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SANITATION AND HYGIENE AT FISH AUCTION PLACE AND ORGANOLEPTIC QUALITY ANALYSIS OF LITTLE TUNA (*Auxis rocchei* Risso, 1810) IN MUARA ANGKE, NORTH JAKARTA

Sanitasi dan Higienitas Tempat Pelelangan Ikan Serta Analisis Mutu Organoleptik Ikan Tongkol Lisong (*Auxis rochei* Risso, 1810) di Muara Angke, Jakarta Utara

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ABSTRACT

The Fish Auction Place (FAP) is a facility that supports fishermen in distributing their catches. Muara Angke FAP is one of the active auction places in Jakarta. Fish is a perishable commodity that requires proper handling to maintain its quality, including hygiene and sanitation facilities, especially to preserve the quality of little tuna (*Auxis rochei*). This study aims to analyze the sanitation and hygiene conditions at Muara Angke FAP based on Minister of Marine Affairs and Fisheries Decree No. 1 of 2007 (KEP. KP 01/MEN/2007), assess the organoleptic quality of little tuna, and analyze the relationship between sanitation-hygiene and tuna quality. The research was conducted from January to February 2025 using a case study method. Sanitation and hygiene data were obtained using purposive sampling, while little tuna samples for organoleptic and pH tests were taken using simple random sampling. Spearman correlation was used to analyze the relationship between FAP sanitation-hygiene and tuna quality. The results show that most sanitation and hygiene aspects meet the standards, although some deficiencies remain in facilities such as handwashing stations, toilets, environmental cleanliness, and warning signs. The organoleptic test yielded a final score of 7, indicating that frozen little tuna at Muara Angke FAP is still considered fresh. The pH ranged from 5.3 to 5.7, also indicating freshness. Spearman correlation analysis showed a weak positive relationship (r= 0.281) with no significant correlation (p= 0.231) between sanitation-hygiene and the quality of little tuna.

Key words: Hygiene, Organoleptic Quality, Sanitation, Fish Auction Place

ABSTRAK

Tempat Pelelangan Ikan (TPI) merupakan sarana yang mendukung aktivitas nelayan dalam mendistribusikan hasil tangkapan. TPI Muara Angke adalah salah satu TPI yang aktif beroperasi di Jakarta. Ikan merupakan komoditas yang mudah rusak sehingga memerlukan penanganan khusus untuk menjaga mutunya. Fasilitas penunjuang higienitas bergantung pada sanitasi yang baik, terutama untuk menjaga mutu ikan tongkol lisong (*Auxis rochei*). Penelitian ini bertujuan menganalisis kondisi sanitasi dan higienitas di TPI Muara Angke berdasarkan

Keputusan Menteri Kelautan dan Perikanan Nomor 1 Tahun 2007 (KEP. KP 01/MEN/2007), menganalisis mutu organoleptik ikan tongkol lisong, dan menganalisis hubungan antara sanitasi dan higienitas TPI Muara Angke dengan mutu ikan tongkol lisong. Penelitian dilaksanakan pada Januari–Februari 2025 dengan metode penelitian studi kasus. Pengambilan data sanitasi dan higienitas dilakukan dengan teknik *purposive sampling*, sedangkan pengambilan sampel ikan tongkol lisong untuk uji organoleptik dan pH menggunakan teknik *simple random sampling*. Analisis hubungan sanitasi dan higienitas TPI dengan mutu ikan tongkol lisong dilakukan menggunakan korelasi Spearman. Hasilnya menunjukkan bahwa sebagian besar aspek sanitasi dan higienitas telah memenuhi standar, namun masih terdapat kekurangan seperti pada fasilitas cuci tangan, toilet, kondisi lingkungan sekitar, dan tanda peringatan di TPI. Uji organoleptik menunjukkan nilai akhir 7 yang artinya ikan tongkol lisong beku di TPI Muara Angke tergolong segar. Nilai pH berada pada rentang 5,3–5,7 yang menunjukkan ikan termasuk segar. Hasil korelasi Spearman menunjukan hubungan positif tetapi lemah dengan koefisien korelasi 0,281 dan signifikansi 0,231 yang berarti hubungan tidak signifikan.

Kata Kunci: Higienitas, Mutu Organoleptik, Sanitasi, Tempat Pelelangan Ikan

INTRODUCTION

The Fish Auction Place (TPI) is the first location in the fish distribution process. The function of the TPI is to support fishermen's activities in carrying out fishing activities at sea, handling and processing the catch, and as a place to supervise fishing vessels (Amiruddin, 2014). TPI plays an important role in the Fishing Port Area and must be managed properly to achieve optimal goals. Some TPIs are known to still not meet standards, this is indicated by the presence of waste in the environment around the TPI which has the potential to cause disease and become a source of bacteria for the fish caught landed at the TPI, thus reducing the TPI's efficiency. Requirements regarding sanitation and hygiene facilities for TPI are contained in the Decree of the Minister of Maritime Affairs and Fisheries Number 1 of 2007 concerning Control of the Quality Assurance System and Safety of Fishery Products in the Production, Processing, and Distribution Processes.

