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Analysis of intensity and prevalence of *Anisakis* sp. in frozen fishery products mackerel

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Abstract
Scomber japonicus mackerel is an imported commodity that has a high nutritional content as a raw material for traditional fish processing industries in the form of steaming in Indonesia, however imported fish can be infected by diseases due to infection from endoparasites caused by worms. This research aims to analyze the nutritional content which includes moisture, ash, protein, and fat content of mackerel that are not infected and infected with the parasite *Anisakis* sp. This research uses an observational method by taking 15 samples of mackerel randomly. Then the organoleptic condition was examined referring to (2014) SNI 4110: 2014 concerning frozen fish to determine the difference between infected and uninfected mackerel *Anisakis* sp. Furthermore, it is examined to determine the number of parasites that infect and the number of samples infected with the parasite *Anisakis* sp. Next the samples were tested proximate according to (AOAC) 2005 to compare the nutritional content of the mackerel fish that are not infected and infected with the parasite *Anisakis* sp. The results of the research were analyzed descriptively and comparatively. It showed that there was no difference between uninfected and infected mackerel with *Anisakis* sp. when viewed from an organoleptic point of view. The results of identification of parasites from 15 samples of mackerel, 10 positive fish were infected with the highest infection intensity in the intestine. The results of the proximate content analysis showed that the mackerel samples were not infected with the parasite *Anisakis* sp. has water content of 62.00%, ash content of 12.96%, protein content of 23.52%, and fat content of 12.28%. While the SM09 sample infected with the parasite *Anisakis* sp. has a water content of 62.81%, an ash content of 10.23%, a protein content of 21.32%, and a fat content of 10.73%.

Keywords: Mackerel (*Scomber japonicus*), organoleptic, fish parasites, *Anisakis* sp., proximate analysis

1. Introduction
Fish like other living things cannot be separated from various diseases. One of the diseases in fish can be caused by parasites. Various types of fish can be attacked by parasites, both freshwater and marine fish. In general, parasite attacks do not kill fish as a host sporadically, but can interfere with the fish's physiological processes, because parasite attacks can damage body tissues, suck blood and fish nutrition as a source of nutrition for these parasites to grow and reproduce. In addition, parasitic attacks on fish can cause secondary infections, either by bacteria, viruses or fungi, which can lead to death in farmed fish, so that it will have an economic impact due to a decrease in fish production [14]. According to Rosidah (2016) in terms of where it lives on the host's body, parasites are divided into two, namely ectoparasites and endoparasites.

There are several types of parasites that are zoonotic, wich is a type of parasite that can infect fish and humans. One oh the parasites zoonotic is *Anisakis* sp. wich live as endoparasites in the intestines of fish. According to Hafid (2016) the risk of transmitting these worms to humans is relative small because the fish consumed after going trought the perfect heating process first causes the worms to die. However, fish infected with *Anisakis* sp. The nutritional content of the fish (meat) will decrease, as Muhdi argued in Hidayati (2016), the nature of parasites is to suck nutrients from their host.

Mackerel fish species *Scomber japonicus* including sea water fish species which is an imported fish as raw material for traditional fish processing industry in the form of pemindangan in Indonesia and sold in auction place fish in a frozen state. According to data from the Directorate General of Fisheries in 2013, mackerel imports in 2011 reached 93,781 tons and an increase in 2012 reached 120,436 tons, this shows that this fish is a leading

commodity in Indonesia. Based on data from the Directorate General of Processing and Marketing of Fisheries Products (2012), mackerel is an alternative source of animal protein for Indonesians.

Apart from having a high nutritional content, this mackerel is easily available in the market and the price is relatively cheap, which is IDR 23,500 / kg. November 2012-2017 increased by 10.58% per year. Based on the description above, it is necessary to conduct research on the intensity and prevalence of *Anisakis* sp. in frozen fishery products mackerel as a standard of feasibility for consumption.

2. Materials and methods

The research method used was observation, by taking samples of frozen mackerel randomly as many as 15 samples. The sampling method used was *purposive sampling method*. The sample was examined for its organoleptic condition and then given a sample code to determine the difference between infected and uninfected mackerel *Anisakis* sp. after surgery on the fish. Then, the fish samples were dissected to determine the presence and number of infecting parasites and the number of samples infected with *Anisakis* sp.

The procedure carried out in this research consisted of three stages, namely organoleptic testing of 15 samples of frozen fishery products. Mackerel by 15 semi-trained panelists. After that, surgery was performed to identify the presence of parasites *Anisakis* sp. In mackerel. Parasite *Anisakis* sp. which was found further preserved using an alcohol solution.

