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Analysis of Traders' Knowledge Level on Formalin Detection in Fresh Fish at Tavip Market Binjai City

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Abstract

Formalin is a prohibited food additive due to its harmful effects on human health. An inspection conducted by the Indonesian Food and Drug Authority (BPOM) in North Sumatra at Tavip Market, Binjai City, found the presence of formalin in several types of fresh fish being sold. The low level of traders' knowledge regarding the dangers of formalin is believed to be one of the main factors contributing to its use in fresh fish. This study aimed to analyze the association between traders' knowledge levels and the presence of formalin in fresh fish at Tavip Market, Binjai City. A quantitative approach with a cross-sectional design was employed. The study population consisted of all 32 fresh fish traders at Tavip Market, selected using a total sampling technique. Data were collected through a validated questionnaire to measure traders' knowledge levels and laboratory testing using the spot test method to detect formalin in fish. Data analysis was conducted using Fisher's exact test. The results revealed a significant association between traders' knowledge levels and the presence of formalin in fresh fish (p-value = 0.021). Low knowledge levels were found to increase the risk of formalin use in fresh fish. Continuous education and intensive supervision by relevant authorities are necessary to reduce the circulation of formalin-contaminated fish in traditional markets.

Keywords: traders' knowledge; fresh fish; formalin; food safety

Introduction

Food is a fundamental necessity that must be fulfilled to maintain health, optimize intelligence, and support productivity at work. Therefore, high-quality food is essential. Food quality should be characterized by high nutritional value, good taste, attractive appearance, proper hygiene, and safety for consumption (Hossain et al., 2025).

According to Article 12 of Law No. 28 of 2004 on Food Safety, Quality, and Nutrition, food producers who use additives in the production process for distribution purposes must only utilize additives that have been officially approved. Any food additive whose health effects remain uncertain must undergo a safety evaluation before being authorized for use in food production and circulation, subject to approval from the Head of the Food and Drug Authority (Badan Pengawas Obat dan Makanan, 2023).

To ensure that consumers obtain food products of high quality, safety, and health standards, the government also enacted Law No. 8 of 1999 on Consumer Protection. Despite these regulations, traders are still found selling fresh fish containing formalin to extend shelf life and maintain the appearance of freshness. This practice may be linked to several factors, including traders' lack of awareness about the dangers of formalin, insufficient monitoring, or limited legal knowledge concerning food trade.

Law No. 8 of 1999 on Consumer Protection, Article 7, stipulates that business actors must provide accurate, clear, and honest information about the condition and guarantees of goods and/or services, including usage instructions, repair and maintenance guidelines, and assurance that marketed products are free from harmful substances. Unfortunately, in many cases, buyers are not given transparent information about the safety of the products they purchase. As a result, consumers may suffer adverse health effects after consuming food contaminated with hazardous substances.

The World Health Organization (WHO) estimates that approximately 600 million people worldwide-one in every ten individuals-are affected by the consumption of contaminated food containing bacteria, viruses, parasites, or chemical substances, resulting in about 420,000 deaths each year (Pires et al., 2021). Similarly, the 2024 data from the Indonesian Food and Drug Authority (BPOM RI) indicate that food

contaminated with such hazardous substances continues to pose serious health risks. Out of 102 food samples tested, about 1.1% contained prohibited substances: formalin (0.53%), rhodamine B (0.30%), borax (0.28%), and methanyl yellow (0.01%) (Badan Pengawas Obat dan Makanan, 2023).

The 2023 Annual Laboratory Examination Report from BPOM North Sumatra revealed that, in Binjai City, specifically at Tavip Market, 200 food samples were tested, of which 127 contained formalin. The contaminated items included anchovies, shredded fish, and fresh fish. Research further supports these findings: (Hoque et al., 2016) identified a significant correlation between fish processors' knowledge levels and formalin detection in fish at fish production centers. Meanwhile, Rahim et al. (2024) found that 31 out of 75 marine fish samples collected from five traditional markets in Padang City contained formalin.

