# Analysis of Histamine Level in *Lemuru* Fish (*Sardinella lemuru*) in the Canning Industry

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**Abstract.** The presence of histamine is one of the food safety issues in the canned fish manufacturing industry. Histamine usually appears in canned fish products due the raw material employed is pelagic fish such as *lemuru* which is rich in histidine amino acid. Histidine can cause histamine production via decarboxylation reaction by bacterial activity during the heat canning process. As a result, the purpose of this study was to investigate the increase in histamine levels that occurred in both canned fish raw materials and final products utilizing the Biofish 300 method. Aside from that, thermocouple and thermometer were used to analyze the fish's central temperature and surface. SNI 2729:2013 was also utilized to assess the physical quality of raw materials regarding fresh fish. Based on the result, the histamine level increased significantly from raw material to product, accounting for 10.24 ppm and 16.92 ppm respectively ($P < 0.05$). However, the histamine levels in all samples remained below the company's threshold (50 ppm) indicating canned fish was still safe to consume. To mitigate the effects of increased histamine, industry must develop a cold chain system by observing the central temperature of raw materials (≤4°C), and the processing room temperature (≤25°C) regularly. Similarly, prior to further processing, the raw material quality should not be less than 7.

## 1 Introduction

*Lemuru* fish is one of the marine commodities that are widely caught in the Bali Strait. According to the Ministry of Marine Affairs and Fisheries of Indonesia (2022) [1], *lemuru* production in Bali Province reached 19,428.56 tons with a production value of 126 billion rupiahs in 2021. The high number of *lemuru* catches has led to the development of *lemuru* fish processing such as canning industries. Fish canning is one of the food preservation processes using sterilization temperatures (110 – 120 C°), which aims to save the food from spoilage [2]. One of the problems that exist in the canning process is the increase in histamine in fresh *lemuru* during the production. *Lemuru* is a small pelagic fish with free histidine amino acid content. Histidine in fish can turn into histamine due

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to an increase in temperature and the process of free histidine decarboxylase by bacteria. BPOM [3] mentioned that 14% of severe food poisoning (KLB KP) was reported to be caused by natural toxins and histamine in raw materials. Therefore, histamine analysis in both fresh fish and its canned products is essential to reduce the possibility of food poisoning and increase the quality of product. In this study, histamine levels of raw materials and products were analysed accompanied by organoleptic testing, temperature of central fish and room temperature during handling to monitor the quality of the fish canned.

## 2 Materials

The main material in this study was fresh *lemuru* and fish canned obtained from one of canning industries located in East Java Indonesia. The analysis uses the Biofish 300 HIS enzymatic biosensor method, an analytical device for measuring histamine in fishery products quickly, efficiently, and accurately by combining high specificity and selectivity of certain enzymes with amperometry signals that are easy to detect and measure [12]. Meanwhile, the tools used in organoleptic and temperature analysis consisted of fresh fish scoresheet assessment based on SNI 01-2346-2006, pen and tray, thermocouple (type K6802), room thermometer (Gea medical), and *beaker glass* (Pyrex), digital scales (Camry), sieves, blenders (Philip) and pipettes (Pyrex).

## 3 Methods

### 3.1 Organoleptic testing of raw materials and canned products

Organoleptic testing was carried out by randomly taking samples of 5 fresh fish from a raw materials truck with a size of 1.8-2 tons based on SNI 01-2346-2006. Meanwhile, sensory analysis of canned *lemuru* was performed by observing its appearance, texture, aroma, and taste. Samples were taken per brand with each code 1 sample and tested according to sensory assessment sheets with a minimum value of 7 by SNI 8222: 2016 concerning sardines and mackerel in canned packaging.

### 3.2 Fish Center Temperature Observation

Fish center temperature was measured by taking randomly five *lemuru* fish from each raw materials truck based on SNI 01-2372.1-1996. The measurement was performed by inserting the tip of the thermocouple probe on the sample to the thermal center point until the thermometer's needle stabile.

### 3.3 Room Temperature Observation

Room temperature measurement in the processing area was carried out periodically every day using thermometers attached to the wall. The room temperature shall have a minimum value of 18 - 30° C by the Decree of the Minister of Health of the Republic of Indonesia number 1405 / MENKES / SK / XI / 2002.

### 3.4 Histamine testing

Histamine analysis was carried out by using the Biofish 300 HIS tool. Five homogenized samples were checked in the Biofish tools in accordance with Salleres et al [4].

## 4 Results

### 4.1 Organoleptic raw materials

Organoleptic testing to determine whether or not raw material quality is feasible for production. Results of organoleptic testing can be seen in Fig. 1.

