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SAFETY AND QUALITY OF DRIED SALTED FISH PRODUCTS SOLD IN TRADISIONAL AND MODERN MARKETS

Analisis Kemanan dan Mutu Produk Ikan Asin Kering yang Dijajakan di Pasar Tradisional dan Pasar Modern

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ABSTRACT

This study aims to analyze the quality and food safety of dried salted fish marketed in traditional and modern markets based on microbiological parameters and chemical contamination. Samples of dried salted fish from traditional markets (P1) and modern markets (P2) were tested for sensory, the presence of Staphylococcus aureus, and formalin content. The test results showed that the sensory values in both samples met SNI 2346:2015, but for the fungal parameter, sample P1 obtained a score of 9 and P2 a score of 8, indicating contamination in both samples, although higher in the traditional market. The *Staphylococcus aureus* test showed that sample P1 contained 9.1 × 10^2 colonies/g, exceeding the SNI 2332.9:2015 threshold of 1 × 10^2 colonies/g, while sample P2 was not detected. The formalin test using a test kit showed negative results in both samples, so dried salted fish is relatively safe from hazardous chemical contamination. These findings confirm that differences in market conditions influence the microbiological quality of dried salted fish, with traditional markets experiencing higher contamination levels than modern markets. The implications of this research are the need for strict supervision, implementation of hygiene and sanitation standards, and education for producers and traders to ensure that dried salted fish products sold are safe, healthy, and meet quality standards.

Key words: Dried salted fish; Food quality; Traditional market; Modern market; SNI

ABSTRAK

Penelitian ini bertujuan untuk menganalisis mutu dan keamanan pangan ikan asin kering yang dipasarkan di pasar tradisional dan modern berdasarkan parameter mikrobiologis dan cemaran bahan kimia. Sampel ikan asin kering dari pasar tradisional (P1) dan pasar modern (P2) diuji sensori, keberadaan *Staphylococcus aureus*, dan kandungan formalin. Hasil pengujian menunjukkan bahwa nilai sensori pada kedua sampel memenuhi SNI 2346:2015, namun pada parameter jamur, sampel P1 memperoleh skor 9 dan P2 skor 8, mengindikasikan adanya kontaminasi pada kedua sampel, meskipun lebih tinggi pada pasar tradisional. Uji *Staphylococcus aureus* memperlihatkan sampel P1 mengandung 9,1 × 10^2 koloni/g, melebihi

ambang batas SNI 2332.9:2015 yaitu 1 × 10^2 koloni/g, sedangkan sampel P2 tidak terdeteksi. Uji formalin menggunakan *test kit* menunjukkan hasil negatif pada kedua sampel, sehingga ikan asin kering relatif aman dari cemaran bahan kimia berbahaya. Temuan ini menegaskan bahwa perbedaan kondisi pasar berpengaruh terhadap mutu mikrobiologis ikan asin kering, di mana pasar tradisional memiliki tingkat kontaminasi yang lebih tinggi dibandingkan pasar modern. Implikasi dari penelitian ini adalah perlunya pengawasan ketat, penerapan standar higiene dan sanitasi, serta edukasi kepada produsen dan pedagang untuk memastikan produk ikan asin kering yang beredar aman, sehat, dan sesuai standar mutu.

Kata Kunci: Ikan asin kering; Mutu pangan; Pasar tradisional; Pasar modern; SNI

INTRODUCTION

Salted fish products are an important commodity in Indonesia, with some catches processed through salting and drying to extend shelf life, facilitate distribution, and add economic value. However, differences in supply chains, sanitation, and packaging between modern and traditional markets often lead to quality variations and food safety risks. International (Codex) and national (SNI) reference standards emphasize edible raw materials, hygienic salting/drying processes, and quality, labeling, and hygiene requirements to ensure consumer safety (SNI 8273:2023).

The quality of salted fish is largely determined by physicochemical parameters such as moisture content, water activity (aw), salt content (NaCl), pH, and freshness/deterioration indicators such as TVB-N/TMA-N and lipid oxidation. Recent studies have concluded that these values, along with proximate composition, correlate with microbiological stability and sensory quality during storage (Jo *et al.,* 2019). Reduced water activity through salting and drying plays a role in inhibiting the growth of spoilage microbes. Several studies have demonstrated the relationship between aw-salt and TVB-N/TMA-N dynamics during and after the drying process (Agustini *et al.,* 2009; Abou-Zied *et al.,* 2020).

