Comparative Study on the Organoleptic Properties of Bali Sardinella (*Sardinella lemuru*) Sold in the Fish Markets of Gingoog City

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Abstract:- **The quality and safety of fishery products have become a significant concern worldwide to consumers, producers, food industries, and regulatory agencies. Organoleptic Evaluation is an assessment method used to determine standards in quality control. In Gingoog City, there have been reports of spoiled fish displayed in markets as per the discussion during the Sangguniang Panlunsod. Hence, the study aims to evaluate and compare the Organoleptic properties of Bali Sardinella (Sardinella lemuru) sold at different markets in Gingoog City. This study used a single-blind research design. The study collected five (5) fish replicates in three consecutive weeks for each market and assessed them using the Quality Index Method with thirty experienced panelists in this field. The findings indicate that the fish from Gingoog City Public Market exhibited lower quality in freshness, with higher demerit scores in terms of general appearance, eyes, cover, gills, and abdomen. Conversely, the fish from Pandan Fish Market showed greater levels of freshness in terms of the above except flesh. These findings can be attributed to longer transport time and need for proper cold storage facilities. Thus, the study suggests the Local Government Unit of Gingoog City to implement the construction of cold storage to preserve fish properly.**

Keywords:- Bali Sardinella, Organoleptic evaluation, Quality Index Method.

I. INTRODUCTION

Aquatic food products are among the world's most nutritious and valuable foods, playing a pivotal role in providing nutrients to many animals and, most of all, to humans. They are high in protein, which provides over 20% of the average per capita animal protein consumption for around 3.3 billion individuals (FAO, 2020). Fish, in particular, contributed to roughly 17% of total animal protein and 7% of all proteins consumed worldwide (FAO, 2020). Among these fish are sardines, an irreplaceable source of essential nutrients in food-insecure places (Robinson et al., 2022).

In the Philippines, sardines are abundantly sold at local markets; these are commonly consumed in many households and can be found in various forms, including fresh, canned, and dried (Tadifa et al., 2020). Considering the geographical position of the Philippines, being surrounded by water makes sardines easily accessible. As such, the country heavily relies on sardines as a cheap and nutritious food source.

Moreover, the quality and safety of fish and fishery products have become a significant concern worldwide to consumers, producers, food industries, and regulatory agencies (Power & Cozzolino, 2020). This is evident in a study by Ziarati et al. (2022), which indicates that the presence of bacteria, fungi, parasites, and other haphazard microorganisms exacerbate the contamination and spoilage of fish. Other causes may be due to lack of facilities, the increased time needed for raw fish to arrive at cold storages inadequate ice, extended stay at the harbors and fish-landing sites, poor processing technique and gear-related injuries (Gyan et al., 2020). Thus, the assessment of safe and high-quality food products, or more specifically, fish, has recently gained more and more attention worldwide.

Organoleptic evaluation remains to be one of the most important assessment methods employed by the seafood industry today. It is mainly used to determine product specifications or standards in quality control and, to an extent, in product development and optimization (Vázquez-Sánchez, 2020). As such, it is an essential step in the fish industry to prevent potential diseases wrought by food spoilage.

Formaldehyde, a preservative, has been known to be administered to fish products to mask their spoilage (Poernomo et al., 2021; Devaraj et al., 2021). This may cause severe corrosive injury to the esophagus and stomach (https://wwwn.cdc.gov/). Additionally, dyes have also been found to be used in order to make it seem fresh (Liu et al., 2020).

Located in Gingoog City are various markets that harvest fish from the locality and the Agusan Province. However, there have been reports of spoiled fish displayed in these markets as per the discussion during the Sangguniang Panlunsod (2023). Hence, the current study aims to evaluate

and compare the Organoleptic properties of Bali Sardinella (*Sardinella lemuru*) sold at different markets in Gingoog City.

II. MATERIALS AND METHODS

A. Selection of Fish Markets

The collection sites are from two selected fish markets: the Gingoog City Public Market and Pandan Fish Market. This is due to the difference in their fishing source locations from the markets above, which may affect the organoleptic properties of Bali Sardinella (*Sardinella lemuru*).

B. Collection of Fish Samples

Five (5) fish samples per week were collected from the following fish markets: Gingoog City Public Market and Pandan Fish Market. The fish samples were collected randomly from each market to ensure that the sample was representative of the population. Fish samples were then partly filleted for further evaluation.

C. Organoleptic Evaluation

Organoleptic Evaluation sensory assessments were carried out on Bali Sardinella (*Sardinella lemuru*) by using the Quality Index Method (Hyldig & Green-Petersen, 2005) to assess the degree of freshness based on organoleptic characteristics such as general appearance, eyes, cover, gills, abdomen, and the flesh was carried out. Thirty (30) experienced panelists were selected to participate in the sensory evaluation. The study used a single-blind research design wherein the participants were unaware of where the fish were sold, thus minimizing bias, and increasing the reliability of the result (Thomas, 2022). QIM is based on significant sensory parameters for whole fish using weighted parameters, a scoring system from 0 to 4 demerit points. Scores are added to give an overall sensory score, the quality index. QIM gives scores of zero to fresh fish and an increasingly larger total result as fish deteriorates.