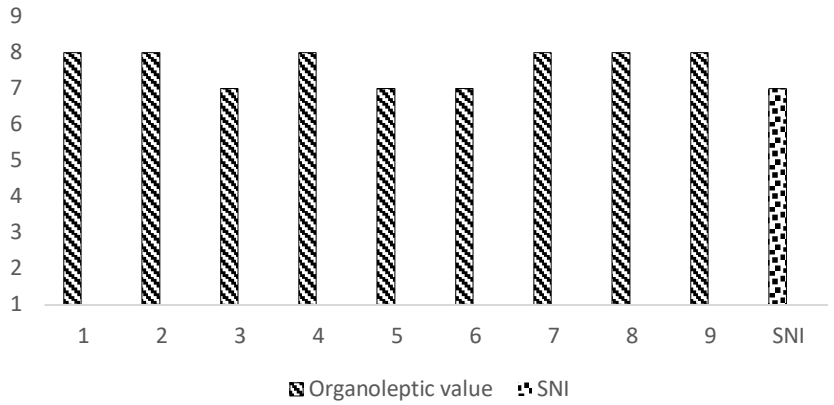


**Fig. 1.** Diagram of organoleptic test results of raw materials

Based on the results of organoleptic testing of lemuru fish raw materials conducted at CV. Pacific Harvest can be known that the quality of raw materials used in the canning process is by SNI. The results show organoleptic testing values above the minimum value of 7—the highest yield of 8 and the lowest seven organoleptic value of raw materials.

### 4.2 End product sensory

#### *4.2.1 Appearance*

According to Hidayat et al. [5] the product's appearance is essential in a product; consumers will consider the appearance of the product. This is because the appearance of a good product is considered to have good taste and high quality. The results of sensory appearance parameters can be seen in Fig. 2.

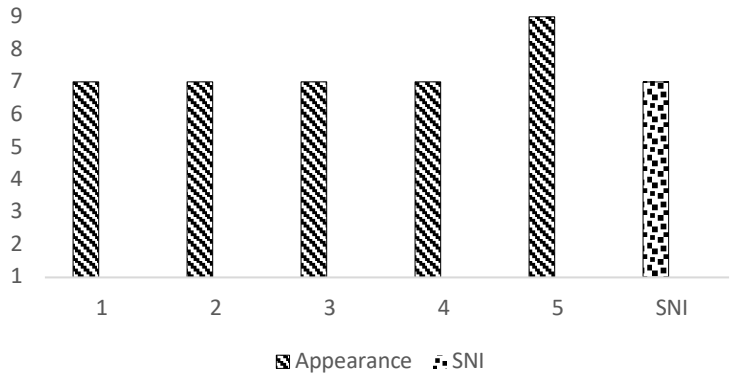


**Fig. 2** Sensory results of appearance

Based on the diagram above, it can be known that the highest value in the appearance parameter is getting a value of 9 on day five of testing with intact and bright appearance specifications. At the same time, the lowest value is getting a value of 7 on the testing days 1, 2, 3, and 4 with the specifications of intact and bright appearance. According to Solehah and Hafiludin [6] these results are by the minimum organoleptic test value listed in SNI 8222:2016 concerning Fish in cans (sardines), which is at least seven so that it can be concluded that Fish in cans (sardines) are suitable for consumption.

### *4.2.2 Aroma*

Aroma is a sense of smell response when there is an aroma from food entering the nasal cavity [7]. The sensory results of aroma parameters can be seen in Fig. 3.

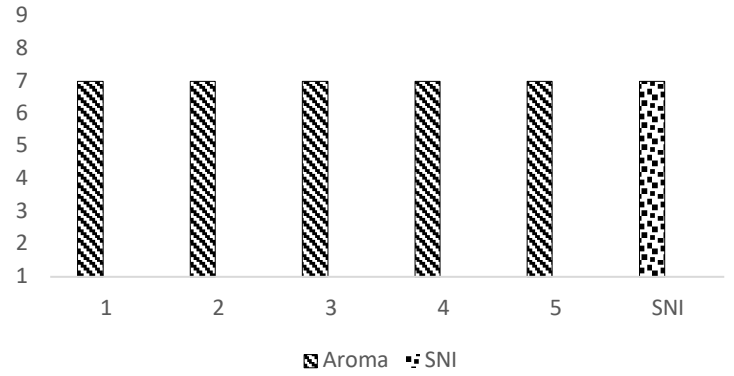


**Fig. 3.** Aroma sensory results

Based on the diagram above, it can be known that the value of the aroma parameter gets a value of 7 with solid aroma specifications by the specifications listed on the final product.

### *4.2.3 Texture*

The texture of a food product includes the viscosity density of food [8]. The results of sensory texture parameters can be seen in Fig. 4.

