

# Evaluation of formalin in salted fish in the main market of Lambaro and Ketapang Aceh Besar

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**Abstract.** Salted fish is one of the favorite local fisheries processed foods by the Indonesian people, where the product is made through a preservation process using salt. The addition of prohibited preservatives such as formalin is still found, this is thought to be due to a lack of knowledge from artisanal fishers about salted fish processing that is safe for consumption. This research aims to determine the formalin content of salted fish in Lambaro Main Market and Ketapang and the distribution pattern of salted fish sales in the Aceh Besar Market. The formalin test was conducted qualitatively using a formalin kit with two repetitions. Data analysis was conducted descriptively. The results showed that three samples were positive for formalin at 38% in Lambaro Main Market (1<sup>st</sup> and 2<sup>nd</sup> repetition). While in Ketapang Market, there were two and three formalin positive samples (1<sup>st</sup> and 2<sup>nd</sup> repetition) at 29% and 43%, respectively. The distribution pattern of salted fish sales in Aceh Besar Market is very short, namely producers sell to collectors, then to traders in Lambaro and Ketapang Market, and forwarder to consumers. The salted fish producers come from Medan (North Sumatra), Meulaboh (West Aceh) and Blang Pidie (Southwest Aceh).

## 1 Introduction

Food is a basic human need that have function as a source of energy and building substances [1]. One of the food sources for human is fish [2]. Fish contains protein, moisture, unsaturated fatty acids, vitamins and minerals. [3] states that fish protein is very easy to digest and absorb because it has shorter protein fibres. High moisture content in fish causes fish to decompose easily (perishable food) [4]. [5] states that fish spoilage is caused by microbial activity. On the other hand, while catches of traditional fishermen are abundant [6], thus, a fish preservation method is needed to sustain the shelf life of fish. Salting is a method of preserving food by reducing its moisture content [5] and adding 15-20% salt [7] with the aim of sustaining the shelf life longer due to the bacteriostatic and bactericidal properties from salt [4]. [8] states that the salt used in making salted fish is included in the Recognized as Safe Group (GRAS), which is a preservative that is safe to use because its natural and non-

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toxic. Fish salting produces a product in salted fish form. Salted fish is a local fisheries product that is favoured by the Indonesian people [6] and almost 65% of fishery products are processed and preserved by salting [9]. [10] states that salted fish has a low moisture content due to absorption by salt and evaporation by heat.

Public knowledge regarding the safe and good salted fish processing for consumption is still lacking [5]. This is proven by the widespread formalin application as a preservative, because it is considered a preservative that is easy to obtain at a low price and ungrow fungi [11], and increase the salted fish yield [12]. Formalin is a liquid preservative used to preserve cadaver and industrial chemicals but is misused by unscrupulous producers in food additives and has been banned by BPOM [6], because it can affect the human health such as stomach irritation [13], corrosive [11], mutagenic and carcinogenic [14]. Formalin reacts quickly with the mucus layer of the digestive and respiratory tracts and in the human body can be oxidized to form formic acid, especially in the liver and red blood cells [5]. In addition, formalin has an aldehyde element that easily reacts with protein and moisture content fish [13,15].

Several researches have been reported on formalin application in salted fish products in various markets in Indonesia. Medan anchovies found in Karangayu Market, Semarang City are positive for formalin with physical characteristics including bright clean, no distinctive smell of salted fish and no flies [5]. Based on laboratory tests using the Kit Test, there were 38 salted fish samples (55,9%) from the Seberang Ulu I Traditional Market in Palembang containing formalin as seen from the color change from clear to purplish red [16]. Salted anchovies found in Kendari City Traditional Market were positive for formaldehyde with the highest level of 31 mg/kg [12]. Six salted anchovy samples jengki and cucut (24%) from Sederhana Market in Bandung City contained formalin [17]. 25 Kepala Batu salted fish samples in Jambi City Traditional Market were identified as containing formalin with the highest level of 1,0326  $\frac{\mu g}{g}$  [13]. Several fish types found in Parluasan Market in Pematang Siantar such as Bawal, Grouper, Snapper, Tuna and Tongkol were positive for formalin with the highest level in Snapper 3,42 mg/L [2]. Salted anchovies found in the Tangerang area market were positive for formalin using the qualitatively chromatophosphoric acid method [6]. Salted Snakehead fishes sold in Sungai Raya Dalam Traditional Market contain formalin with an average amount of 3,14 mg/kg [11]. Salted Fine Anchovy fish found in the Yogyakarta City Traditional Market was positive for 100% formalin using the ET brand formalin kit test [18].

