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QUALITY IDENTIFICATION OF SKIPJACK TUNA (*KATSUWONUS PELAMIS*) CAUGHT USING POLE-AND-LINE VESSELS IN SORONG CITY

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ABSTRACT

Fish handling on vessels plays an important role in the quality of skipjack tuna. The purpose of this study was to identify the quality of pole-and-line caught skipjack tuna. The study was conducted using a descriptive method and purposive sampling, taking a sample of 3 vessels. An analysis was conducted through organoleptic, microbiological, and chemical (histamine) tests. Data were analyzed by descriptive, qualitative and quantitative displays via tables and graphics. The results of organoleptic, microbiological and chemical tests showed that skipjack tuna caught by pole-and-line vessels were still suitable to be consumed.

KEY WORDS

Skipjack tuna, pole, line, Sorong.

Skipjack tuna is the product of pelagic species fishery. Medium-sized skipjack of *Scombridae* (tuna) family is the only species of *Katsuwonus* genus (Suara *et al.*, 2014). Skipjack tuna (*Katsuwonus pelamis*) is one of the economically valuable fish resources resulting from Indonesia's waters, both as an export commodity and domestic consumption (Tumonda *et al.*, 2017). Fishes of *Scombridae* family such as tuna, komu, skipjack, mackerel naturally contain histamine (Hattu *et al.*, 2014).

Skipjack tuna is in high demand throughout the world because of its abundant population and high nutritional value (Saeed *et al.*, 2013). Skipjack tuna can be found in almost all the waters of Indonesia (World Wide Fund for Nature, 2015). The result of skipjack catches in Indonesia in 2015 was 122,587 tons (KKP, 2015) while the catches of skipjack in Sorong City in 2012 amounted to 2,339.4 tons which then experienced an increase of 42.14% in 2016 to 3,325.2 tons (Supervisor Work Unit of Marine and Fishery Resource of Sorong City, 2016).

Skipjack tuna catching in Indonesia is mostly done using *pole-and-line* fishing gear (Sunoko and Huang, 2013). Pole-and-line method belongs to a type of curved line attached to a pole (fishing rod) so that it is categorized into a selective and environmentally friendly fishing method. Therefore, *pole-and-line* fishing gear is highly recommended for catching skipjack tuna (World Wide Fund for Nature, 2015). According to Metusalach *et al.* (2014), gill nets and ring nets cause a higher level of damage than fishing rods and *bubu* (traditional fish pot/trap). Fish is a perishable foodstuff. After caught, fish is often placed at the room temperature in a long time, resulting in decreased quality and post-harvest fish spoilage (Olodosu *et al.*, 2011). Freshness quality changes can take place enzymatically, chemically and bacteriologically followed by an organoleptic decline. Fish is perishable due to biochemical and microbiological changes occurring during the post-harvest time, which is the leading cause of decreased quality (Mol *et al.*, 2007). The treatment aspect when the fish caught is very important to note because it involves how to obtain a good quality fish (Mboto *et al.*, 2014). This study aimed to examine and identify the content of histamine, TPC, and organoleptic contained in skipjack tuna caught using *pole-and-line* fishing gear.

MATERIALS AND METHODS OF RESEARCH

Skipjack tuna used were caught using pole-and-line vessels in Sorong City with the average length of 50-58 cm and weight of 3,000 – 4,000 g per fish obtained from the catches of skipjack tuna using pole-and-line vessels in Sorong City.

The primary tool used in this study to test the histamine content was a spectrofluorometer, and the analysis of total plate count (TPC) used a stomacher (*Interscience Bagmiser*) and Petri dish containing *plate count agar* (PCA).

The study used a descriptive survey method while the sampling was conducted on three (3) pole-and-line vessels using a purposive sampling method. The selection of the three (3) vessels was based on the consideration that these three (3) vessels existed in Sorong City, sized 40-90 GT, and used the same cooling system, *i.e.*, using ice. Fish were taken at three points, covering the fish that were placed in the bottom of holds (C), the middle of holds (B), and the top of holds. It was done to determine the fish quality based the fish location or position differences in the holds.

Based on ISO 2729:2013, an organoleptic test of fish consists of six (6) specifications, *i.e.*, eyes, gills, mucus on the fish skin surface, fish (flesh), smell and texture. The analysis of TPC was done based on SNI 01-2332.3-2006. The test of histamine content was carried out using spectrofluorometer with a method referring to ISO 2354.10.2009.