Regarding biological hazards, *Staphylococcus aureus* is frequently reported in dried fish products and has the potential to produce heat-stable enterotoxins. Laboratory tests have shown that S. aureus can survive in dried fish matrices and, under certain conditions, produce enterotoxins. Prevalence studies in various countries have also found the presence of S. aureus in retail salted fish. These findings emphasize the importance of hygienic controls, particularly at the point of handling in traditional markets, which are more open and have minimal packaging (Moon *et al.,* 2017; Morshdy *et al.,* 2022).

Chemical risks also require attention. Histamine and other biogenic amines can form in histidine-rich fish if temperature control is inadequate prior to the salting/drying process. Historical accounts and FAO/WHO technical reviews emphasize the role of the cold chain and hygiene practices as key controls. Retail testing of salted/dried fish products in Southeast Asia has shown variable histamine levels, some approaching/exceeding regulatory thresholds in local jurisdictions, a significant warning for oversight (FAO, 2013; Amascual *et al.,* 2020). Furthermore, contamination with toxigenic fungi (aflatoxin-producing Aspergillus) has been reported in salted fish from traditional markets, reinforcing the need for proper drying/storage conditions and adequate packaging—aspects typically more regulated in modern markets (Kusmarwati *et al.,* 2021).

In Indonesia, the use of hazardous substances such as formalin in food is strictly prohibited by the Food and Drug Authority (BPOM). Field studies in various regions have detected positive cases of formalin in salted fish in several markets, making strengthening trader education, regulating suppliers, and routine monitoring key. BPOM Regulation No. Regulation No. 22 of 2023 confirms the list of raw materials and additives prohibited in processed foods, including formalin (Mustika *et al.,* 2020; Dolorosa *et al.,* 2025).

Given the differences in market characteristics, salted fish products in modern markets generally go through a more controlled supply chain: supplier standards, packaging, labeling, and storage are more consistent, resulting in a more uniform sensory quality and physicochemical parameters. Conversely, in traditional markets, exposure to open environments, variations in salting/drying practices, and the potential for cross-contamination during display can increase quality variability and microbiological/chemical risks. Therefore, microbiological analysis (S. aureus), residue/use of prohibited substances (formalin), and sensory assessment are highly relevant for mapping compliance with standards (SNI/Codex) and evaluating the effectiveness of supervision.

RESEARCH METHODS

This study was conducted using a survey method among dried salted fish traders in traditional (P1) and modern (P2) markets in Sorong City, Southwest Papua. Sampling was conducted randomly in both markets. The data obtained were analyzed descriptively and qualitatively. Parameters used to assess the food safety of dried salted fish included sensory testing, *Staphylococcus aureus* analysis, and formalin detection. Sensory testing was conducted using the human senses as the primary tool for assessing product quality. The purpose of this test was to determine the level of consumer preference for dried salted fish.

Sensory Test Procedure (SNI 2346:2015))

Sensory testing is a method of testing that uses the human senses as the primary tool for assessing sensory quality. This sensory testing aims to measure the level of preference for a product. The testing is conducted by 15 trained panelists. The panelists are tasked with subjectively assessing the product's sensory quality specifications. Trained panelists are individuals who have experience in conducting sensory testing through a selection process but are accustomed to consuming fishery products. Trained panelists are first trained in descriptive tests, including basic taste tests to identify flavors, triangle or discrimination tests, limit tests, and taste intensity tests (Anupama *et al.,* 2018). The tool used to guide panelists in assessing a product is called a score sheet. This is done through specifications that outline the levels of sensory quality based on values/scores. Testing to determine quality levels is based on a scale of 1 as the lowest value and 9 (nine) as the highest value using a score sheet.

Staphylococcus aureus Test Procedure

Fish samples were weighed as much as 2 grams, then mashed with a blender for 30 seconds until the texture of the fish meat was soft, insert a sterile swab into the blender results. Next, insert the sterile swab into the Nutrient Broth (NB) media. The tube containing 10 ml of Nutrient Broth (NB) media was homogenized and incubated at 37ºC for 24 hours, then the bacterial suspension was taken from the Nutrient Broth NB media, then streaked on Mannitol salt agar (MSA) media using a T streak and incubated at 37oC for 24 hours (Riski *et al.,* 2017).