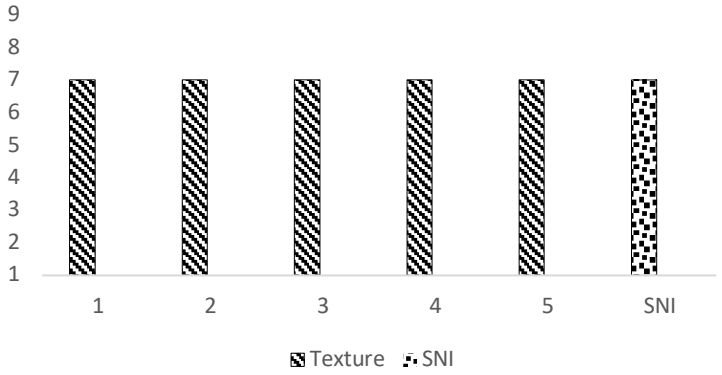


**Fig. 4.** Texture Sensory Results

Based on the diagram above, it can be known that the highest value in the texture parameter gets a value of 7 with specifications that are not easily destroyed and compact according to the specifications. Processes that can affect the texture of meat compactness are *pre-cooking* and sterilization that occur in raw materials during the canning process.

### *4.2.4 Color*

Color is the first sensory that can be seen directly by panelists. The sensory results of color parameters can be seen in Fig. 5.

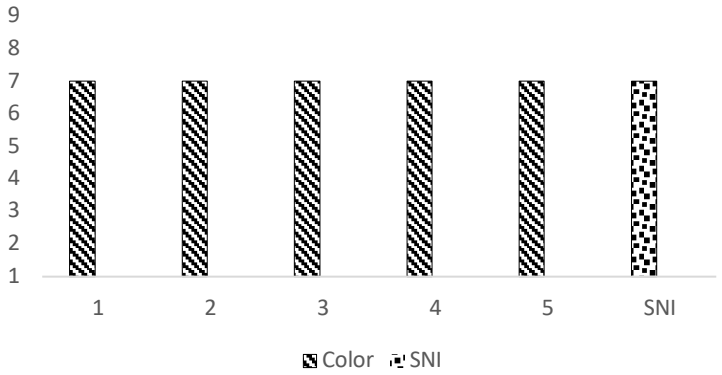


**Fig. 5.** Color sensory results

Based on the diagram above, it can be known that the highest value in the color parameter gets a value of 7 with solid color specifications by the specifications listed on the final product. The sterilization process can cause color changes if not cooled immediately; most likely, there will be *overcooking*, which causes charring of meat [9].

### *4.2.5 Taste*

One of the factors that determine the quality of food is taste. Taste is the biological perception of food after it is put into the mouth [10]. The sensory results of taste parameters can be seen in Fig. 6.

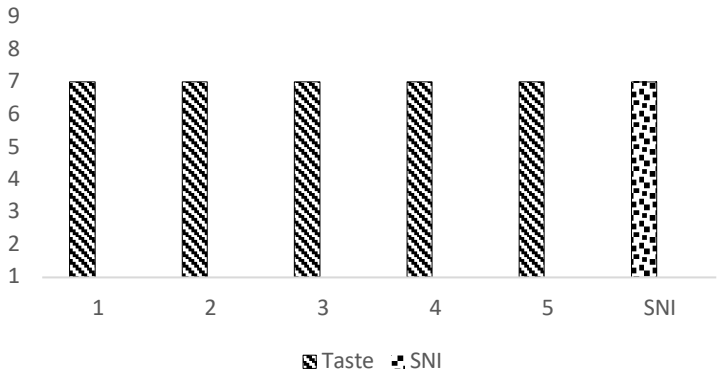


**Fig. 6.** Sensory taste results

Based on the diagram above, it can be known that the highest value in the taste parameter gets a value of 7 with the taste specifications in the final product. According to Solehah and Hafiludin [6], these results are by the minimum organoleptic test value listed in SNI 8222:2016 concerning Fish in cans (sardines), which is at least seven so that it can be concluded that Fish in cans (sardines) are suitable for consumption.

### 4.3 Fish center temperature

The results of the central temperature testing of *lemuru* fish raw materials can be seen in Fig. 7.

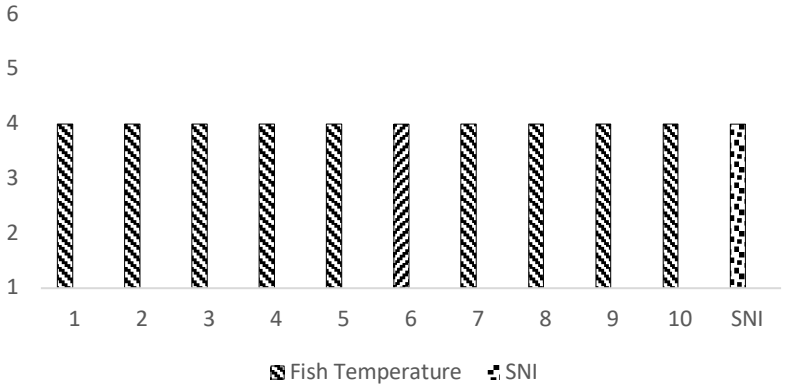


**Fig. 7.** Fish center temperature test results diagram

Based on the results of fish canter temperature testing, it can be concluded that the temperature of the fish is acceptable to CV. Pacific Harvest is 4ºC by SNI 2729:2013, which has a threshold value of 4.4ºC for fish freshness.

