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REVIEW ARTICLES; UTILIZATION OF FISH OFFAL FOR FOOD

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Abstract

Fish offal or entrails (intestines, liver, heart, gonads or eggs) are fish processing waste that has the potential to be utilized. This article aims to review food products made from fish offal based on the results of research conducted in Indonesia. Based on the results of the review, it was found that the use of fish innards was used for the manufacture of terasi, soy sauce, tamarind, extracted fish liver oil for supplements and fish eggs were made for protein fortification in sistik products.

Keywords : Terasi, Soy Sauce, Bekasang, Oil, Sistik

PRELIMINARY

The wealth of Indonesian fishery resources is very abundant in quantity and diversity. The fisheries sector is one of the sources of regional economic growth and development as well as a source of foreign exchange earners. Fisheries in Indonesia have so far played a significant role in meeting the world's food needs (Hastuti *et al* . 2012).

Fishery products in Indonesia are marketed in fresh form, as well as in processed form. In the production process, it generally produces solid, liquid and gas waste. Solid waste from the fish processing industry is skin, craftsman, fish head and offal. Waste, whether in the form of solids, liquids, or gases, if not managed and processed properly will cause inconvenience to humans and the environment, and can even pollute and damage the environment (Indriani *et al.* 2013). Waste discharged into the environment will have an

impact on public health. Potential diseases that can be caused are diarrhea, skin diseases, typhoid, intestinal worms, and many more (Hasibuan 2016).

Utilization of fish processing waste is very urgent to do to avoid the bad effects it causes. Utilization of fishery waste in Indonesia is still not optimal, especially fish offal. Fish innards are fish stomach contents consisting of liver, intestines, spleen, heart, gonads (male fish) and eggs (female) tissues.

Fish offal is high in protein and unsaturated fat. Fish offal account for 10-15% (depending on species) of fish biomass. The protein content in offal of sturgeon fish (Acipenser persicus) is 15.48%, catla fish (Catla catla) is 8.52% and tuna fish is 16.72% (Bhaskar et al., 2008). Based on this nutritional content, fish offal can be used as an ingredient for making food products. This article aims to review food products made from fish offal based on the results of research conducted in Indonesia.

Terasi

Figure 1. Terasi

Source: news.unair.ac.id

Offal fish offal (intestines, heart, liver and eggs) can be processed into terasi. Terasi is a type of food flavoring material with a distinctive smell, fermented with or without other permitted additives. The terasi is generally solid, has a slightly rough texture, and has a characteristic sharp aroma but tastes very savory. Good quality terasi is usually dark brown in color, has a distinctive smell of terasi, does not smell rancid, does not contain impurities. According to Farid *et al.* (2012), the main stages in making terasi are fermentation, milling, pounding and drying.

The tools used in making terasi from fish offal are knives, scissors, panicles, and analytical scales. The ingredients used are offal (intestines, liver, lungs, and eggs), lime, table salt (NaCl), tapioca flour, brown sugar and aquades.

The process of making terasi (Fatimah *et al.* 2017) is as follows: Fish innards are washed, cut into pieces, then given lime to remove the fishy smell. After that the fish innards are dried in the sun for approximately 6 hours. After that, the dried fish offal is ground to get a smaller size. The milled fish offal is then mixed with 20% salt, 25% tapioca flour, and

brown sugar 50% of the weight of the offal. The mixture was stirred evenly until a homogeneous mixture was obtained. Then the homogeneous mixture was wrapped in aluminum foil and fermented for 20 days.

Based on the results of research by Nenabais et.al (2018), terasi made from offal of skipjack tuna (Katsuwonus pelamis L) produces a favorable level of organeleptic preference, in accordance with Indonesian national quality standards. The color of the terasi is blackish brown and specific for skipjack offal terasi. The skipjack offal terasi is comparable to commercial terasi, as shown in Table 1.

Table 1. Organoleptic Test Results of Offal Shrimp and Commercial Shrimp

Sample Type	Organoleptic Parameters			
	Appearance	Smell	Flavor	Texture
Offal Terrace	7.2267 x 7.7733	7,345 x 7,615	7,299≤ x 7,701	7.3302 x 7.6698
Commercial Terasi	6.235 x 7.8765	7.1901≤ x 7.8099	6.1217 x 7.1127	7,213 x 7,4291

Source: Nenabais et.al (2018)

Fish sauce

Figure 2. Fish sauce

Source: blueelephant.com

According to Kristianawati *et al.* (2014), fish offal can be processed into fish sauce. Fish sauce is a fermented product with raw fish or fish parts. Fish sauce is a clear brown liquid resulting from hydrolysis of salted fish and is usually used as a flavor enhancer or salt substitute in various types of food (Briani *et al* . 2014). This product is usually used as a flavor enhancer or salt substitute in some dishes. Fish sauce is a traditional flavoring and is widely used in many countries in the Southeast Asian region (Rianingsih *et al.* 2016). Fish sauce can be made from trash fish, or from fish waste such as fish viscera. According to Ibrahim *et al.* (2013), fish viscera contain, among others, protein (7-9%), fat (1-11%), protease and lipase enzymes.