Data analysis of organoleptic was processed using SPSS Statistics 17.0 while data for the histamine test was processed using Microsoft Office Excel. Histamine contents were analyzed using an analysis of variance (ANOVA) at the significance level of 0.05. Additionally, the nonparametric data (organoleptic) were tested using *Kruskall Wallis* test.

RESULTS AND DISCUSSION

Pole-and-line vessels have fish holds (hatches) functioning to keep the fish catches and ice as the coolant. The holds should be cleaned before and after being used.

The ice used was in the form of ice blocks sized 50 kg with the total 400 – 500 blocks of ice for once sailing. The ice blocks used were crushed and then used to lower the temperature of the fish. The fish caught were washed using clean sea water. The fish preparation in the holds was conducted in a *bulking* method, *i.e.*, piling up the fish in the cargo holds with an ice-coated base. The fish were piled up in multi-layers, alternating with layers of ice.

Organoleptic Quality. The analysis results showed that the organoleptic quality of skipjack tuna covering the eyes, gills, mucus, fish (flesh), smell, and texture had a significant difference, in which the fish location or position in the holds caused different organoleptic values (Table 1). Meanwhile, one of the quality requirements of organoleptic test suggests that the standard minimum value is 7 (SNI 2729:2013).

Table 1 – Average Organoleptic Test Results of Skipjack Tuna

Sample Code		Specification					
		Eyes	Gills	Mucus	Fish (Flesh)	Smell	Texture
Vessel 1	A	8.9±0.15	8.9±0.15	9±0	8.5±0.29	8.6±0.27	8.7±0.34
	B	8.6±0.27	8.8±0.16	8.6±0.37	8.4±0.16	8.3±0.26	8.5±0.29
	C	8.2±0.15	8.5±0.29	8.3±0.12	8.1±0.28	8.1±0.16	8.1±0.15
Vessel 2	A	8.9±0.15	8.8±0.16	8.7±0.26	8.5±0.21	8.6±0.25	8.8±0.16
	B	8.5±0.21	8.5±0.33	8.7±0.22	8.4±0.21	8.5±0.21	8.4±0.41
	C	8.1±0.25	8.3±0.22	8.3±0.12	8.4±0.25	8.1±0.22	8.6±0.16
Vessel 3	A	8.7±0.61	9±0	8.8±0.15	8.7±0.42	8.5±0.44	8.8±0.84
	B	8.5±0.20	8.8±0.16	8.7±0.24	8.5±0.20	8.4±0.07	8.5±0.20
	C	8±0	8.3±0.36	8.3±0.24	8.1±0.28	8±0	8.1±0.15

Source: Data of Research Results (2017).

The fish placed in the bottom part of holds had the lowest organoleptic value. In linear, a study conducted by Ekasari *et al.* (2017) showed that skipjack tuna recently purchased from the Fish Auction (TPI) of Tumumpa obtained an average organoleptic value of 9. Meanwhile, Irianto (2008) explained that the preparation of fish in a hold should not be more than three layers of fish because it can cause physical damage to the fish placed in the bottom or lower layer due to the weight of ice and fish put on it. Moreover, Murniyati and Sunarman (2000) added that the piles of fish and ice should not be more than 50 cm.

If the number of fish stored is quite a lot, horizontal bulkheads should be used to hold the second and next layers. Increased temperatures can cause a significant decrease in organoleptic values (Zhang *et al.*, 2011). The analysis results of *Kruskal Wallis* suggested that the organoleptic value of skipjack tuna in different fish location or position in the holds showed a significant difference ($P < 0.05$).

Total Microbial Content (TPC). The TPC test results of skipjack tuna caught using the fishing gear of pole-and-line are presented in Figure 1. The TPC test results of the three vessels with different fish positions in the holds showed that the number of bacteria living in skipjack tuna was still below the threshold limit of the ISO standards for fresh fish or microbial contamination in food. Based on ISO 2729:2013, the quality and safety requirement of fresh fish is 5×10^5 colonies/gram.

Figure 1 – Average TPC of Skipjack Tuna

The activity of microorganism can cause fish spoilage and be used to measure the quality of the fish (Cosansu *et al.*, 2011). The TPC test results of the three vessels showed that fish placed in the top of the holds obtained TPC values ranging from 3.5×10^2 – 7.75×10^2 while those set in the middle of the holds obtained TPC values ranging from 3.5×10^2 – 1.0×10^3 . On the other side, the TPC test results of the fish placed in the bottom of the holds gained TPC values ranging from 4.7×10^3 – 6.3×10^3 . Widiastuti and Putro (2010) reported that tuna caught directly by fishermen who live in *Pelabuhan Ratu*, West Java using vessels equipped with insulated holds and without being weeded have a TPC value of 10^2 colony / g.

