

ANALYSIS OF BACTERIAL COUNT AND ACCEPTABILITY LEVEL OF SMOKED SAGELA FISH IN DIFFERENT MARKETING LOCATIONS

Analisis Jumlah Bakteri dan Tingkat Penerimaan Ikan Sagela Asap di Tempat
Pemasaran Berbeda

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(Received August 3rd 2025; Accepted November 24th 2025)

ABSTRACT

Sagela fish (*Hemiramphus* sp.), also known as smoked julung-julung fish, is a high-value fishery product popular in Gorontalo Province. This study aimed to analyze and compare the organoleptic quality and microbial contamination levels (Total Plate Count and mold) of sagela fish sold in three different marketing locations: a home industry in Paguyaman Pantai, the Central Market, and Gelael Supermarket. The research employed a descriptive exploratory method. The results showed that the organoleptic quality of sagela fish from all three locations was generally acceptable, with average scores above the minimum standard of 7. Samples from Gelael Supermarket exhibited the highest sensory quality, followed by the Central Market and Paguyaman Pantai. Regarding the Total Plate Count (TPC), all samples met the Indonesian National Standard (SNI) limit of 5.0×10^4 CFU/g, with results of 2.5×10^3 CFU/g for Gelael and Paguyaman Pantai, and 2.7×10^4 CFU/g for the Central Market. However, for mold contamination, all samples from the three locations exceeded the SNI maximum limit of 1×10^2 CFU/g. The highest level of mold contamination was found in samples from the Central Market (7.07×10^3 CFU/g), followed by Paguyaman Pantai (5.67×10^3 CFU/g), and the lowest in Gelael Supermarket (3.56×10^3 CFU/g). Although the organoleptic quality and total bacterial count (TPC) of the marketed sagela fish met the standards, the products were not safe for consumption in terms of mold contamination, which significantly exceeded the permitted limit. Differences in selling conditions and sanitation practices across marketing locations are strongly suspected to be the main factors causing the variation in contamination levels.

Keywords: Bacteria, Microbiology, Organoleptic, Smoked Fish, Sagela Fish.

ABSTRAK

Ikan sagela (*Hemiramphus* sp.), atau ikan julung-julung asap, merupakan produk perikanan bernilai ekonomis tinggi yang populer di Provinsi Gorontalo. Penelitian ini bertujuan untuk

menganalisis dan membandingkan mutu organoleptik dan tingkat cemaran mikroba (Angka Lempeng Total dan kapang) pada ikan sagela dari tiga lokasi pemasaran yang berbeda yakni, *home industry* di Paguyaman Pantai, Pasar Sentral, dan Supermarket Gelael. Metode penelitian yang digunakan adalah eksploratif deskriptif. Hasil penelitian menunjukkan bahwa mutu organoleptik ikan sagela dari ketiga lokasi secara umum dapat diterima, dengan skor rata-rata di atas standar minimum 7. Sampel dari Supermarket Gelael menunjukkan mutu sensori tertinggi, diikuti oleh Pasar Sentral dan Paguyaman Pantai. Untuk parameter ALT, semua sampel memenuhi syarat SNI ($5,0 \times 10^4$ kol/gr), dengan hasil untuk Gelael dan Paguyaman Pantai $2,5 \times 10^3$ kol/gr dan Pasar Sentral $2,7 \times 10^4$ kol/gr. Namun, untuk parameter kapang, seluruh sampel dari ketiga lokasi tidak memenuhi syarat SNI (batas maks. 1×10^2 kol/gr). Tingkat cemaran kapang tertinggi ditemukan pada sampel dari Pasar Sentral ($7,07 \times 10^3$ kol/gr), diikuti Paguyaman Pantai ($5,67 \times 10^3$ kol/gr), dan yang terendah pada Supermarket Gelael ($3,56 \times 10^3$ kol/gr). Meskipun mutu organoleptik dan total bakteri (ALT) ikan sagela yang dipasarkan memenuhi standar, produk tersebut tidak aman dikonsumsi dari segi cemaran kapang yang jauh melampaui batas yang diizinkan. Perbedaan kondisi penjualan dan sanitasi antar lokasi pemasaran diduga kuat menjadi faktor penyebab perbedaan tingkat kontaminasi.