The processing of fish sauce made from fish offal is as follows: Fish offal (a mixture of intestine, liver, and stomach is washed and then blended. Then it is mixed with 25% salt and 0.3% trypsin enzyme from fish offal. After that, it is stirred until homogeneous. The mixture is then put into a jar, then tightly closed and fermented for 7 days. After fermentation, it is then sterilized at 115°C using an autoclave for 15 minutes. The results of the sterilization are then filtered. The filtered solution formed after the fermentation process is then separated from the solids using a *centrifuge* . obtained it is fish sauce.

Based on the research results of Widyastuti *et al.* (2014), soy sauce made from the innards of catfish *(Arius thalassinus*) was favored by panelists with a preference level of 6.80 6.88. The soy sauce is brownish yellow in color and has a salt content of 28.14% and a pH of 5.36. The salt content and pH value of the product have met the requirements for fish sauce based on Indonesian national quality standards.

Bekasang

Processing of fishery products cannot be separated from the production of high waste, such as waste from fish fillet production in the form of fish heads, offal, and fish bones. The production of this large fish offal needs to be balanced with efforts to handle and utilize fish offal waste into products that have added value, one of which is bekasang. Bekasang is one of the food ingredients made from fish offal and fish eggs made by traditional fermentation techniques with the help of sunlight for several days (Vani *et al* . 2016).

Figure 3. Bekasang

Source: dispar.malukuprov.go.id

This bekasang is also one of the typical foods of eastern Indonesia, especially North Sulawesi. Bekasang is generally made from the innards of skipjack tuna from the Scombridae family. Generally, the salt content used for the fermentation process is as much as 25%. Bekasang has a brown color with a distinctive odor and is in the form of a liquid paste. It can also contain spices and other ingredients to get the desired flavour. Bekasang is usually used

as a flavoring in many dishes or mixed with red chilies, tomatoes, onions and garlic and then sautéed in coconut oil (Hursepuny *et al* . 2021) .

The procedure for making used was modified at a controlled temperature and a salt content of 20%. Start by separating the entrails from the skipjack tuna. The offal used consists of intestines, liver, heart, lungs, and eggs. The offal is then washed and drained in a sieve. The offal is then weighed and given lime and table salt as much as 20% of the weight of the offal. Then put in a glass container and heated in a water bath at 50 ^{o} C for 10 days (Yempormase *et al* . 2017).

The results of research by Hursepuny *et al.* (2021), bekasang made from offal yellowfin tuna (*Thunnus albacares*) has 46.29% water content and 17.10% protein content. Good quality used containers contain high protein content with low water content and low fat content.

Fish Liver Oil

Waste has the potential to be processed into products with more economic value, such as fish liver oil. Fish oil is an essential oil intake that contains many important nutrients needed by the human body because it contains about 25% saturated fatty acids and 75% unsaturated fatty acids (Seviyanto *et al.* 2022).

According to Kamini *et al.*, (2016), the distinctive characteristic of freshwater fish liver oil is that it contains high levels of oleic, palmitoleate, and arachidonic fatty acids. The fatty acid composition consists of SFA, MUFA and PUFA. In catfish offal, the dominant fatty acids are palmitic (21.34±0.82%), oleic acid (27.19±1.00%) and linoleic acid (8.48±0.55%).

Figure 4. Shark Liver Oil Supplement.

Source: unair.ac.id

To obtain oil from fish liver can be done by the extraction process. Extraction is one way that can be done to obtain oil from food which is suspected to contain oil or fat. One of the extraction methods that are often used in fish oil is the rendering method. Rendering is an

extraction method by using heat to agglomerate the proteins contained in the cell wall of the material and break the cell wall so that trapped oil and fat can be released more easily. There are two types of rendering methods, namely *wet rendering* and *dry rendering* . *Wet rendering* is done by adding some water in the process and refluxing for 5 hours at 100°C. The *dry rendering method* is carried out without adding water in the process, heating the material can be done in a vacuum oven with a temperature of 70°C for 3 hours. Furthermore, the extracts from each of these methods were further processed which included pressing, centrifugation, decantation, addition of 2.5% NaCl and separation of oil and water using a separating funnel to obtain catfish oil yield.