According to Sofiah and Sukarminah (2011), sanitation in the food industry is a habit, a lifestyle, not aseptic, and clean towards objects including humans who will come into direct and indirect contact with food products. Sanitation activities are carried out from when fish are caught or harvested, stored, processed, until served to consumers. Sanitation and hygiene are the main keys in controlling contamination (Pratama et al., 2017). Meanwhile, hygiene is an effort to maintain health by maintaining environmental cleanliness, including fishing activity areas, such as floors at TPI to protect the quality of fish landed. Sanitation and hygiene are related because facilities to support hygiene are supported by good sanitation (Atomoko, 2017).

The Muara Angke Fish Auction (TPI) is an active fish auction site in North Jakarta. Auctions take place daily, and the catch landed consists of frozen fish such as tuna (Auxis rochei), ribbonfish, scad, lemuru, scad, mackerel, and others.

Skipjack tuna is a type of pelagic fish belonging to the TCT (Tuna, Skipjack, and Tongkol) group and is a leading Indonesian export commodity (Hartanto et al., 2021). Skipjack tuna is also nutritionally complete, with a protein content of up to 26% and is affordable (Diniarti et al., 2020). The abundance of fish resources in Indonesia is not in line with the relatively low fish consumption rate. Low fish consumption in Indonesia is due to various factors, such as price, income, consumer motivation, processed form, and fish quality (Ikhsanudin et al., 2023). Therefore, maintaining fish quality until it reaches consumers is a crucial factor in increasing fish consumption in Indonesia.

Fish is a perishable food group due to enzyme changes occurring within 12 hours of being killed (Nurjanah et al., 2004). The implementation of a cold chain system is an important factor in maintaining quality from the time the fish dies, during distribution, and up to the marketing stage (Junianto, 2003). Several parameters are used to determine fish quality, including organoleptic, physical, chemical, and biological parameters. One way to identify fish quality decline is through organoleptic testing or sensory assessment, where panelists observe parameters such as texture, color, shape, aroma, and taste of a food, beverage, or medicine product (Ayustaningwarno, 2014). Organoleptic testing can provide a direct picture of fish quality, which can be a primary consideration for consumers. In addition to organoleptic testing, pH testing is another parameter in determining fish quality. The principle of pH testing in fish focuses on measuring the acidity or alkalinity of the fish flesh, as changes in the pH value of the fish will occur over time after the fish dies. The final pH of fish meat is classified as high, at 6.4–6.6. This is due to the high microbial content and low glycogen content, which accelerates fish spoilage. Proteolytic microbes grow rapidly and easily, producing a foul odor caused by protein metabolism (Leiwakabessy et al., 2024).

The purpose of this study was to analyze the sanitation and hygiene conditions at the Fish Auction Place (TPI) in accordance with the Decree of the Minister of Maritime Affairs and Fisheries Number 1 of 2007 (KEP. KP 01/MEN/2007), to analyze the organoleptic quality (scoring test) of lisong tuna (Auxis rochei) in Muara Angke, and to analyze the relationship between the sanitation and hygiene conditions of the TPI and the quality of lisong tuna.

RESEARCH METHODS

Place and Time of Research

The research was conducted in January–February 2025 at the Muara Angke Fish Auction Place (TPI) for sampling, observation, and interviews. Organoleptic and pH testing of the flesh of the lisong tuna (Auxis rochei) was conducted at the Muara Angke TPI Laboratory, Pluit Village, Penjaringan District, North Jakarta City.

Research methods

This research was conducted using a case study method. According to Septiana et al., (2024), the case study method is a research method that is carried out in depth and in detail on an activity or event at the institutional, group, organizational, or individual level. This study analyzed the actual conditions of sanitation and hygiene at the Muara Angke Fish Farming Center (TPI) and the organoleptic quality of lisong tuna. The method of collecting data for the assessment of sanitation and hygiene at the Muara Angke Fish Farming Center (TPI) was carried out using a purposive sampling technique. According to Setiawan et al., (2020), the purposive sampling technique is a sampling technique that considers certain criteria. Data collection for the assessment of sanitation and hygiene at the TPI was carried out through interviews and direct observations with 20 respondents. The assessment of sanitation and hygiene variables at the TPI refers to the Ministerial Decree of Maritime Affairs and Fisheries Number 1 of 2007. The data obtained were qualitative data, then scored using a Likert scale with a value range of 1–3 to indicate the level of conformity of the actual conditions of the TPI to the standards stated in the Decree. KP 01/MEN.2007 as shown in Table 1.

Table 1. Likert Scale Assessment of Sanitation and Hygiene at TPI Muara Angke

Alternative options	score
Very suitable	3
Suitable	2
Not suitable	1

Sampling of lisong tuna fish was carried out using a simple random sampling technique. Twenty lisong tuna fish samples were taken from the catch landed at the Muara Angke Fish Farm (TPI). Organoleptic and pH testing took place over the same day. Organoleptic testing was conducted using a scoring method that refers to SNI 01-2346-2006 concerning sensory assessment of frozen fish.

Materials and tools

The materials used in this study were 20 lisong tuna (Auxis rochei) weighing 20–60 grams from TPI Muara Angke as test fish, buffer solutions 4 and 7 to calibrate the pH meter, and distilled water as a sample solvent in testing the pH of lisong tuna meat.