The traditional markets in Aceh Besar that sell salted fish products are Lambaro and Ketapang Markets. Lambaro Market is the main market located in Aceh Besar District. These two markets sell a lot of local fisheries products in the form of various type salted fish. The purpose of this research was to determine the formalin content found in salted fish in Lambaro and Ketapang Main Markets and to determine the distribution pattern of salted fish sales in the Aceh Besar Market.

## **2. Materials and method**

### **2.1 Materials**

The materials used include salted fish obtained from Lambaro and Ketapang markets, Formalin Kit Test and distilled water. The tools used include measuring pipette, filler, knife, mortar, pestle, test tube rack, spatula, test tube, scales, beaker glass, and stationery.

## 2.2 Research method

This research was carried out in May until June 2024. Research data in the form of formalin test results on salted fish found in Lambaro and Ketapang markets. Formalin test was conducted qualitatively using a formalin kit with two repetitions. Data analysis was carried out descriptively. The descriptive method is one type of qualitative research where the data obtained is words, pictures form, and not numbers. [19] states that the descriptive qualitative method is a study that explains or describes what is in the field. [20] states that the purpose of descriptive qualitative research is to provide a description of the object to be studied through sample data, then analyze and make general conclusions.

## 2.3 Research procedures

This research was carried out through several stages, including taking and observing the distribution pattern of salted fish samples, taking preparation, and sample testing. Samples were taken from Lambaro and Ketapang markets using a simple random sampling method, then coded. Sampling was repeated 2 times with an interval of 1 month with the same seller. Samples were characterized organoleptically, by looking at the physical condition of the salted fish (texture, smell and color). Sample preparation was done by grinding the sample using a mortar and pestle and then homogenized with distilled water (sample and distilled water ratio 1:5) [21]. Samples testing was carried out qualitatively with the Formalin Kit Test of Labtest Reagent Brand [21, 22].

## 2.4 Research parameter

Samples testing was carried out qualitatively with the Formalin Kit Test of Labtest Reagent Brand [21, 22]. Samples, that have been homogenized with 3 mL distilled water, were added with 1<sup>st</sup> formalin reagent as much as 1 drop, then rehomogenized. Next step, add 3 drops of 2<sup>nd</sup> formalin reagent and rehomogenized. Samples were allowed to stand for 5-15 minutes and observed its color change. A color change from white to purplish indicates formalin positivity. Negative control used distilled water and positive control used formalin solution, 3 mL respectively.

## 3. Results and discussion

### 3.1 Salted fish physical characteristics

There are eight types of salted fish obtained from Lambaro Main Market, including Talang-talang, Ayam-ayam, Kepala Batu, Layur, Squid, Dencis, Kembung, and Pisang-pisang. There are seven types of salted fish obtained from Ketapang Market, including Talang-talang, Ayam-ayam, Kepala Batu, Squid, Dencis, Kembung, and Pisang-pisang. The physical characteristics results of salted fish obtained from Lambaro and Ketapang Market are showed in Table 1.

**Table 1.** The Salted Fish Physical Characteristics in Aceh Besar Market.

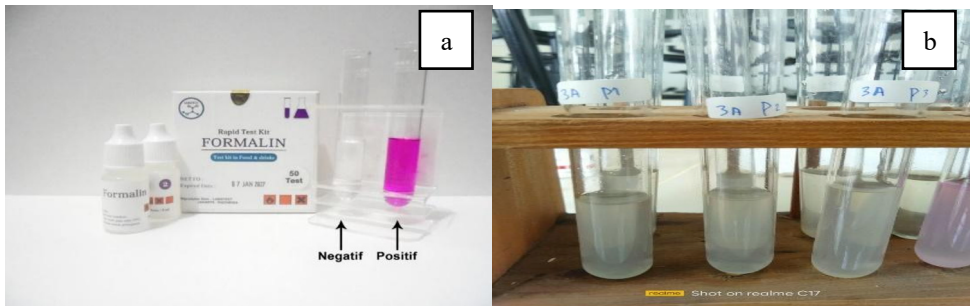
Fish type	Observation parameters			Market origin
	Color	Smell	Texture	
Talang-talang fish	Brownish	Less fishy	Hard	Lambaro
Ayam-ayam fish	Brownish	Less fishy	Not hard	
Kepala Batu fish	Brownish	Less fishy	Hard	
Layur fish	Brownish	Less fishy	Hard	