Rodiah *et al.* (2013) have extracted the stomach contents of catfish using the *dry rendering method* for 8 hours to produce oil with quality characteristics of free fatty acids (1.67±0.38%) and peroxide value (4.26±0.13). The quality characteristics of the resulting oil do not meet the International Fish Oil Standard. Ayu *et al.* (2019) stated that catfish liver oil has a dominant fatty acid composition of palmitic, stearic, and myristic acids, while the unsaturated fatty acids are oleic, linoleic, and linolenic. Comparison of n-3:n-6:n-9 fatty acids in catfish liver oil 1:10:20. The results of this study indicate that catfish liver oil can be used as a source of functional food.

Catfish liver oil is a source of Omega-3 and Omega-6 unsaturated fatty acids. Other nutritional content is 16.08% protein, 5.75% fat content, 1.5% carbohydrates, 0.97% ash and 75.7% water (Almunady *et al.* 2012). Omega 3 is found in many marine fish, one of which is shark *(Centrophorus atromarginatus).* Shark liver is a source of raw material for fish oil production which is rich in omega 3. The content of *polyunsaturated fatty acids* (PUFA) in shark liver oil is 19.11%. The values of EPA and DHA in shark liver oil were 1.50 and 14.35%, respectively. The balance of the ratio between omega 9, 6, and 3 is necessary for physiological balance in humans. Balance consumption of omega 9, 6 and 3 can be achieved with a combination of catfish liver oil and shark liver.

Based on research conducted by Nor *et al.* (2021) stated that the ratio of the fatty acid composition of the combination of shark liver oil with catfish obtained a 2:1 result, where the highest PUFA content was 32.59%, which was dominated by oleic acid. While the content of omega 3 and omega 6 fatty acids amounted to 2.59 and 29.75%, respectively. According to Swanson *et al.* (2012) the role of EPA and DHA for fetal development and supplements for pregnant women. The results of the analysis of fatty acid profiles showed that the combination of treatment with the addition of shark liver oil could increase the content of omega 3 and omega 6 fatty acids in catfish oil. The addition of shark liver oil to catfish oil can increase the content of omega 3 and omega 6 fatty acids. Omega 3 fatty acids from fish play a role in lowering blood cholesterol, triglyceride levels and improve their excretory

ability, improve cell membrane fluidity. Omega 6 is useful in preventing muscle breakdown and increasing muscle mass. According to Diana (2013) omega 3 and omega 6 play a role to help fight heart disease and depression. Therefore, shark liver oil and catfish oil which are rich in omega 3 and omega 6 can be used as health supplements or medicines to meet the needs in the pharmaceutical sector.

Fish Eggs as Additive Processed

Figure 5. Sistik

Source: rumah-bumn.id

Sistik is a snack made from flour which has a low protein content while protein has a role in the growth of the human body. The use of nilem fish eggs in the manufacture of sistik is a solution to meet these protein needs. Nilem fish (*Osteochilus hasselti*) is a local fish native to Indonesia whose potential has not been fully explored. Nilem fish has the advantage that it has high fecundity which means it can produce eggs in large quantities. Nilem fish eggs are one of the potentials that can be utilized in the field of fishery processing. Based on the results of preliminary research, nilem fish eggs have a protein content of 16.56%. The high levels of protein contained in nilem fish can be used as an ingredient to add nutritional content to snacks, one of which is sistik.

The materials used for the manufacture of sistik products are wheat flour, tapioca flour, chicken eggs and nilem fish eggs. Additional ingredients used in the manufacture of these sistik products are salt, margarine and coconut milk. The tools used are ampia, knives, stoves, and frying pans.

The manufacture of sistik is carried out in three stages, namely kneading, printing and frying. The manufacture of nilem egg sistik was carried out with five treatments of adding nilem eggs from the concentration of wheat flour, namely 0%, 10%, 15%, 20% and 25% of the weight of wheat flour. The parameters observed were organoleptic characteristics and then continued with chemical testing at 0% treatment (control) and the best treatment.

The organoleptic characteristics observed included appearance, aroma, taste and texture. The organoleptic test was carried out by 20 semi-trained panelists who would provide

an assessment of the appearance, aroma, taste and texture of the sistik product. Data analysis used non-parametric statistical test in the form of Friedman test and continued with multiple comparison test if there were significant differences in each treatment. The best treatment decision-making was analyzed using the Bayes method. Based on the results of the study on

the addition of nilem fish eggs at the sistik preference level, it can be concluded that the treatment of adding nilem fish eggs with a concentration of 15% resulted in the most preferred treatment by the panelists. The sistik with the addition of nilem eggs with a concentration of 15% of wheat flour had a water content of 4.27%, an ash content of 2.19%, a fat content of 37.66% and a protein content of 12.72% (Iqbal *et al.* 2016) .

CONCLUSION

Based on the results of the review, it was found that the use of fish innards was used for the manufacture of terasi, soy sauce, bekasang, extracted fish liver oil for supplements and fish eggs were made for protein fortification in sistik products.

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