Kata Kunci: Bakteri, Ikan Asap, Ikan Sagela, Mikrobiologi, Organoleptik.

INTRODUCTION

Fish is an important source of animal protein for health because it contains unsaturated fatty acids, vitamins, and macro and micronutrients derived from the water (Andhikawati *et al.*, 2021). However, its high water content makes fish spoil more quickly than other foods. Therefore, processing efforts are needed to extend its shelf life, one of which is through smoking (Fuadi *et al.*, 2015). Smoking is a food preservation technique, especially meat and fish. Food is smoked using heat and smoke generated from burning wood, and is kept away from fire to prevent it from roasting or burning (Munti *et al.*, 2019).

Sagela fish (*Hemiramphus sp.*), also known as smoked julung-julung fish, is a processed fishery product that is widely consumed and has high economic value in Gorontalo Province. The smoking process aims to preserve fish from microbiological spoilage. According to Ningrum *et al.* (2021), the purpose of smoking fish is threefold: to prepare the fish for immediate consumption, to impart a distinctive flavor to enhance consumer preference, and to preserve it through heating, drying, and the chemical reaction of the smoke with the fish tissue during the smoking process.

However, fishery products such as smoked fish remain susceptible to quality deterioration. Microbial contamination can occur if processing and storage are not carried out hygienically (Mailoa *et al.*, 2019). Factors such as the use of inappropriate raw materials, unclean equipment, and the sale of products without adequate packaging can trigger microbial contamination. Traditional processing often neglects hygiene and sanitation, resulting in products that are less than ideal for consumer health (Akinwumi *et al.*, 2015). Microbes found in smoked fish products include *Salmonella* (Mailoa *et al.*, 2013), *Staphylococcus aureus* (Karimela *et al.*, 2017), and *Escherichia coli* (Mailoa *et al.*, 2019).

The handling, storage, and sales conditions of sagela fish show significant differences between marketing locations. Modern supermarkets implement better cold chain systems and packaging, while traditional markets and home industries often have limitations in these aspects. Given these differences, this study aims to analyze and compare the organoleptic quality and levels of microbial contamination (Total Plate Count and mold) of sagela fish marketed in three different locations in Gorontalo Province: the home industry in Paguyaman Pantai, the Central Market, and the Gelael Supermarket.

RESEARCH METHODS

The tools used in this study included an autoclave, Bunsen burner, Petri dishes, vortex oven, test tubes, Durham tubes, measuring pipettes, volumetric pipettes, a water bath, an incubator, an inoculation loop needle, a marking pencil, a microscope, slides, slide clamps, a colony counter, and a test tube rack. The materials used in this study included smoked fish samples, ALT media, PDA media, PCA media, NA media, distilled water, NaCl, fertilizer media, BPW, pure bacterial cultures, methylated spirits, and immersion oil.

The study was conducted from February to May 2025. Sample testing was conducted at the Fishery Products Biotechnology Laboratory of the Faculty of Marine Affairs and Fisheries Technology and the Gorontalo Province Fishery Product Quality and Diversification Testing Center. This study used a descriptive exploratory method to collect factual data in the field through systematic recording and observation. According to Rukajat (2018), the descriptive method is a method that seeks to present a realistic and actual picture of a phenomenon.

The sampling locations for sagela fish (*Hemiramphus* sp.) were taken from three marketing locations with different sales conditions: Gelael Supermarket (modern refrigerated sales), Central Market (traditional open-air market), and a home industry in Paguyaman Pantai (production location). Five sagela fish were selected from each location using simple random sampling.

Organoleptic analysis: Organoleptic testing was conducted to assess panelists' level of preference for the product based on sensory attributes such as appearance, odor, taste, texture, mold, and slime. The assessment referred to SNI 2725:2013, using a hedonic scale of 1 to 9 completed by 12 trained panelists.

Microbiological Analysis: Microbiological testing included Total Plate Count (TPC) and Mold Count. The TPC test was conducted using Plate Count Agar (PCA) media with incubation at 35°C for 48 hours. Mold count testing was performed using Potato Dextrose Agar (PDA) media, incubated at room temperature (25-28°C) for 5 days.