The tools needed are stationery, trays, labels, 100 ml measuring cups, tissues, mobile phones, digital pH meters, 100 ml beakers, digital scales, mortars and pestles, gloves, frozen fish organoleptic scoresheets referring to SNI 01-2346-2006, TPI assessment forms based on the Decree of the Minister of Maritime Affairs and Fisheries Number 1 of 2007 concerning the Quality Assurance System and Safety of Fishery Products in the Production, Processing, and Distribution Processes.

Work procedures

This research consists of several stages, including the preparation stage for tools and materials, the stage of taking samples of lisong tuna for organoleptic and pH testing, and collecting data for assessing sanitation and hygiene at the Muara Angke TPI.

Sampling of Lisong Skipjack Tuna

The procedure for taking samples of lisong tuna at the Muara Angke TPI, namely:

1. Samples of skipjack tuna were taken randomly (simple random sampling) from the Muara Angke Fish Farm (TPI).
2. A total of 20 samples were taken, weighing 20–60 grams.
3. The fish were placed in plastic bags and taken to the laboratory for testing.
4. The skipjack tuna samples were then analyzed through organoleptic testing (scoring test) and pH measurement of the fish flesh.

TPI Sanitation and Hygiene Assessment

The sanitation and hygiene assessment at the Muara Angke TPI was conducted by directly observing the TPI and conducting interviews with 20 respondents, namely:

1. Four officers from the Muara Angke Fish Farming Site
2. Four fishermen
3. Four collectors/consumers
4. Four local residents
5. Four people from the Jakarta Special Region's Food Security, Maritime Affairs, and Agriculture Agency (DKPKP).

Observation Parameters

The parameters observed in this research were organoleptic tests conducted by five trained panelists from the Muara Angke Fish Farming (TPI) laboratory staff. The organoleptic assessment referred to SNI 01-2346-2006 concerning sensory characteristics of frozen fish, which included parameters such as ice layer, drying (dehydration), discoloration, appearance, odor, and fish flesh (color, appearance, and texture). Furthermore, pH testing was also conducted on the flesh of the lisong tuna. The pH testing of the fish flesh aimed to assess the freshness and quality of the lisong tuna at the Muara Angke Fish Farming (TPI). Measurements were made using a calibrated pH meter and referred to Hindayani et al., (2022).

Data analysis

The organoleptic test data were analyzed using calculations referring to SNI 01-2346-2006 concerning sensory assessment of frozen fish. The data obtained from the organoleptic test scoresheet were tabulated and the quality value was determined by finding the average result for each panelist with a 95% confidence interval. The calculation of the average quality value interval for each panelist used the following formula from SNI 01-2346-2006:

$$P\left(\bar{x} - \left(1{,}96.\frac{s}{\sqrt{n}}\right)\right) \leq \mu \leq \left(\bar{x} + \left(1{,}96.\frac{s}{\sqrt{n}}\right)\right) \cong 95\%$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$S^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$$

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}}$$

Information:
n = Number of panelists.
S2 = Diversity of quality values.
1,96 = Standard deviation coefficient at 95% level.
$\bar{x}$ = Average quality value.
x(i) = Quality score from panelist i, where i = 1, 2, 3,...n.
s = Standard deviation of quality values.

Data from observations of sanitation and hygiene at the TPI were analyzed using comparative descriptive techniques that can describe the comparison of the actual conditions of the TPI with the Ministerial Decree of Maritime Affairs and Fisheries Number 1 of 2007.

The relationship between TPI sanitation and hygiene on the quality of lisong tuna was analyzed using Spearman correlation analysis, where the sanitation and hygiene conditions of TPI were variable X and the quality of lisong tuna was variable Y. The analysis was carried out using Minitab Statistical Software 2021 with the formula:

$$r_s = 1 - \frac{6 \sum D^2}{n(n^2 - 1)}$$

Information:
D = Difference between X and Y data.
6 = Constant number.
n = A lot of data.
X = Sanitation and Hygiene Conditions TPI Muara Angke.
Y = The quality of lisong tuna.

RESULTS

Condition of the Muara Angke Fish Auction Place

The Muara Angke Fish Auction Place (TPI) is located in Pluit Village, Penjaringan District, North Jakarta. The Muara Angke TPI covers the Muara Angke Nusantara Fisheries Port (PPN) area, which covers approximately 67 hectares. The Muara Angke TPI is quite active in conducting auction activities, taking place daily. According to consumers, the fish auctioned are usually processed through drying, salting, smoking, and smoking. Fish auctioned at the Muara Angke TPI are frozen and have grade B, meaning the skin and other parts are slightly abraded but the flesh is not oozing or the stomach is not ruptured. While grade A fish are high-quality fish with no defects or are intact (Haya and Restuwati, 2022).

According to Najah et al., (2015), the quality of fish landed at the Muara Angke Fish Farm is generally low because most of them are of low economic value. Fish with high economic value are usually not sold through auctions at the fish farm, but are instead distributed directly to ship owners through the opouw auction system for export purposes. Fish with high economic value include tuna, scad, lemuru, and skipjack tuna (Euthynnus affinis). Meanwhile, fish with grade B quality such as semar fish, mackerel, tembang, and skipjack tuna (Auxis rochei) are common fish commodities auctioned at the Muara Angke Fish Farm..