This research will produce two observable analyzes, namely the results of the organoleptic test and the analysis of the intensity & prevalence of the parasite *Anisakis* sp. In frozen mackerel fishery of frozen mackerel fishery products infected and not infected with the parasite *Anisakis* sp. Organoleptic data and intensity & prevalence of parasites *Anisakis* sp. of mackerel fish were analyzed descriptively. The results of this research will produce a standard of consumption feasibility for the community for frozen mackerel fishery products in particular.

3. Result and discussion

3.1 Organoleptic Test

The organoleptic test in this research uses a sensory assessment sheet for frozen fish which refers to BSN (2014) SNI 4110: 2014 concerning frozen fish. The aspects assessed in the frozen fish assessment sheet are divided into two parts, namely when it is frozen and after melting, as presented in Table 1.

Table 1: Results of the average sensory assessment of mackerel

Spesifications	Value	Sampel Code	
		SM01	SM09
A. Frozen State			
1. Appearance (especially for *frozen blocks*)			
Flat, clear, thick enough on the entire surface covered with ice.	5	√	√
2. Drying (dehydration)			
No drying on the product surface	5	√	√
3. Color change (discoloration)			
Has not experienced a color change on the product surface.	5	√	√
B. After melting (*thawing*)			
1. Appearance			
Brilliant type specific.	5	√	√
2. Smell			
Fresh, type specific.	5	√	√
3. Meat			
The meat incision is less than brilliant.	4	√	
The cutlet is getting dull.	3		√
4. Texture			
A little less compact, a little less elastic.	2	√	√

Information: SM01 (sample of mackerel infected with *Anisakis* sp.), SM09 (sample of mackerel infected with *Anisakis* sp.)

Based on Table 1, observed from the appearance of the fish in a frozen state, the two samples both have a value of 5, which means that they are coated with ice evenly, clear, thick enough on the entire surface. Then, from the drying indicator, the two samples also got a value of 5 which means that there is no drying on the surface of the product. Both samples also received a value of 5 from the color change indicator, which means that there has not been a change in color on the surface of the product. The next fish assessment is an assessment after the fish has gone through theprocess *thawing*. The appearance of the two samples got a value of 5, which means that they looked bright and were specific to the type of fish. The aroma of the two samples also scored 5, which means that it is fresh with specific types. However, if seen from the indicator of the meat, the samples were not infected with *Anisakis* sp. The average score was 4, which means that the incisions were less brilliant, while the samples infected with *Anisakis* sp. On average, it got a lower score of 3, which means that the cutlet is getting dull. The texture of the two samples also got the same value, namely 2, which means that it is a little less compact, a little less elastic. The decline in the quality of fish meat can be caused by the freezing and thawing processes, as argued by Hong (2013) and Hasan (2016) stated that freezing and melting greatly affect the characteristics of fish meat, this occurs due to the oxidation process of fat, protein damage, and changes in the structure of fish meat.

Organoleptic observation of fishery products is very important to do as the main tool for measuring the acceptance of the product. Organoleptics, namely assessing and observing the texture, color, shape, aroma, taste of a food, drink or medicine [8].

3.2 Observation Results of Parasites *Anisakis* sp.

3.2.1 Identification Result of *Anisakis* sp.

Parasite *Anisakis* sp. which is often found in fish is the third stage *Anisakis*, morphology *Anisakis* sp. The third stage is a

hard cuticle, has teeth in the ventral part of the mouth that protrudes to make a hole, the secretion holes between the dorsal lips, the simple digestive system (*esophagus, ventriculus, intestine*) (Figures 1 and 2).

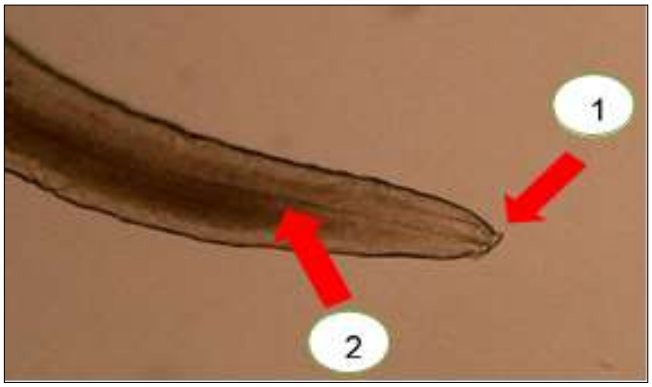
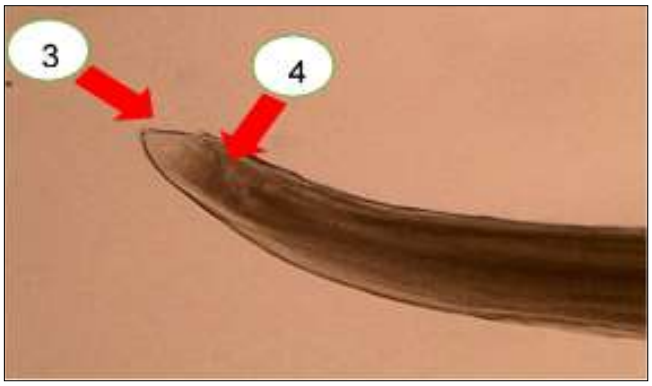


Fig 1: The head of *Anisakis* sp.