Formalin Test Procedure

Formalin testing uses test kits. The sample is chopped, 10 g of the sample is placed in a 50 mL beaker, and soaked in distilled water. Afterward, 1 mL of the sample is taken and placed in a test tube. Reagent I is added, shaken, and reagent II is added. The color change is then observed. If a faint purple to deep purple color forms, the sample is positive for formalin (Yulianti & Safira, 2020).

Data Analysis

The results of this study are presented in tables and graphs, then analyzed descriptively. The method used in this study is a descriptive method with a quantitative approach and a

verification method, namely the research results are then processed and analyzed to draw conclusions. The research conducted is a study that emphasizes the analysis of numerical data (numbers). By using this research method, significant relationships between the variables studied will be identified, thus producing conclusions that will clarify the picture of the object being studied.

RESULT

Dried salted fish is a processed fishery product widely consumed by Indonesians due to its high shelf life and distinctive flavor. In Sorong City, Southwest Papua, this product is widely marketed in both traditional and modern markets. These two markets have distinct characteristics that can impact the quality and food safety of the products sold. Samples of dried salted fish can be seen in Figures 1 and 2 below.

Figure 1. Salted dried fish in a traditional market

Figure 2. Salted dried fish in a modern market.

Sensory Test

Sensory testing, also known as organoleptic testing, has existed since humans began using their senses to assess the quality and safety of food and beverages (Setyaningsih *et al.,* 2010). The sensory tests conducted in this study included appearance, taste, odor, texture, and mold. The results of the sensory tests on dried salted fish in traditional and modern markets in Sorong City are presented in Table 1 below.

Table 1. Results of Organoleptic Tests of Dried Salted Fish in Traditional and Modern Markets

Sample	Appearance	Smell	Flavor	Texture	Mold	SNI 2346:2015
P1	8	8	8	8	9	Minimum 7
P2	8	8	8	8	8	

Description:
P1 (sample of dried salted fish from traditional market)
P2 (sample of dried salted fish from modern market)

Appearance

Appearance is a key parameter in sensory quality assessment because it directly relates to consumers' initial perception of a food product. Salted fish with good appearance is typically characterized by bright, clean, and clean colors, not dull, and free from dirt contamination. Appearance assessment is related to the level of consumer acceptance of the product (Putra *et al.,* 2022).

The appearance assessment for samples P1 and P2 obtained a score of 8, which is above the minimum standard of 7 according to SNI 2346:2015. Therefore, the product was visually assessed as very good. According to Soekarto, appearance is not the primary determinant of quality, but it significantly influences initial consumer acceptance because first impressions are determined by sight (Ahmad *et al.,* 2024). Another study on shrimp paste products showed an average appearance score of 7.47–8.13, proving that a score of 7 or higher indicates good panelist acceptance (Rochminta *et al.,* 2021). A study of salted fish in Morotai also confirmed that appearance is a crucial aspect in determining a product's sensory quality (Puni *et al.,* 2020). SNI 2346:2015 indeed stipulates appearance as a key component of the sensory assessment of fishery products. Therefore, P1 and P2 appearance scores of 8 indicate the product has an attractive appearance, is free from spots or mold, and is acceptable to consumers.

Smell

Smell or aroma is a very important sensory attribute because it provides information about the freshness, fermentation level, or damage of fishery products. Based on the test results, samples P1 and P2 both received a score of 8, indicating a distinctive, fresh aroma that was acceptable to panelists. According to research by Rochminta *et al.,* (2021), shrimp paste with a strong aroma received an average score of 7.33–8.00, and a higher score indicates greater consumer preference. Nurfitriyani *et al.,* (2024) also stated that the odor of salted fish is a key aspect in assessing its edible quality, as an unnatural, pungent odor indicates spoilage or contamination. Research on salted fish in Manado also stated that a distinctive and natural odor enhances the overall organoleptic value. SNI 2346:2015 emphasizes that odor must reflect the distinctive characteristics of fishery products without any indication of damage. Therefore, a score of 8 for dried salted fish indicates that the product still has a distinctive, desirable odor and meets quality standards.