Squid	Purple	Fishy	Not hard	Ketapang
Dencis fish	White	Fishy	Not hard	
Kembung fish	White	Fishy	Not hard	
Pisang-pisang fish	Brownish	Fishy	Not hard	
Talang-talang fish	Brownish	Less fishy	Hard	
Ayam-ayam fish	Brownish	Less fishy	Not hard	
Kepala Batu fish	Brownish	Less fishy	Hard	
Squid	Purple	Fishy	Not hard	
Dencis fish	White	Fishy	Not hard	
Kembung fish	White	Fishy	Not hard	
Pisang-pisang fish	Brownish	Fishy	Hard	

The salted fish physical characteristics found in Lambaro and Ketapang markets have a cleaner white color, hard texture/rigid, not infested by flies, less fishy smell, can be stored for a long time. [12] reported that salted anchovies obtained from the Kendari City Traditional Market have the characteristics of clean white color, hard texture, not infested with flies and no fishy smell. Generally, foods adding formalin have organoleptic characteristics, including a harder texture, paler color, do not produce the natural food smell, and rarely infested with flies [22]. Fish physical characteristics containing formalin positively include looking clean and bright, not smelling typical of salted fish, hard texture and not swarmed by flies [16]. [12] explained that the hard texture of salted fish is obtained by mixing formalin into fish meat, then formalin will remove the fish meat cells contents, and replace it with stiffer formaldehyde.

### 3.2 Formalin content qualitative results

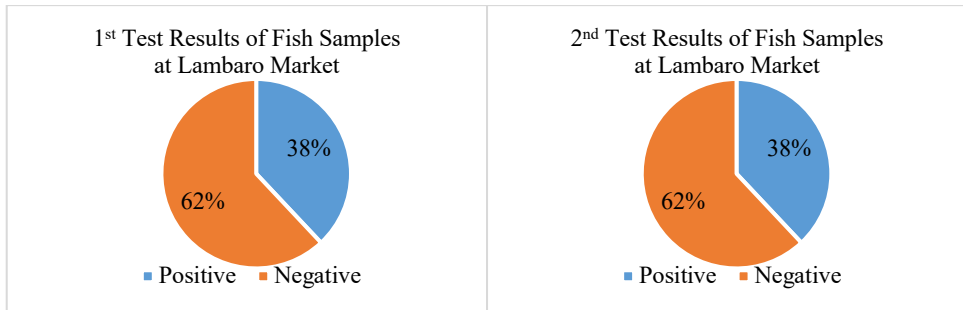
The negative and positive controls used were distilled water and formalin solution. Salted fish samples testing was carried out qualitatively with Labtest Reagent Brand Formalin Kit Test. [22] states The Rapid Formalin Kit Test (Labtest Reagent) can detect formalin solutions up to a concentration of 10 mg/L, which is indicated by a weak purple discoloration. Positive and negative formalin salted fish testing results can be seen from the color change to purplish showed in Fig 1.



**Fig. 1.** Color Change of Control (a) and Salted Fish (b).

The formalin content qualitative test results of salted fish samples found in Lambaro Market in the 1<sup>st</sup> repetition, out of eight salted fish samples, three samples were positive for formalin (38%), which is found in Ayam-ayam (2A), Dencis (6A) and Kembung (7A). Meanwhile, five salted fish samples were negative for formalin (62%). In the 2<sup>nd</sup> repetition, there were three salted fish samples positive for formalin (38%), namely Squid (A5), Dencis (A6), and Kembung (A7). Meanwhile, five salted fish samples were negative for formalin (62%). [23] reported that nine salted fish samples at the Banda Aceh City Traditional Market

(Rukoh, Peunayong and Ulee Kareng) were positive for formalin (64%). The results of the percentage of salted fish samples positive and negative for formalin are presented in Figure 2.