Quantitative data from ALT and mold testing results were analyzed using descriptive statistics and compared with the maximum limits set by SNI 2725:2013. Organoleptic test results were also analyzed descriptively.

RESULT

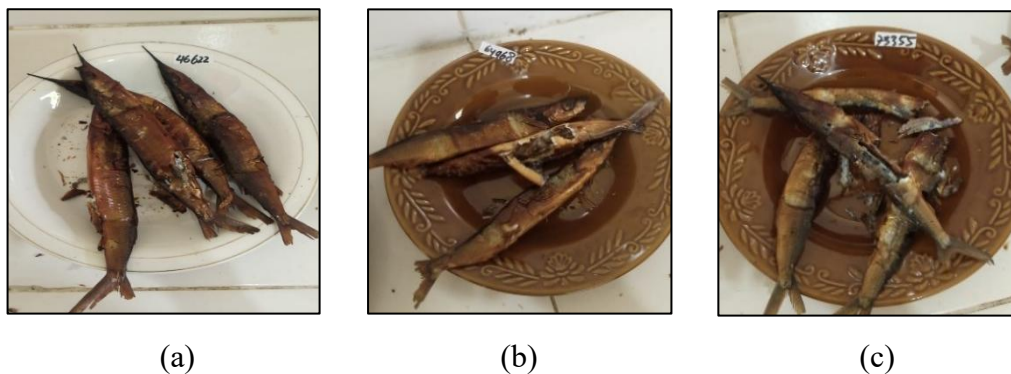
The organoleptic quality of sagela fish from three marketing locations is presented in Table 1. In general, all samples met sensory quality requirements with an average score above 7. The sample from Gelael Supermarket obtained the highest average score (8.14), followed by Pasar Sentral (8.06), and Paguyaman Pantai (7.50). For appearance, the sample from Gelael Supermarket received the highest score (7.50). For odor and taste, samples from Gelael Supermarket and Pasar Sentral showed higher scores than Paguyaman Pantai. For mold and slime, all samples from the three locations obtained the maximum score (9.00), indicating no visible mold growth or slime formation.

Table. Organoleptic testing of sagela fish (*Hemiramphus* sp.)

No	Sample	Parameter					
		Appearance	Smell	flavor	Texture	Mold	Mucus
1	Roa Fish Gelael Supermarket (SG)	7,50	8,00	8,00	8,00	9,00	9,00
2	Roa Fish Paguyaman Beach (PP)	7,0	7,2	7,7	7,2	9,0	9,0

3	Roa Fish Central Market (PS)	7,0	8,0	7,8	7,8	9,0	9,0
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Microbiological analysis of ALT test results from the three locations met the requirements because they were below the maximum limit of SNI 2332.3:2015, which is 5.0×10^4 kol/gr. Samples from Gelael Supermarket and Paguyaman Pantai home industry showed ALT values of 2.5×10^3 kol/gr, while samples from the Central Market had a value of 2.7×10^4 kol/gr. The results of mold testing are presented in Table 3. All samples from the three locations showed levels of mold contamination that exceeded the maximum limit of SNI 2725:2013 (1×10^2 kol/gr). The highest mold contamination was found in samples from the Central Market with an average of 7.07×10^3 col/gr, followed by the Paguyaman Pantai home industry (5.67×10^3 col/gr), and the lowest in samples from the Gelael Supermarket (3.56×10^3 col/gr). Images of smoked fish samples can be seen in Figure 1.



(a) (b) (c)
Figure 1. Sample of smoked fish originating from
(a) Gelael Supermarket; (b) Beach Association; (c) Central Market

DISCUSSION

Organoleptically, the sagela fish from Gelael Supermarket demonstrated the highest quality. This was supported by its attractive appearance and the panelists' preferred odor, taste, and texture. The lower appearance score in the sample from Paguyaman Pantai was likely due to the traditional smoking process using firewood, which can produce a dull and uneven color. According to Sukowati et al. (2021), the length of smoking time also affects the appearance and color of the fish. Good sensory quality in all samples, particularly for mold and slime, indicated that the product still appeared visually fresh and showed no signs of early spoilage.