### 4.4 Process room temperature

Room temperature observations are carried out to determine the level of effect influenced by room temperature on fish raw materials used in the fish canning process. The temperature of

the production room is between 24º-30ºC, which can affect good production results according to standards. The results of room temperature observations can be seen in Fig. 8.

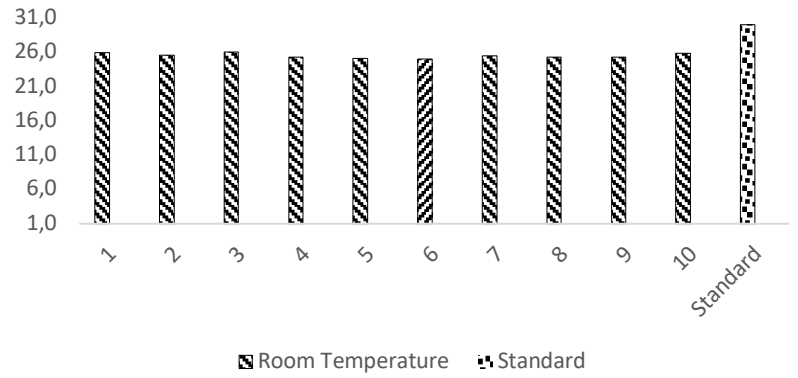


**Fig. 8**. Diagram of process room temperature observation results description

Based on the diagram of the results of observations for ten weeks of space in CV. Pacific Harvest is still below the temperature threshold value. Room temperature is limited to 18° C - 30 °C in accordance with the Decree of the Minister of Health of the Republic of Indonesia number 1405 / MENKES / SK / XI / 2002.

### 4.5 Histamine raw materials and end products

Histamine testing was carried out using bio-fish tools with the following results can be seen in Fig. 9.

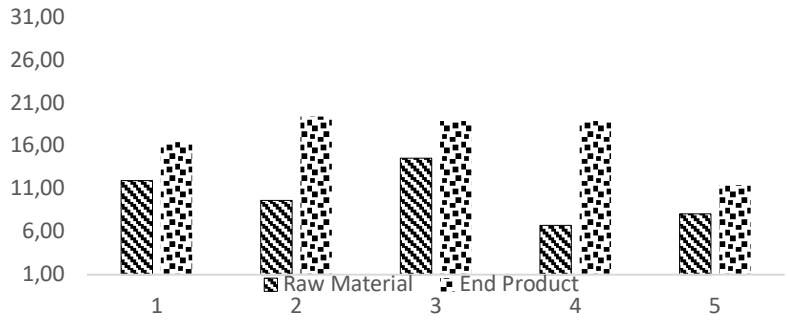


**Fig. 9.** sample diagram of histamine rises from raw material to final product.

Based on the image of the analysis results using the SPSS Paired Sample T Test, the average histamine of raw materials is 10.24 ppm, and the histamine of the final product is 16.92 ppm. From 121 test samples from nine different companies, only 1 sample with a

histamine content can be concluded that tuna exporting companies have implemented good handling of frozen tuna loin products [11]. The results of the SPPS Paired Sample T Test showed a significant value of 0.019 less than 0.05 in t count, showing a value of -3.833 < t table 2.13; then H0 was rejected and H1 was accepted so that it can be concluded that there was an increase in histamine of raw materials before and after the final product during the canning process.

## 5 Conclusion

Organoleptic testing of raw materials of *lemuru* fish (*Sardinella lemuru*) in CV. Pacific Harvest meets organoleptic grade standards with values above 7. The central temperature of the fish has an average temperature of 4ºC, and the temperature of the production room, according to the maximum limit standard, is 30ºC, with the average temperature in the process room being 24ºC to 26ºC. Histamine testing is present on CV. Pacific Harvest was conducted using the Biofish 300 tool with histamine testing results using SPSS Paired T Test analysis averaged raw material histamine of 10.24 ppm and final product histamine of 16.92 ppm. There is an increase in the histamine value of raw materials and final products due to the canning process. The increase that occurs by the canning process is still below the company's threshold value and SNI 235410: 2016 concerning histamine tests, which have a limit value of 50 ppm.

## References

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