Sanitation and Hygiene Parameters at the Muara Angke TPI

The results of the assessment referring to the Ministerial Decree of Maritime Affairs and Fisheries Number 1 of 2007 (KEP. KP 01/MEN/2007) will be averaged and described based on the predetermined assessment scale. The sanitation and hygiene parameters observed at the Muara Angke TPI based on KEP. KP 01/MEN/2007 include (1) walls, (2) floors, (3) sanitation facilities, (4) lighting, (8) water sources, (9) special containers, and (10) quality control. The average sanitation and hygiene assessment of the Muara Angke TPI from 20 respondents is shown in Figure 1.

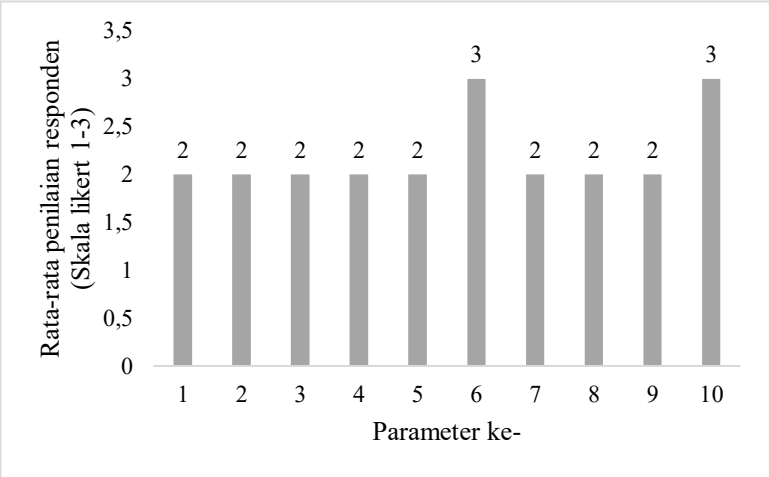


Figure 1. Average Rating of 10 Sanitation and Hygiene Parameters at the Muara Angke Fish and Chips Terminal

Based on Figure 1, it can be seen that the results of the assessment of the suitability of the physical conditions of the Muara Angke TPI referring to the Ministerial Decree of Maritime Affairs and Fisheries Number 1 of 2007 with 10 parameters have an average of 2–3, which means that the sanitation and hygiene conditions of the Muara Angke TPI are quite suitable to very suitable with the Ministerial Decree of Maritime Affairs and Fisheries Number 1 of 2007.

Organoleptic Test

Fish in Frozen Condition

Organoleptic quality determination of lisong tuna (Auxis rochei) was carried out using a scoresheet referring to SNI 01-2346-2006 concerning sensory assessment of frozen fish. There are 6 parameters observed in frozen fish which are divided into 2 conditions, namely when the fish is frozen with parameters of ice layer, drying (dehydration), and color change (discoloration), then when the fish is in a condition after thawing with parameters of appearance, odor, and fish flesh (color and appearance).

The average results of organoleptic observations of 20 samples of frozen tuna fish are shown in Figure 2.]

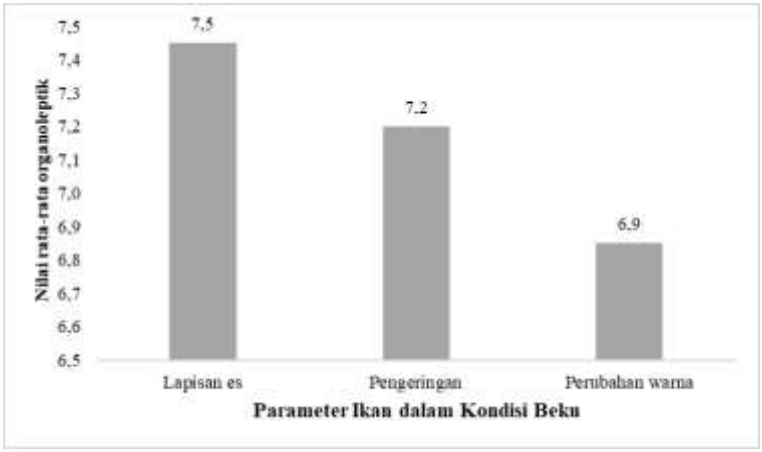


Figure 2. Average Score Test of 20 Frozen Lisong Skipjack Tuna Samples

Based on Figure 2. the results obtained from the assessment of 5 trained panelists on the organoleptic quality value of frozen tuna (Auxis rochei) are in accordance with the minimum value of SNI 01-2346-2006, which is 7. The first parameter is the ice layer, obtained an average of 7.5 which means the ice layer on the fish is uneven, the open part is 20%–30%. The highest value is 9 which indicates a flat, clear, and thick ice layer on the entire surface of the fish. The lowest value is 1 which indicates there is no ice layer on the surface of the fish and the middle value is 8 which indicates a flat, clear, fairly thick ice layer, there is an open part of 10%.