Microbiologically, all sagela fish samples met safety standards for ALT. The low ALT value in the sample from Gelael Supermarket ($<2.5 \times 10^3$ kol/gr) can be attributed to the implementation of a cold chain system that effectively inhibits bacterial growth. Higher ALT values were found in samples from the Central Market (2.7×10^4 kol/g), although still below the threshold, reflecting a greater risk of contamination due to open and unhygienic sales conditions. According to Sartika et al. (2019), bacterial contamination can occur through direct or indirect contact with air. Air is the most potential source of contamination in traditional markets.

However, the most significant finding was the high levels of mold contamination in all samples, far exceeding the limits set by the Indonesian National Standard (SNI). The lowest contamination level was in Gelael Supermarket (3.56×10^4 kol/g), even though the levels were higher than the safe limit. According to Soepandi & Wardah (2013) in Alinti et al. (2018), mold is a determining quality indicator for smoked fish because certain types of mold produce mycotoxins, which impact the quality and safety of food products.

Conditions at the Central Market, where products are sold openly without adequate packaging, are the primary cause of the high mold contamination. According to Jeujanar (2022), smoked fish sold in markets is generally susceptible to contamination, both due to available facilities and infrastructure and air and insect pollution. The high level of contamination at the producer level (the Paguyaman Pantai home industry) also indicates that sanitation practices during and after the production process are inadequate.

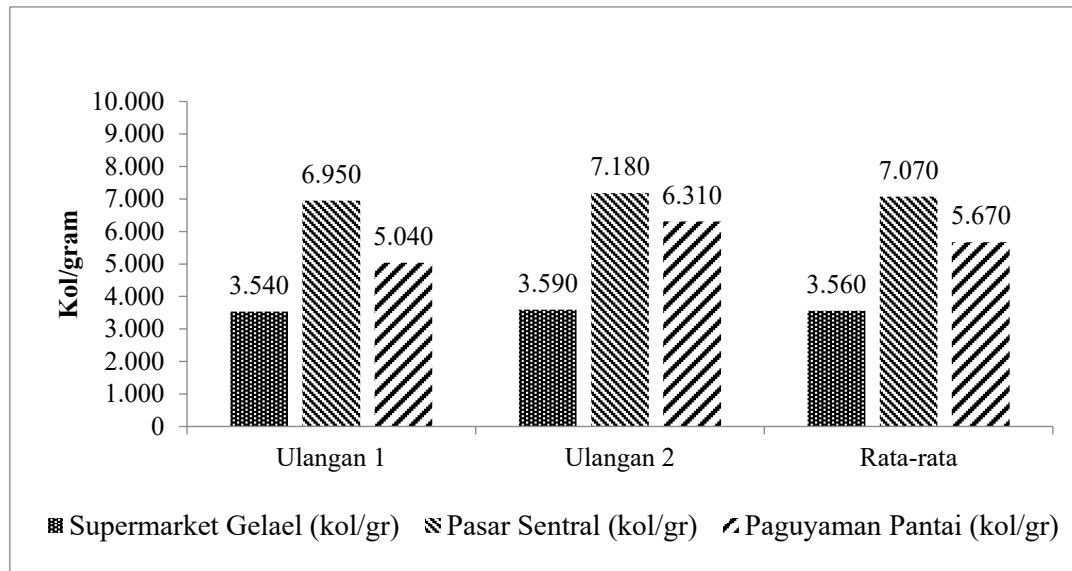


Figure 2. Graph of the number of mold colonies

CONCLUSION

The organoleptic quality of sagela fish from Gelael Supermarket, Central Market, and the Paguyaman Pantai home industry generally met the standard requirements, with the highest sensory quality found in samples from Gelael Supermarket. For the Total Plate Count (TPL) parameter, all samples met the SNI food safety requirements. However, for the mold parameter, all samples did not meet the requirements because the number of colonies far exceeded the maximum permitted limit, with the highest contamination found in samples from Central Market. This indicates that although organoleptically and total bacterial counts are acceptable, sagela fish circulating in the market are not safe for consumption due to mold contamination.

ACKNOWLEDGMENT

Thank you to the UPTD Center for Testing the Implementation of Quality and Diversification of Fishery Products, Fisheries and Maritime Affairs Service of Gorontalo Province for assisting in testing fishery product samples, as well as providing facilities and technical support during the research process.

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