***Source*:** Personal documentation (2020)

Fig 2: The tail of *Anisakis* sp. Morphology of *Anisakis* sp. (1) The head with a *booring tooth*, (2) Part Esophagus, (3) The tail, (4) The tail of the anal (sewer)

3.2.2 The results of the calculation of the intensity and prevalence of *Anisakis* sp.

Intensity is the average number of parasites per fish observed, in this case the parasites observed were *Anisakis* sp. while the infected fish object was mackerel with a size of ≥ 20 cm. The spread of *Anisakis* sp. in some organs, namely to complete its life cycle. The high intensity in the intestine indicates that the intestine is a very favorable place for *Anisakis* sp. The small intestine provides a source of nutrition for nematodes, including blood, tissue cells, body fluids, and food juices contained in the lumen of the small intestine [13].

Based on Table 2, it can be revealed that there is a significant difference in the number of individuals between the number of *Anisakis* sp. in the intestines and the meat. The results of the observation of the spread of *Anisakis* sp. In 15 samples of frozen mackerel, the average intensity data of *Anisakis* sp. in the intestine as many as 6 individuals per 1 fish, while the average number of *Anisakis* sp. on the muscle as much as 2 individuals per 1 fish. The prevalence of the 15 mackerel fish samples was observed, the results were that 10 fish were infected with the parasite *Anisakis* sp., while the other 5 samples were declared uninfected (clean), so it can be concluded that 67% of the mackerel fish samples in the SKIPM Cirebon laboratory were positively infected by theparasite. *Anisakis* sp. This indicates *Anisakis* sp. distributed in the digestive organs, especially in the intestine with a total of 45 individuals, while those that were distributed to the meat were only 3 individuals.

The existence of *Anisakis* sp. in the body of the fish is influenced by several factors, namely fish age, fish length, and geographic location [11]. Parasitic attacks usually attack adult fish more often because they accumulate more parasites. Because the increase in fish body length results in higher parasite accumulation in the life cycle of its host due to the increase in the number and types of food in larger fish. According to [9] the abundance of (L3) larvae is *Anisakis simplex* influenced by *feeding habits*, fish microhabitat, fish species and water conditions in an area. Based on the results of prevalence calculations, from the 15 mackerel samples observed, 10 were infected with the parasite *Anisakis* sp., While the other 5 samples were declared uninfected (clean), so it can be concluded that as many as 67% of the mackerel fish samples in the SKIPM Cirebon laboratory positively infected by the parasite *Anisakis* sp. The large number of fish infected with parasites can be caused by several factors, one of which is extreme temperature changes in the environment. An increase in temperature (environmental change) that cannot be tolerated by the host and will spur the development of pathogenic agents, disease will arise because on the one hand it will cause stress to the fish (host) while on the other hand it will cause pathogenic malignancies to attack the host [12].

Table 2: The results of the distribution data of *Anisakis* sp. in mackerel

No.	Sampel Code	Length (cm)	Weight (g)	Where the Larvae were Found *Anisakis* sp.	
				Meat (ind)	Intestines (ind)
1.	SM01	20,5	75	-	-
2.	SM02	21	78	-	2
3.	SM03	21,3	80	-	2
4.	SM04	22	104	-	3
5.	SM05	20	77	-	-
6.	SM06	21	75	-	-
7.	SM07	20,5	77	-	6
8.	SM08	22	103	-	2
9.	SM09	23	95	-	17
10.	SM10	23	81	-	-
11.	SM11	21	86	-	-
12.	SM12	20,5	77	-	5
13.	SM13	20,5	65	2	3
14.	SM14	22	83	-	1
15.	SM15	20	67	1	4
Total				3	45

Information: SM01 (sample of mackerel infected with *Anisakis* sp.), SM09 (sample of mackerel infected with *Anisakis* sp.)

4. Conclusions

Based on the research results, it can be concluded that

a. The organoleptic test results showed that the organoleptic conditions of infected and uninfected mackerel did not show a significant difference in terms of appearance, smell and texture of meat.
b. The parasite intensity of *Anisakis* sp. in the intestinal organs of mackerel as many as 6 fish / fish and in the muscle organs as many as 2 fish / fish, while the prevalence value of *Anisakis* sp. in mackerel by 67%.

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