**Fig. 2.** Formalin content percentage in salted fish in Lambaro market.

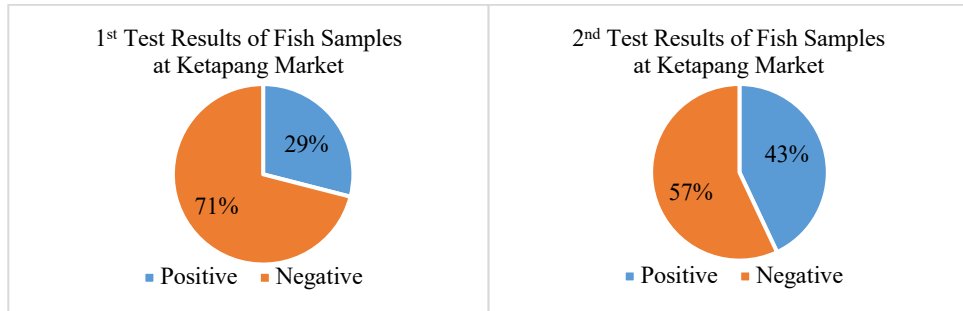
Based on the results of formalin content qualitative analysis of salted fish found in Lambaro Market can be seen from the color changes observation that occur, show in Table 2.

**Table 2.** Qualitative results of salted fish formalin content in Lambaro market.

Repetition to-	Samples code	Fish type	Final color	Explanation
First	1A	Talang-talang fish	Translucent	Negative
	2A	Ayam-ayam fish	Purple	Positive
	3A	Kepala Batu fish	Translucent	Negative
	4A	Layur fish	Translucent	Negative
	5A	Squid	Translucent	Negative
	6A	Dencis fish	Purple	Positive
	7A	Kembung fish	Purple	Positive
	8A	Pisang-pisang fish	Translucent	Negative
Second	A1	Talang-talang fish	Translucent	Negative
	A2	Ayam-ayam fish	Translucent	Negative
	A3	Kepala Batu fish	Translucent	Negative
	A4	Layur fish	Translucent	Negative
	A5	Squid	Purple	Positive
	A6	Dencis fish	Purple	Positive
	A7	Kembung fish	Purple	Positive
	A8	Pisang-pisang fish	Translucent	Negative

The qualitative test results of salted fish samples formalin content found in Ketapang Market in the 1<sup>st</sup> repetition, out of seven salted fish samples, two samples were positive for formalin (29%), namely Kembung (5B) and Squid (7B). Meanwhile, five salted fish samples were negative for formalin (71%). In the 2<sup>nd</sup> repetition, there were three salted fish samples positive for formalin (43%), namely Dencis (B4), Kembung (B5) and Squid (B7). Meanwhile, four salted fish samples were negative for formalin (57%). The differences in formalin content results in 1<sup>st</sup> and 2<sup>nd</sup> months are thought to be due to the condition of the salted fish samples used. The salted fish processing is carried out by traditional fishermen who are thought to have a lack of extensive knowledge about the dangers of using formalin, which has an effect on salted fish producing. The salted fish testing results for positive and negative formalin can be seen from the color change to purplish. The Test Kit principle is the formation of a purple-red complex compound from the reaction between formaldehyde and 4-amino-3-hydrazino-5-mercapto-1,2,4-triazole [16]. [13] explained that formalin reacts with chromatophytic acid to produce a purplish red complex compound. [17] states the

reaction of chromatophytic acid follows the condensation principle of phenol compounds with formaldehyde to form the compound (3,4,5,6-dibenzoxanthylum), where the NaOH addition to accelerate the reaction. The percentage results of salted fish samples positive and negative for formalin are shown in Fig 3.



**Fig. 3.** formalin content percentage in salted fish in Ketapang market.

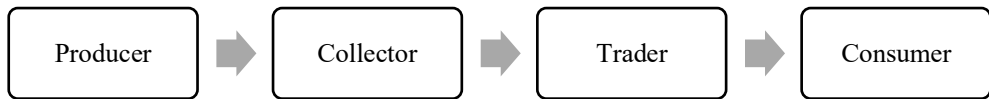
Based on the results of formalin content qualitative analysis of salted fish found in Ketapang Market can be seen from the color changes observation that occur, show in table 3.