The second parameter is drying (dehydration), which is the condition of physical damage that occurs on the surface of the fish during frozen conditions. The results of organoleptic observations of frozen skipjack tuna on the drying (dehydration) parameter at TPI Muara Angke obtained an average value of 7.2, which means the fish experienced drying starting to be clear on the surface, which is around 20%–30%. The highest value is 9, which indicates no drying on the surface of the product. The lowest value is 5, which indicates many parts of the fish appear to be drying (60%–70%), and the middle value is 8, which indicates the fish experienced slight drying on the surface, around 10%.

The third parameter is discoloration. Based on organoleptic observations of frozen skipjack tuna at the Muara Angke Fish Farm, the average value was 7.2, with a median value of 7 indicating a 20%–30% change in surface color. The highest value was 9, indicating no discoloration on the surface, and the lowest value was 1, indicating a complete discoloration on the surface.

Fish in Condition After Thawing

The average results of organoleptic observations of 20 samples of lisong tuna in the condition after thawing are shown in Figure 3.

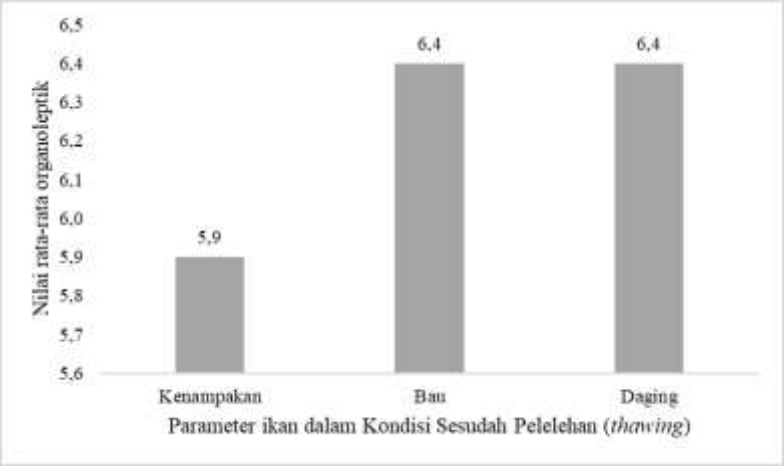


Figure 3. Average Test Score of 20 Samples of Lisong Skipjack Tuna After Thawing

Based on Figure 3. the results of the assessment by 5 trained panelists on the organoleptic quality value of lisong tuna (Auxis rochei) after thawing have an average of 5–6, which means the fish is in the slightly fresh category based on SNI 01-2346-2006. The organoleptic test of lisong tuna after the thawing process includes three parameters, namely appearance, odor, and meat (color and appearance).

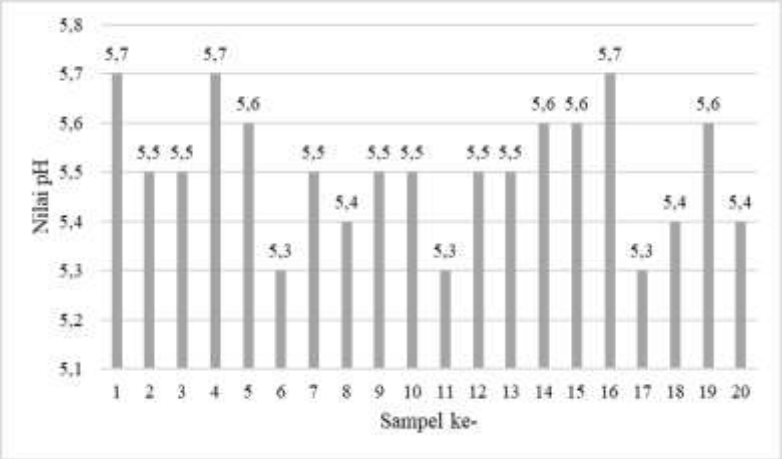
The first parameter of organoleptic test of lisong tuna in the condition after thawing, namely the appearance of the fish. The parameters of fish appearance observed include the integrity of the fish's body, the color and condition of the skin surface, and the presence of scales on the lateral line of the lisong tuna. Based on the results of organoleptic observations of lisong tuna, an average value of 5.9 was obtained and a middle value of 5, which indicates the condition of the fish is slightly defective, the color is somewhat dull, the skin is somewhat tight, and many scales are damaged. The highest value of 9 indicates the condition of the fish is intact, without defects, bright color, tight skin, and intact scales and the lowest value of 3 indicates the condition of the fish is slightly damaged, dull, the skin is somewhat loose, and many scales are damaged..

The second parameter of the organoleptic test for lisong tuna after thawing is fish odor. Based on the results of organoleptic observations of lisong tuna in the odor parameter at the Muara Angke Fish Farming Center (TPI Muara Angke), an average value of 6.4 was obtained, with a median value of 7, indicating a fresh odor. The highest value of 9 indicates a very fresh, distinctive fish odor, and the lowest value of 3 indicates a slightly rancid odor.

The final parameter of organoleptic test of lisong tuna fish in the condition after thawing, namely the condition of fish meat including color, texture and appearance. Based on the results of organoleptic observations of lisong tuna fish on meat parameters (color and appearance) at TPI Muara Angke, an average value of 6.4 was obtained and a middle value of 7 which indicates a type-specific color, bright, dense, compact, and elastic meat. The highest value of 9 which indicates a type-specific color, very bright, very dense, compact, and elastic meat and the lowest value of 3 which indicates a type-specific fish color, dull, and soft meat.