Flavor

The taste of dried salted fish is the organoleptic attribute that most determines consumer acceptance. Taste is influenced by the raw fish, salt content, processing method, and storage. Test results showed that samples P1 and P2 scored 8, indicating that the product's salty and savory flavors were at optimal levels and were preferred by panelists. According to research by Rochminta et al. (2021), shrimp paste with a distinctive flavor scored high (8.13–8.33), demonstrating a close relationship between taste and consumer preference. Furthermore, taste

is a key indicator in determining the organoleptic quality of salted fish, where an unbalanced taste (too salty or bitter) will decrease consumer acceptance (Nurfitriyani *et al.,* 2024). This aligns with the SNI 2346:2015 standard, which stipulates a minimum value of 7 for taste suitability. Therefore, a score of 8 indicates that the dried salted fish in this sample has a distinctive flavor that is balanced, delicious, and meets consumer expectations.

Texture

The texture of dried salted fish is a parameter that indicates the physical consistency of the product, such as elasticity, density, and dryness. A good texture will feel dense, not mushy, and easy to consume. Test results showed that P1 and P2 received a score of 8, which means the product texture was highly preferred by the panelists. Studies on traditional smoked mackerel showed that a compact and firm texture remains acceptable to consumers with a score of ≥ 7 (Tupan *et al.,* 2023). In salted fish, texture is also influenced by water content and the drying process, so a perfectly dry product will receive a higher score (Puni *et al.,* 2020). Research by Nurfitriyani *et al.,* (2024) confirmed that texture is an important aspect tested in salted fish because it is directly related to consumption comfort. Texture is one of the main parameters in sensory testing because it is closely related to product quality. A score of 8 for the texture of dried salted fish indicates that the product has an ideal consistency, dense, and meets the panelists' preferences.

Mold

The results of the mold test on dried salted fish showed that sample P1 scored 9, while sample P2 scored 8. Both values are above the minimum threshold (≥7) according to SNI 2346:2015, indicating that the sensory quality related to mold contamination is still considered good and organoleptically acceptable. However, this difference in scores remains significant because it indicates a higher potential for mold or yeast contamination in P1 compared to P2. Mold is an important indicator in assessing the quality of dried salted fish because its presence indicates microbiological contamination that can reduce product quality.

Research on salted fish in Morotai showed that the presence of mold directly reduces the organoleptic value because it is related to food safety (Puni *et al.,* 2020). A similar finding was reported by Nurfitriyani *et al.,* (2024), who stated that mold is a determining factor in product acceptance in sensory tests. According to SNI, dried salted fish products must be free from mold contamination to be categorized as fit for consumption. Another study also confirmed that mold on salted fish reduces its market value and indicates quality degradation during storage (Yanuar *et al.,* 2016). This aligns with findings that traditional markets often have unhygienic storage conditions, contributing to high mold growth. Therefore, controlling moisture content and ensuring proper storage sanitation are crucial factors.

Therefore, the higher mold score for P1 (9) compared to P2 (8) may indicate external factors such as poor air circulation, humidity, and storage container sanitation in sample P1. Although both are within safe limits, mold control is crucial to prevent the risk of quality degradation and health hazards.

***Staphylococcus aureus* test**

Based on research identifying *Staphylococcus aureus* in salted fish sold in traditional and modern markets, it was found that samples from the traditional market contained Styplococcus aureus bacteria, while samples from the modern market did not contain Styplococcus aureus bacteria (see Table 2 below).

Table 2. Results of *Staphylococcus aureus* Identification in Salted Fish in Traditional and Modern Markets

Sample	Result	SNI 2332.9.2015
P1	$9{,}1x10^2$	$1x10^2$ koloni/g
P2	0	

Description:
P1 (sample of dried salted fish from traditional market)
P2 (sample of dried salted fish from modern market)

In sample P1, derived from dried salted fish from a traditional market, *Staphylococcus aureus* was found to contain 9.1×10^2 colonies per gram, while sample P2 showed a negative result (0 colonies/g). This value significantly exceeds the maximum threshold set by SNI 2332.9:2015, which is 1×10^2 colonies per gram. Sample P1 was contaminated tenfold above the tolerable limit, while sample P2 was safe from contamination with this bacterium.