Table 1. Quality Index Method (QIM) Scheme Bali Sardinella (*Sardinella lemuru*)

	Parameter	Characteristic	Demerit points
General Appearance	Surface appearance	Very bright, iridescent	0
		Bright	1
		Less bright	2
		Slightly opaque, dull	3
	Stiffness	Flexible (pre rigor)	0
		Tense (rigor)	1
		Less tense	2
		Soft	3
	Flesh firmness	Firm, elastic	0
		Firm, hard	1
		Less elastic	2
		Soft	3
Eyes	Clarity (cornea)	Clear, transparent	0
		Slightly opalescent	1
		Opalescent or bloodstained	2
	Pupil	Black and circular	0
		Black and distorted	1
		Grey and distorted, bloodstained	2
	Shape	Slightly convex, normal	0
		Plane, flat	1
		Concave, sunken	2
Cover	Bloodiness	No visible (0%)	0
		Slight (<10%)	1
		Some (<50%)	2
		Wide (>50%)	3
Gills	Color	Red or dark red	0
		Brownish red	1
		Discolored (brownish)	2
	Odor	Seaweedy	0
		Slightly seaweedy	1
		Slightly acre or rancid or sweet	2
		Rancid oil or ammonia or sour	3
Abdomen	Postgill (belly-burst)	Intact, firm	0
		Intact, soft	1
		Stretch marks, soft	2
		Torn or ruptured	3
Flesh	Appearance	Smooth, translucent	0
		Slightly opaque	1
		Flattened, blood-stained	2
		Total	0-28

D. Photography

Photography was taken during the whole process as a proof.

III. RESULTS

Table 2. Mean Values of Organoleptic Properties for *Sardinella lemuru* collected from two markets in Gingoog City.

Market Location / Area	Organoleptic Properties											
	General Appearance		Eyes		Cover		Gills		Abdomen		Flesh	
	Mean	Desc.	Mean	Desc.	Mean	Desc.	Mean	Desc.	Mean	Desc.	Mean	Desc.
Gingoog City Public Market	1.43	IS	1.03	IS	1.35	IS	1.12	IS	1.33	IS	0.89	OC
Pandan Fish Market	0.79	OC	0.73	OC	0.93	OC	0.79	OC	0.77	OC	0.81	OC

*OC- optimal condition, IS- Intermediate stage, SP- spoiled putrid

Table 2 shows the mean value of the demerit points of S. *lemuru* in terms of general appearance, eyes, cover, gills, abdomen, and flesh.

A higher demerit point of Organoleptic Properties of S. *lemuru* was observed for Gingoog City Public Market for general appearance, eyes, cover, gills, and abdomen with a mean value of 1.43, 1.03, 1.35, 1.12, and 1.33 respectively.

However, for the flesh, both markets' mean value falls under optimal conditions (M= 0.89; M= 0.81).

IV. DISCUSSION

The present study evaluated the organoleptic properties of S. *lemuru* from Gingoog City Public Market and Pandan Fish Market. Contextually, organoleptic properties refer to various characteristics of fish changes that occur in raw fish (Huang et al., 2021). These relate to the outer appearance attributes of the eyes, skin, gills, and odor, as well as a scoring system from 0 to 3 demerit index points (Atanda et al., 2023). Via the quality index method, it can provide information concerning the fish freshness status as a predictor of the remaining shelf-life for specific species (Freitas et al., 2021).

As presented in Table 2, the demerit points of the organoleptic properties of S. *lemuru* in Gingoog City Public Market regarding general appearance, eyes, cover, gills, and abdomen lie within the range of 1.03-1.43. Thus, it is characterized in the grading scale as an "Intermediate Stage" based on the Quality Index Method. The general appearance of intermediate stage fish is typically characterized by a slight dullness in terms of its skin, along with rigidity and a gradual decrease in firmness (Omwange, 2022). Eyes, on the other hand, are typically flat and distorted. Gills also exhibit discoloration, while the cover oozes with blood (Singh, 2020). Lastly, the abdomen displays slight stretchmarks or belly bursting due to the enzymatic action in the guts (Murthy, 2019). This above indicates that the fish are acceptable for consumption, albeit it has shown signs of degradation and is approaching spoilage (Bernardo et al., 2020; Tahiluddin et al., 2022).

However, in terms of flesh, both Gingoog City Public Market and Pandan Fish Market characterized optimal conditions; thus, implying that the appearance of the fish's flesh indicates favorable quality (Capozzi et al., 2023). Furthermore, in terms of general appearance, eyes, cover, gills, and abdomen, the Pandan Fish Market lies within the range of 0.77-0.93. Therefore, it is classified under optimal conditions, signifying peak desirability and minimal signs of deterioration (Capozzi et al., 2023).

In the context of comparing both markets, higher mean values can be observed in the Gingoog City Public Market, indicating lower quality in terms of general appearance, eyes, cover, gills, and abdomen. Conversely, the lesser mean values in Pandan Fish Market suggest greater levels of freshness in the aspects mentioned above. Lastly, regarding flesh, the fish from both markets were reported to have optimal freshness, although Pandan Fish Market showed greater favorability by a small margin.

The results found in the current study are coherent with the findings by Mohamed et al. (2022), where there was a marked decrease in the quality of sardines by increasing storage time and temperatures; fish freshness decreases faster at 21°C than at 0°C. Similarly, the results also conform to a study by Janči et al. (2023), where higher temperature equates to faster degradation. Comparable to the study by Conteh (2018), fish in the intermediate stage typically show signs of deterioration, characterized by sunken eyes and dull flesh. In contrast, optimal freshness was seen in concave eyes and bright iridescent flesh.

These findings can be attributed to the time of transport from fish landing sites to the marketplace and the need for a proper cold storage location in the city. Small pelagic fish are highly perishable due to the activity of microorganisms, endogenous enzymes, and oxidation processes that affect their muscle tissues during storage (Janči et al., 2023). Coupled with the short shelf life of S. *lemuru* under room temperature, rapid deterioration of freshness is to be expected (Freitas et al., 2019; Yu et al., 2020; Janči et al., 2023).

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