Testing the Acidity Degree (pH) of Fish Meat

The results of pH testing of 20 samples of lisong tuna (Auxis rochei) at TPI Muara Angke are shown in Figure 4.



Gambar 4. Nilai pH 20 Sampel Ikan Tongkol Lisong dari TPI Muara Angke

Based on the results of pH testing conducted on 20 samples of lisong tuna from the Muara Angke Fish Farm, the pH values varied, ranging from 5.3 to 5.7. The average pH of the lisong tuna from the 20 samples at the Muara Angke Fish Farm was 5.5.

The Relationship between Sanitation and Hygiene of Muara Angke Fish Farming Center and the Quality of Lisong Skipjack Tuna (Auxis rochei)

The relationship between TPI sanitation and hygiene and the quality of lisong tuna is shown in Figure 5.

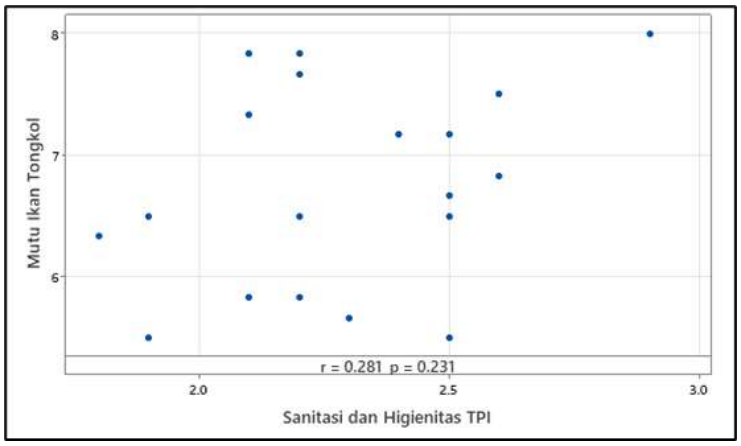


Figure 5. Spearman Correlation Scatter Plot

Based on Figure 5. Shows that the sanitation and hygiene of TPI Muara Angke with the quality of lisong tuna have an insignificant relationship. The significance value (p-value) is 0.231 which means >0.05, so there is no significant relationship between variable X and variable Y. The correlation value obtained is positive, which is 0.281, which means the relationship between sanitation and hygiene of TPI and the quality of lisong tuna is unidirectional, if variable X (sanitation and hygiene conditions of TPI Muara Angke) increases then variable Y (quality of lisong tuna) will also increase. Based on the correlation coefficient value, which is 0.281, it means that the relationship between the two variables is included in the category of weak or low relationships.

DISCUSSION

Sanitation and Hygiene Parameters at the Muara Angke TPI

The sanitation and hygiene parameters of TPI Muara Angke refer to the Decree of the Minister of Maritime Affairs and Fisheries Number 1 of 2007 (KEP. KP 01/MEN/2007), the 10 parameters for assessing sanitation and hygiene conditions at TPI Muara Angke are as follows;

1. Walls, protected and have walls that are easy to clean. The walls at TPI Muara Angke are made of ceramic which is waterproof and easy to clean. Wall cleaning is only done by spraying water from a hose without using disinfectant, wall cleaning is done after the auction activity is completed. According to Pratama et al., (2017), floor cleaning is recommended using cleaning soap or disinfectant intended for walls made of tiles/ceramics, such as iodophors, Quaternary Ammonium Compounds (QAC), and chloride dioxide (ClO_2).
2. Floors, which are waterproof and easy to clean and sanitize, are equipped with drainage channels and a hygienic liquid waste disposal system. The floors at the Muara Angke Fish Farm (TPI) are made of concrete coated with waterproof, non-slip paint. There is no discharge of liquid waste or fishery waste in the auction area, as fish ready for auction have been sorted and packaged on board. When the fish arrive at the TPI, they are ready for auction. Regular monitoring of the floors at the Muara Angke Fish Farm is necessary to ensure that they remain non-slip and do not cause puddles. This is a fundamental problem that commonly occurs at TPI and can pose a risk to contamination or occupational safety (Widyaningrum et al., 2023).
3. Sanitation facilities, with sufficient handwashing stations and toilets. These stations are equipped with disposable handwashing supplies and dryers. Sanitation facilities at the Muara Angke Fish and Fish Farming Fish Farm are limited, with only one piped handwashing station available. Toilet facilities are available inside the Muara Angke Fish and Fish Farming.
4. Lighting: There is sufficient lighting to facilitate the monitoring of fishery products. Lighting in the Muara Angke Fish Farm building at night is quite optimal because it uses 14 spotlights and 4 spiral lights. The estimated total lighting produced reaches 418,000 lumens. With the Muara Angke Fish Farm area of around 2,000 m2, the lighting intensity is estimated at 209.05 lux. This lighting is still within the minimum lighting range for activities at the Fish Farm.6
5. Environmental conditions, vehicles emitting smoke and animals that can affect the quality of fishery products are not permitted in the TPI. The environmental conditions around the Muara Angke TPI still show vehicles parked inside the TPI building. The number of vehicles parked per day is usually 3–5 vehicles, one of which is motorcycles. According to Karimah et al., (2019), the presence of vehicles that emit fumes from fuel combustion can potentially pollute the environment and affect the quality of fishery products. Vehicles should be parked in the parking spaces provided. Meanwhile, the presence of wild animals in the auction area is still visible, one of which is cats. The presence of cats is observed almost daily with a fairly frequent appearance during the auction. The presence of pests, such as flies or other wild animals can carry dangerous bacteria and will pose a threat to food safety (Subhany et al., 2022).
6. Cleaning the Fish Market (TPI). The TPI is cleaned regularly, at least after each sale. Containers must be cleaned and rinsed with clean water or clean seawater. Cleaning of the Muara Angke TPI is carried out by 3–4 officers on the same day, before and after the auction. The area cleaned includes the auction floor and the fish baskets used in the auction process. The auction floor cleaning process uses a driving floor cleaner, an automatic floor cleaner driven by a driver to maintain the hygiene of the work area.