**Table 3.** Qualitative Results of Salted Fish Formalin Content in Ketapang Market.

Repetition to-	Samples code	Fish type	Final color	Explanation
First	1B	Talang-talang fish	Translucent	Negative
	2B	Pisang-pisang fish	Translucent	Negative
	3B	Kepala Batu fish	Translucent	Negative
	4B	Dencis fish	Translucent	Negative
	5B	Kembung fish	Purple	Positive
	6B	Ayam-ayam fish	Translucent	Negative
	7B	Squid	Purple	Positive
Second	B1	Talang-talang fish	Translucent	Negative
	B2	Pisang-pisang fish	Translucent	Negative
	B3	Kepala Batu fish	Translucent	Negative
	B4	Dencis fish	Purple	Positive
	B5	Kembung fish	Purple	Positive
	B6	Ayam-ayam fish	Translucent	Negative
	B7	Squid	Purple	Positive

### 3.3 Salted fish distribution pattern

The distribution pattern is a pattern used by a business when distributing its products to reach consumers [24]. Based on the research results, the distribution pattern of salted fish in Aceh Besar Market can be described starting from producers to consumers. The distribution pattern of salted fish is shown in Figure 4. The distribution pattern of salted fish in Aceh Besar Market is short, starting from producers selling salted fish to collectors, then selling to traders in Lambaro Market or Ketapang market, and continuing to consumers. [25] states that distribution pattern with 2 intermediary institutions (collectors and retailers) are included in the level II distribution pattern type and have efficiency values above 50%. Distribution patterns will affect fish price stability. [26] states that a long fish distribution pattern can cause fish prices to more fluctuate at consumer level than fishermen level and distribution becomes inefficient. The average selling prices of fish are IDR 50,000 - IDR 70,000/kg, squid IDR 100,000 - IDR 110,000/kg.



**Fig. 4.** Distribution pattern of salted fish in Aceh Besar market.

The producers of salted fish sold in the Aceh Besar market include Meulaboh (West Aceh), Medan (North Sumatra) and Blang Pidie (Southwest Aceh) (Table 4). Salted fish traders in Aceh Besar Market source fish from other areas such as Meulaboh (Layur and Talang-talang Fishes), Blang Pidie (Kepala Batu Fish) and Medan (Ayam-ayam, Dencis, Kembung, Pisang-pisang Fishes and Squid).

**Table 4.** Salted Fish Producers in Aceh Besar Market.

Market name	Fish type	Source
Lambaro Market	Talang-talang fish	Meulaboh
	Ayam-ayam fish	Medan
	Kepala Batu fish	Blang Pidie
	Layur fish	Meulaboh
	Squid	Medan
	Dencis fish	Medan
	Kembung fish	Medan
	Pisang-pisang fish	Medan
Ketapang Market	Talang-talang fish	Meulaboh
	Ayam-ayam fish	Medan
	Kepala Batu fish	Blang Pidie
	Squid	Medan
	Dencis fish	Medan
	Kembung fish	Medan
	Pisang-pisang fish	Medan

## 4. Conclusion

The salted fish physical characteristics found in Lambaro and Ketapang markets have a cleaner white color, hard texture/rigid, not infested by flies, less fishy smell, can be stored for a long time. The qualitative test results of salted fish formalin content were three samples containing formalin (38%) and five samples not containing formalin (62%) in Lambaro Main Market (1<sup>st</sup> and 2<sup>nd</sup> repetition). The qualitative test results of salted fish formalin content were two and three samples containing formalin (29% and 43%), five and four samples not containing formalin (71% and 57%) in Ketapang Market (1<sup>st</sup> and 2<sup>nd</sup> repetition). The distribution pattern of salted fish sales in Aceh Besar Market is very short, namely producers sell to collectors, then to traders in Lambaro and Ketapang Market, and forwarder to consumers. The salted fish producers come from Medan (North Sumatra), Meulaboh (West Aceh) and Blang Pidie (Southwest Aceh).

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