg content (ppm)
Fish Cracker A	n.d.	Negative
Fish Cracker B	n.d.	Negative
Fish Cracker C	n.d.	Negative
Fish Cracker (Big)	n.d.	Negative
Fish Shredded	n.d.	Negative
Jerked fish	n.d.	Negative
Salted Fish (redtail scad) (with boiling)	n.d.	Negative
Salted Fish (redtail scad) (without boiling)	n.d.	Negative
Salted Fish (threadfins fish)	n.d.	Negative

Table 3 Formalin content of traditional aquatic products

Products	Formaldehide content (ppm)
Fish Cracker A	0
Fish Cracker B	0
Fish Cracker C	0
Fish Cracker (Big)	0
Fish Shredded	0
Jerked Fish	0
Salted Fish (redtail scad) (with boiling)	0
Salted Fish (redtail scad) (without boiling)	0
Salted Fish (threadfins)	0

starch, comminuted fish, salt, sugar, monosodium glutamate. Before consumption, the dough is sliced and the sliced are fried in hot oil [12]. The result showed that the highest carbohydrate content was presented in fish cracker C (80.56%). The high carbohydrate content in fish cracker obtained from tapioca starch as a mixture of fish meat. Tapioca starch is one source of carbohydrate. The result opposite with carbohydrate content in salted fish. The low carbohydrate content in salted fish was caused by no ingredient containing carbohydrate which was added in the making of product, neither sugar nor starch.

Heavy Metal Content (Lead And Mercury): The types of heavy metal analyzed were lead (Pb) and mercury (Hg). The result showed that lead was not detected in all of products. Pb get into the fish body tissue through the water environmet where fish live. The Pb analysis was important, because related to consumer's healthy. Lead will get into fish's body tissues by biomagnification. Biomagnification occurs through food network. And then, lead get into the human body by food products containing lead. Lead will accumulate in the body tissues, so it causes degerenative disease. Lead can bind active enzyme and it causes enzyme to be inactive, so Hb synthesis is inhibited and this phenomenon can lead to anemia [13].

Mercury belong to heavy metal element. Mercury is a toxic heavy metal which is widely dispersed in nature. Mercury occurs in several chemical forms, with complex pharmacokinetics [14]. Enviromental Protection Agency stated that mercury exists in several form: elemental or metallic mercury, inorganic mercury compound and organic mercury compound. Pure mercury is a liquid metal, sometimes referred to as quicksilver that volatizes readily. The result in Table 2 showed that mercury was not detected in all of products. Environmental Protection Agency set the mercury level for the food products for reference level is 5.8 µg/L. It was showed that all of traditional products observed was safe to be consumed.

Formalin Content: Formalin is an aqueous solution of 37% (w/w) of formaldehyde (H-CO) in water which is used as preservative in medical labolatories and museums [15]. Ingestion of as little as 30 mL (1 oz) of formalin has been reported to cause death in adult human being. Ingestion may cause corrosive injury to the gastrointestinal mucosa, with nausea, vomiting, pain, bleeding and perforation [16]. Formaldehyde is a highly reactive agent which can react with macromolecules in biological systems [17]. The results showed that formalin was not detected in all of products (Table 3). Formalin is commonly used for illegal preservation of aquatic traditional products, such as salted fish, salted squid, etc. Although it is illegal, formalin can be used as food preservatives because it can inhibit microbial and enzimatic activity in food, so that food have long shelf life. Formalin also has ability to hold the water in the tissues of material causing the stable weight of fish, so it can reduce loss weight which implies on lower production cost.

CONCLUSION

The products observed in this study were fish cracker A, fish cracker B, fish cracker C, fish cracker (big size), shredded fish, jerked fish, salted fish (redtail scad) with boiling, salted fish (redtail scad) without boiling and salted threadfins fish. For proximate analysis results, the highest water content was found in salted fish (threadfins) (52.25%), the highest ash content was found in salted fish with boiling (18.05%), the highest protein content was found in salted fish (without boiling) (38.17%), the highest fat content was found in shredded fish (26.38%) and the highest carbohydrate content was found in fish cracker in all types. Lead, mercury and formalin was not detected in all studied products.

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