Meanwhile, basket cleaning only uses clean running water. Cleaning activities at the Muara Angke TPI are generally carried out around 11:00 WIB after the auction. Cleaning equipment used in cleaning the TPI must be well maintained and easy to operate for effective and efficient use (Kau et al., 2024).

7. Warning signs: There are warning signs prohibiting smoking, spitting, eating, and drinking, and they are placed in clearly visible places. The warning signs at the Muara Angke Fish Market only cover the prohibition of smoking, parking, and a warning against the use of formalin in fish catches. The warning signs prohibiting smoking and parking are only printed on A4-sized HVS paper and affixed to the walls of the Fish Market.
8. Water sources: have adequate clean water and/or seawater supply facilities. The clean water supply at the Muara Angke TPI comes from drilled water or groundwater at a depth of 50 meters, collected in two towers approximately 36 meters from the TPI, then channeled to the TPI using a water treatment unit.
9. Special container, has a special container that is rust-resistant and waterproof to accommodate fishery products that are not suitable for consumption. TPI Muara Angke does not provide a special container to accommodate unsuitable fishery products, the container provided is used to accommodate catches that are suitable for auction, because the fish have been packaged using plastic from each ship, so there is no separation of unsuitable fish in the TPI area.
10. Quality control, implementation of a cold chain system, and collaboration with competent authorities to conduct quality control. Quality control at the Muara Angke Fish Farming Center (TPI) is carried out routinely by the Muara Angke Fisheries Port Management Unit (UPPP) 2–3 times a week at the Muara Angke Fish Farming Center Laboratory. The quality control performed includes formalin testing.

Based on the 10 parameters, there are still several parameters that do not comply with the standards of the Decree of the Minister of Maritime Affairs and Fisheries Number 1 of 2007 (KEP. KP 01/MEN/2007), namely the parameters of sanitation facilities, environmental conditions, and warning signs at the Muara Angke TPI.

Organoleptic Test

Fish in Frozen Condition

The first parameter of the organoleptic test on frozen fish is the ice layer. The ice layer plays a crucial role in protecting the surface of the fish from dehydration and oxidation during storage. The freezing process for fish in Muara Angke on board the vessel is carried out using a blast freezer system (Najah et al., 2015). Low values for this parameter indicate the ice layer has melted due to the lack of additional ice after unloading, as the auction takes place quite a long time after unloading.

The next organoleptic test parameter for frozen fish is dehydration. Dehydration is caused by exposure to cold air during storage, which reduces the natural moisture content of the fish's surface. Low values indicate suboptimal protection for the fish. Glazing can be a solution to mitigate the effects of dehydration. The glazing process aims to prevent direct oxygen contact with the fish. Glazing involves immersing the fish in cold water for several minutes, then removing it and immediately freezing it (Liviawaty and Afrianto, 2010).

The third organoleptic test parameter for frozen fish is discoloration. Discoloration generally occurs due to protein denaturation during freezing, as well as variations in temperature and storage in the ship's hold. Freezing can cause proteins to lose their natural properties; this change is called protein denaturation, which can affect the color of the fish (Laylah, 2024). The use of blast freezers on ships in Muara Angke has helped maintain quality, but results show that some fish still experience discoloration due to temperature exposure

before auction. Despite this, the lisong tuna is still classified as fresh based on SNI 01-2346-2006 standards.

Fish in Condition After Thawing

The first parameter of the organoleptic test on fish after thawing is appearance. Changes in appearance can be caused by temperature fluctuations during frozen storage and suboptimal handling, especially if the fish has passed the rigor mortis phase, as at this stage the muscle tissue begins to soften and the sensory quality of the fish begins to decline (Liviawaty and Afrianto, 2010).

The next organoleptic test parameter for fish after thawing is odor. Differences in fish odor parameters can be caused by several factors, one of which is changes in the chemical components of the fish's body (Wijana et al., 2018). Changes in odor are caused by the degradation of proteins and fats, which produce compounds such as trimethylamine and histamine (Liviawaty and Afrianto, 2010). Fish decomposition can also occur more quickly due to low levels of glycogen in the fish's body, which causes rigor mortis to occur more quickly. After the fish dies, the remaining glycogen and glucose will undergo glycolysis to form pyruvic acid, which is then converted to lactic acid, which lowers the pH of the fish's flesh. This decrease in pH will affect the sensory quality of the fish, including its odor (Suara et al., 2014).