The presence of S. aureus in sample A indicates a potential serious health risk, as S. aureus is a salt-tolerant pathogenic bacterium that can survive in dried and fermented fish products, as described in international literature. For example, S. aureus can survive in salted and fermented fish products despite low water content and high salt content (Moon *et al.,* 2017). This characteristic makes this bacterium a target pathogen for control through drying and salting. Furthermore, previous field studies, such as those conducted at Segiri Market in Samarinda City and various other traditional markets, have shown that S. aureus contamination in salted fish products is not uncommon. One study found that approximately 42% of salted fish samples were identified as containing S. aureus (Hernanda *et al.,* 2023). Factors triggering this contamination include poor hygiene practices, open processing environments, the use of non-sterile equipment, and human handling, which can serve as a source of bacteria (Malelak *et al.,* 2015).

Physiologically, S. aureus requires a population size of approximately 10^6 to 5×10^6 CFU/g to begin producing heat-stable enterotoxins, and these toxins can trigger food poisoning even after the bacteria have been killed (Malelak *et al.,* 2015). Although sample P1 did not reach this level, exceeding the SNI limit created potential conditions for further bacterial growth during unhygienic storage. On the other hand, sample P2, with a negative result for S. aureus, indicates that this dried salted fish product meets the microbiological safety requirements based on SNI. This is consistent with other findings that low water content (water activity, Aw) generally below 0.85 can effectively inhibit the growth of S. aureus, making drying and salting a natural barrier to its growth (Febriyanti, 2015).

Formalin Test

Formalin content is classified into two categories: positive for formalin and negative for formalin. The study results showed no formalin content in salted fish sold in traditional and modern markets in Sorong City.

Table 3. Formaldehyde test results on salted fish in traditional and modern markets

Sample	Result	Method Test
P1	ND	IK 2.17 (Teskit)
P2	ND	

Description:
P1 (sample of dried salted fish from traditional market)
P2 (sample of dried salted fish from modern market)
ND : No Detected

The results of formalin testing on dried salted fish showed that neither samples P1 nor P2 contained any formaldehyde (ND = Not Detected) based on analysis using the IK 2.17 Test Kit. This is very positive news because formalin is a synthetic preservative prohibited in food, including fishery products like salted fish, due to its known carcinogenic properties and potential health risks for consumers. Numerous field studies have shown that the use of formalin in salted fish continues, especially in traditional markets, such as Kedungprahu Market, Banjarmasin Market, and various other regions in Indonesia, despite being prohibited by the Minister of Health Regulation. Several studies have found that up to 33–38% of salted fish samples tested positive for formaldehyde using the kit test or permanganate test (Rovita & Wulandari, 2022).

The presence of formalin in food can pose various serious health risks, including respiratory tract irritation, digestive disorders, and even potential cancer due to its carcinogenic properties (Putri *et al.,* 2024). Furthermore, a review of Indonesian salted fish products also noted the presence of formalin residues in several regions, including Lampung, Manado, Bandung, Gorontalo, Pekanbaru, and Madura (Dewi & Widiyanto, 2021). Therefore, the absence of formalin in samples P1 and P2 not only demonstrates that the products meet preservative safety requirements but also indicates that the processing and distribution of dried salted fish, in this case, were carried out properly, without the addition of harmful preservatives. Overall, these test results provide quality assurance for dried salted fish products, ensure that consumers are not exposed to the risk of formalin, and reflect practices worthy of being maintained in safe and hygienic traditional food processing.

CONCLUSION

The results of the study showed that dried salted fish from traditional markets (P1) and modern markets (P2) both still met the organoleptic standards of SNI 2346:2015, although the fungal score in P1 was higher (9) than P2 (8). Microbiological tests showed that P1 was contaminated with *Staphylococcus aureus* at 9.1×10^2 colonies/g (exceeding the threshold of SNI 2332.9:2015), while P2 was not detected. Formalin tests showed both samples were negative (ND), so they were safe from harmful preservatives. Overall, salted fish from modern markets is safer to consume because they have better sanitation and handling, while traditional markets require improved hygiene and quality control.

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