In Binjai City, particularly at Tavip Market, no prior study has been conducted regarding the use of formalin in fresh fish and the knowledge levels of traders regarding formalin. However, preliminary observations and interviews with several consumers suggested that fish sold in the market contained formalin. Indicators included a pungent chemical odor when frying the fish, an unpleasant taste, and cooking oil that turned black. These signs suggest that fresh fish sold at Tavip Market may indeed contain formalin, likely due to traders' limited knowledge about its risks. This situation represents a serious threat to public health.

Based on preliminary findings indicating the presence of formalin in fresh fish, it is evident that some traders continue to sell formalin-treated fish despite government regulations prohibiting its use as a preservative due to its harmful effects on human health (Lu et al., 2025). In light of these concerns, this study aims to investigate traders' knowledge regarding formalin detection in fresh fish at Tavip Market, Binjai City. By assessing the extent of traders' awareness about the dangers and regulations of formalin, this research seeks to provide insights that may contribute to more effective legal awareness, monitoring, and consumer protection, thereby fostering safer and healthier food markets.

Method

This study employed a quantitative approach with an analytical cross-sectional design to analyze traders' knowledge of formalin detection in fresh fish at Tavip Market, Binjai City. The study population consisted of all 32 fresh fish traders, selected using a total sampling technique.

Data were collected through a validated questionnaire (r = 0.374–0.798) with high reliability (Cronbach's alpha = 0.842), which measured traders' knowledge of formalin through 15 questions. Knowledge levels were categorized as good (≥75%) or poor (<75%). Fresh fish samples (100 grams) from each trader were analyzed using the spot test method with Schiff's reagent at the Nutrition Laboratory, Universitas Islam Negeri Sumatera Utara, to detect formalin content. Results were classified as positive (color change to purple) or negative (no color change).

Data analysis was performed using SPSS version 25.0, with univariate analysis for descriptive statistics and Fisher's exact test for bivariate analysis ($\alpha = 0.05$), as the assumptions for the chi-square test were not met.

Results

The study involved 32 respondents, all of whom were fresh fish traders at Tavip Market, Binjai City. The characteristics of the respondents analyzed included age, gender, education level, and length of time engaged in the fresh fish trade. Details of respondent characteristics are presented in Table 1.

Table 1. Characteristics of Fresh Fish Traders at Tavip Market

Variabel	n	%
Age (Years)		
17-25 years	3	9.4%
26-45 years	15	46.9%
46-65 years	14	43.7%
Gender		
Male	27	84.4%
Female	5	15.6%
Education		
Elementary school	1	3.1%
Junior high school	10	31.2%
Senior high school	18	56.3%
Bachelor's degree	3	9.4%
Length of Fish Trading		
1-5 years	10	31.2%
6-10 years	16	50%
10-20 years	6	18.8%

(Source: Primary Data, 2025; n = 32)

As shown in Table 1, a total of 32 respondents participated in the study, with the majority being male traders (27 respondents, 84.4%). Based on age, most

respondents were in the 26–45 years group, totaling 15 respondents (46.9%). In terms of education, the largest proportion had completed senior high school (18 respondents, 56.3%). Furthermore, regarding trading experience, most respondents had been selling fresh fish for 6 to 10 years, amounting to 16 respondents (50%).

The frequency distribution of each research variable is presented in Table 2.

Table 2. Distribution of traders' knowledge levels and formalin detection results

Variabel	n	%
Traders' knowledge level		
Poor	14	43.8%
Good	18	56.2%
Formalin test results		
Positive	13	40.6%
Negative	19	59.4%

(Source: Primary Data, 2025; n = 32)

According to the data, the majority of fresh fish traders at Tavip Market, Binjai City, demonstrated good knowledge levels (18 respondents, 59.4%). However, 13 fresh fish samples (40.6%) tested positive for formalin contamination.

Figure 1. Fish examination process in the laboratory

In the bivariate analysis, the independent variable (traders' knowledge level) and the dependent variable (formalin content) were tested using the Chi-square method. The results of this test, showing the relationship between the two variables, are presented in Table 3.