The final organoleptic test parameters for fish after thawing include color, texture, and appearance. According to Khairunnisa et al., (2020), changes in color and texture are influenced by several factors, such as enzyme activity, chemical activity, and bacteria. Dull color and less dense meat texture occur due to the oxidation of chemical compounds and enzyme and bacterial activity during storage. This can reduce the elasticity and compactness of fish muscles. The process of changing fish meat color is chemically related to the interaction between oxygen and compounds contained in the fish's body (Liviawaty and Afrianto, 2010). Bacterial activity such as Pseudomonas spp. and Aeromonas spp. breaks down proteins and fats during storage. This process decomposes fish muscle tissue and causes the meat texture to become less compact (Pianusa et al., 2015). Uncontrolled enzymatic and bacterial activity causes fish muscles to relax and lose their elasticity, leading to protein breakdown (Wiraditama et al., 2024).

Testing the Acidity Degree (pH) of Fish Meat

According to Kaban et al., (2019), the process that occurs in the decline in fish quality is closely related to changes in the pH of the fish meat. The average pH value of lisong tuna from 20 samples from the Muara Angke Fish Farming Center (TPI) was 5.5. According to Fatich et al., (2023), the pH value of lisong tuna ranges from 5.56–6.11. In general, after the fish dies, the pH value will approach neutral (Liviawaty and Afrianto, 2010). Fish quality is said to be good if the pH value is <6, moderate at pH 6–7, and the quality decreases if the pH is >7 (Metusalach et al., 2014). The quality of lisong tuna at the Muara Angke Fish Farming Center can be said to be good because it has a range of values and an average pH value of <6. The pH value as a determinant of fresh fish quality can be divided into two categories: a pH value <7 is categorized as very fresh fish, while fish with a pH value >7 are categorized as fish that have undergone a change in freshness leading to decay (Asni et al., 2022). Therefore, the lisong tuna at the Muara Angke TPI can be categorized as very fresh fish.

The Relationship between Sanitation and Hygiene of Muara Angke Fish Farming Center and the Quality of Lisong Skipjack Tuna (Auxis rochei)

The insignificant or weak relationship between the two variables may be caused by external factors directly observed during observations at the Muara Angke Fish Auction (TPI

Muara Angke). One factor is the duration of the auction; the time between unloading and auction varies depending on the time the fish are unloaded. Meanwhile, the auction at the Muara Angke Fish Auction is only held once a day, between 9:00 and 10:00 a.m. Western Indonesian Time (WIB). Fish that are kept at room temperature for too long before being auctioned will experience a decline in quality, and post-unloading storage methods that do not include the addition of ice also accelerate the process of quality decline. According to Junianto (2003), factors that influence the decline in fish quality at the TPI are the duration of the auction and storage temperature. Another factor observed is the initial quality of the fish before the auction; the initial quality of the fish varies depending on the landing time and the cooling system on board. These differences can be factors that influence fish quality, so the relationship between TPI sanitation and hygiene with fish quality is not statistically significant.

Recommendations for Facility Improvements at the Muara Angke TPI

Recommendations for improving facilities at the Muara Angke Fish Farming Center (TPI) aim to support sanitation and hygiene standards in accordance with the Decree of the Minister of Maritime Affairs and Fisheries Number 1 of 2007 concerning the Quality Assurance System and Safety of Fishery Products in Production, Processing, and Distribution. Recommendations for improving sanitation and hygiene facilities at the Muara Angke Fish Farming Center (TPI) cover three parameters. First, on sanitation facilities that include handwashing stations and toilets. It is necessary to add adequate handwashing stations, at least 5 units equipped with soap, sinks, disinfectants, and disposable dryers such as tissues, as well as increasing the number of toilets in the auction area in accordance with the provisions of the Minister of Manpower Regulation No. 5 of 2018, which states that the number of toilet facilities in the work environment must not be less than 2/3 of the number of toilets required by the regulation. Second, on the parameters of environmental conditions around the TPI, it is recommended that there be routine supervision of incoming vehicles and the installation of permanent parking prohibition signs in strategic areas. Third, on the warning sign parameters, it is necessary to add clear and permanent prohibition boards such as prohibitions on eating, drinking, and spitting using sturdy materials and equipped with visuals for easy understanding.

CONCLUSION

Based on the research results, it can be concluded that the sanitation and hygiene conditions at the Muara Angke Fish Auction Place (TPI) have met several parameters in accordance with the Decree of the Minister of Maritime Affairs and Fisheries Number 1 of 2007, although there are still deficiencies in sanitation facilities such as toilets and handwashing areas, warning signs, and environmental conditions that require improvement. The results of organoleptic quality tests on lisong tuna (Auxis rochei) showed a final score of 7 and a pH value ranging from 5.3 to 5.7, indicating that the fish are classified as fresh and of good quality. In addition, the results of the Spearman correlation analysis showed a positive relationship between the sanitation and hygiene conditions of the TPI and the quality of lisong tuna, although the relationship between the two variables was weak ($r = 0.28$ and $p = 0.23$), so that improvements in sanitation and hygiene facilities still have the potential to improve fish quality, although not statistically significant.

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