The TPC test results of the three pole-and-line vessels with different fish positions in the holds indicated that the fish handling on the vessels was quite good and the ice used for cooling and storing the fish was adequate. Refrigeration of fish can prolong the fish freshness for 12 to 18 days after the fish catching (Adawyah, 2007). Moreover, Husni *et al.* (2015) stated that the increase and decrease in TPC values could occur because fish meat is a suitable medium for bacterial growth.

Fish freshly caught should be given with crushed ice to keep the fish in a good condition when being marketed and to inhibit or stop the activity of detrimental substances and microorganism because, according to Siburian *et al.* (2012), the fish storage at cold temperatures or frost can also destroy the microbes that lead to fish spoilage. Wibowo *et al.* (2014) revealed that the use of a low temperature of 0°C after fish died can extend the phase of rigor mortis, lower the enzymatic, bacterial and chemical activities as well as minimize the physical fish changes. Moreover, Gram and Dalgaard (2002) added that the use of low temperatures will inhibit microbial growth in fish.

Histamine Contents. The laboratory test results showed that the average histamine contents of skipjack tuna caught using pole-and-line vessels ranged from 1.20 – 1.90 mg/kg as presented in Figure 2.

Histamine production in fish depends on the histidine content of the fish, the presence of decarboxylase enzyme-producing bacteria and environmental conditions (Kantun *et al.*, 2015). Results of histamine contents of skipjack tuna caught using pole-and-line vessels ranged from 1.26 mg/kg to 1.8 mg/kg. The value is far below the standards set by ISO

2729:2013. Widiastuti and Putro (2010) found that the histamine content values of fresh tuna landed in *Pelabuhan Ratu*, West Java ranged from 1.28 – 1.61 mg/100 g.

Figure 2 – Histamine Contents of Skipjack Tuna

The test results of fish histamine contents in Vessel 1 showed that the amount of histamine content of skipjack tuna in the bottom of the hold was 1.74 mg/kg. It was higher than the amounts of histamine contents of skipjack tuna placed in the middle and top of the hold, which respectively amounted to 1.40 mg/kg and 1.26 mg/kg. It occurred because the pile of fish in the hold was too high. Besides, instability of the temperature in the hold and the catching time that was too long would lead to the shrinkage or melting of coolants (ice), making it very difficult to maintain the stability of the temperature in the hold. According to Kantun *et al.* (2015), the temperature instability will stimulate increased histamine. Furthermore, according to Heruwati *et al.* (2004), histamine cannot be formed at 0°. Therefore, FDA determined that the critical limit temperature for histamine growth in fish is 4.4° C (FDA, 2011).

The test results of fish histamine contents in Vessel 2 showed that the amounts of histamine contents of skipjack tuna placed in the bottom, middle, and top of the hold were respectively 1.51 mg/kg, 1.55 mg/kg, and 1.42 mg/kg. It indicated that the histamine content of skipjack tuna placed in the top of the hold was fewer than those set in the middle and bottom of the hold. It possibly happened because the crew did not evenly give or put the ice in the hold. According to Setiawati *et al.* (2016), each fish must be covered with ice. Low temperatures can control the formation of histamine (Kerr *et al.*, 2002).

Furthermore, the test results of histamine contents in Vessel 3 showed that the amounts of histamine contents of skipjack tuna placed in the bottom, middle, and top of the hold obtained respectively 1.6 mg/kg, 1.45 mg/kg and 1.8 mg/kg. It was because the ice was not spread evenly. During or after being stored at the temperature of above 4° C, fish will experience the formulation of histamine (Evangelista *et al.*, 2016). Failure to apply the cold chain during the fish handling and processing is the primary factor triggering an increased histamine content in fish (Heruwati *et al.*, 2014). Handling without weeding at sea will further accelerate the increase in histamine (Kantun *et al.*, 2015).

The results of variance analysis showed that the different positions in laying the fish in the holds did not significantly influence the formed histamine content of skipjack tuna ($p > 0.05$).

CONCLUSION

In general, the findings of this study suggest that the organoleptic results of skipjack tuna range from 8 to 9. Meanwhile, the results of TPC contents range from 3.5×10^2 to 6.3×10^3 , and the results of histamine contents range from 1.26 mg/kg to 1.8 mg/kg. To sum up, the test results of organoleptic, TPC and histamine of skipjack tuna caught using pole-and-line vessels still meet the quality standards of ISO 2729:2013. Besides, different positions in laying fish in a hold significantly influence organoleptic test results ($p < 0.05$) but do not significantly influence the histamine contents ($p > 0.05$).

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