Table 3. Analysis of Traders' Knowledge Levels on Formalin Detection in Fresh Fish at Tavip Market

Knowledge Level	Formalin Content				Total		p-value
	Positive		Negative				
	n	%	n	%	n	%	
Poor	9	64.3%	5	35.7%	14	43.7%	0.021
Good	4	22.2%	14	77.8%	18	56.3%	

(Source: Primary Data, 2025; n = 32)

The results of the bivariate analysis showed a p-value of 0.021 ($p < 0.05$), indicating a significant association between traders' knowledge levels and the presence of formalin in fresh fish at Tavip Market, Binjai City. Among the 14 traders with poor knowledge, 9 (64.3%) were selling fish that tested positive for formalin. In contrast, only 4 out of 18 traders with good knowledge (22.2%) were selling fish that tested positive for formalin. These findings suggest that traders with inadequate knowledge are more likely to sell fish contaminated with formalin.

Discussion

The findings of this study strongly support Lawrence Green's PRECEDE-PROCEED Model, which explains that health behavior is influenced by three main factors: predisposing factors, enabling factors, and reinforcing factors (Scott, 2001). In the context of formalin use in fresh fish, traders' knowledge functions as a fundamental predisposing factor shaping their behavior.

According to Green's theory, knowledge as a predisposing factor not only encompasses factual understanding but also awareness of consequences and the ability to make appropriate decisions (Scott, 2001). The findings demonstrate that traders with good knowledge exhibited greater awareness of the health risks of formalin, such as understanding its carcinogenic and toxic effects on consumers, being aware of government regulations—including the prohibition of formalin under Law No. 8 of 1999 and BPOM regulations—possessing the ability to identify formalin-treated fish through visual and organoleptic cues, and knowing safe natural preservation alternatives.

The difference in the proportion of formalin use between traders with poor knowledge (64.3%) and those with good knowledge (22.2%) indicates that knowledge has a significant protective effect. This aligns with the cognitive domain in Green's theory, which posits that individuals with adequate knowledge demonstrate greater perceived susceptibility and perceived severity regarding health risks.

These findings are consistent with the study by (Febriani et al., 2024)which identified a significant interaction ($p = 0.012$) between knowledge and the presence of formalin in meatball and cilok products. However, they contrast with Abdillah & Wulandari (2022) research, which found no association

between knowledge levels and the presence of formalin in salted fish.

The fact that four traders with good knowledge were still selling formalin-contaminated fish indicates that predisposing factors alone are insufficient (Amri et al., 2025; Twentyna Dolorosa et al., 2025). In line with Green's model, interventions are also needed to address enabling factors and reinforcing factors. Possible enabling factors include limited access to high-quality fresh fish suppliers, inadequate cold storage facilities, and insufficient capital to purchase ice regularly (Lemes et al., 2025).

Conclusion

This study demonstrated a significant association between traders' knowledge levels and the presence of formalin in fresh fish sold at Tavip Market, Binjai City ($p = 0.021$). Traders with lower knowledge were more likely to sell formalin-contaminated fish compared to those with higher knowledge. These findings highlight that knowledge plays a protective role in reducing the risk of unsafe food practices. However, knowledge alone is insufficient, as some traders with adequate knowledge were still found to sell formalin-contaminated fish, suggesting that broader contextual factors also influence behavior.

Recommendations

To ensure food safety and protect public health, it is essential to implement comprehensive strategies involving traders, regulatory authorities, and the wider community. Fresh fish traders are encouraged to adopt natural preservation methods, such as the use of ice, cold storage, or drying techniques, and to replace formalin with safe natural preservatives such as salt, citric acid, or herbal extracts. At the same time, the Food and Drug Authority (BPOM) and local health authorities should strengthen surveillance and inspection in traditional markets, particularly targeting fresh fish suspected of contamination, while also enforcing strict sanctions-including license revocation and financial penalties-against traders found to be in violation. Continuous education and direct outreach are also critical, not only to improve traders' awareness of the health risks of formalin but also to enable them to clearly distinguish between formalin-treated fish and naturally preserved fish that is safe for consumption.

Moreover, consumer education campaigns and community participation in monitoring practices should be promoted to build collective responsibility in ensuring food safety. Through these integrated efforts, it is expected that the circulation of formalin-contaminated fish can be significantly reduced, thereby fostering safer traditional markets and safeguarding public health.

Conflict of Interests Statement

The author declares that there are no conflicts of interest related to the publication of this article.

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