

## ORIGINAL ARTICLE

# Factors Related to the Presence of Formaldehyde in the Salted Fish Trade in Ciputat, Indonesia

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## ABSTRACT

**Introduction:** The use of formaldehyde in salted fish as a food preservative is prohibited and against the law. Salted fish is food that in demand in many Indonesian cuisine. The purpose of this study is to determine the relationship between education, knowledge, attitude and duration of work selling salted fish with the existence of formaldehyde in salted fish products. **Methods:** A quantitative cross-sectional study. Data collection by interviews 11 sellers and testing 72 salted fish samples. Tests were carried out using colourimetric test of formaldehyde and interviews sellers in a traditional Market Ciputat, Banten Indonesia in 2018. **Results:** The results of this study were from 72 laboratory samples of salted fish, 42 positive containing formaldehyde, most of them were Anchovy *Stolephorus tri* (21.9%) and delivered from several places in Indonesia. Based on Fisher exact tests showed that there were no relationship ( $p$ -value > 1.000) between education, knowledge, perception, and attitudes of sellers using formaldehyde and Man-Whitney tes determined there was no difference in the duration of works between sellers who use and who do not use formaldehyde ( $p$ -value 0.301). **Conclusions:** The highest percentage of carcinogenic formaldehyde in salted fish is crucial. Public health sector should pay more attention and the government should run inspection and health promotion regularly.

**Keywords:** Formaldehyde, Salted fish, Education, Duration of works

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## INTRODUCTION

With thousands of islands and limited infrastructure for transportation, problems with storage and cooling and a lack of government oversight and weak regulation, inconsistent with increasing consumer demand for food products has led to an increase in issues related to food control and food security(1). Increased fraudulent practices for food preservation, especially on seafood products carried out for commercial purposes. Many traders abuse the use of hazardous chemicals, such as formaldehyde(2), sorbic, benzoic as well as propionic acid(3). To achieve improvement in the Sustainable Development Goals (SDGs), the existence of a strong national food control system will play an important role in protecting consumer health, ensuring safe food consumption, and facilitating good trade practices to achieve successful human and economic development in Indonesia. However, this is not the case in the field, where there are still misuse the use of chemicals.

Formalin is a liquid form of formaldehyde in the form

of a 35-40% stable aqueous solution with methanol. Formaldehyde (HCHO) that we know in general is general air pollutants and gases at room temperature(4). Formaldehyde is widely used in the manufacture of household appliances such as paints, laminated furniture and cleaning fluids. This chemical is carcinogenic if it is misused will cause harm to public health as it triggers cancer risk(5). The use of formaldehyde as a food additive is illegal according to the International Agencies for Research on Cancer (4) and the Republic of Indonesia minister of health in regulation No. 033 the year 2012. However, formaldehyde is still used in preserving salted fish to keep fish product are always in good quality. Based on research conducted in various regions in Indonesia, it has been found that all samples of salted fish sold in several markets in Madura positively contain forbidden preservatives of formaldehyde(6, 7). Investigations conducted by Indonesian Food and Drug Inspection Agency (BPOM) and the District Office of Trading in Ciputat Market founded similar condition in salted fish products. Moreover, the pilot studies conducted at Ciputat Market also showed all samples of positive salted fish containing formaldehyde.

There is a considerable amount of studies that have determined the existence of formaldehyde as a preservative in some food(8, 9). However, the reasoning

behind the personal motivation of seller adding formalin to their products remain unclear. The study aim is to determine the formaldehyde contain in salted fish on aspect of behavioural of the sellers such as education, knowledge, attitude and duration of work selling salted fish.

## MATERIALS AND METHODS

### Study design

The study design of this research is a descriptive analytic study with a cross-sectional approach were selected 11 respondents with occupation as salted fish sellers and also included laboratory sample of 72 salted fish products purchased from local market. The study outcome were collected at the same time using the total sampling method.

### Instrument

The study determined some variables including age, sex, education, knowledge about formaldehyde, attitude, duration of work, and analysed its association with the existence of formaldehyde in salted fish products. Scores and Likert scale (0-5 level) were applied to some specific questions interviewed. The information from drug and food inspection agency and regional health centre are used as secondary data, while questionnaire outcome obtained from in-depth interviews are used as primary data in the study.

### Ethical approval

All materials involving human subjects had the approval of the Ethics Committee (Ethical approval no.Un.01/F10/KP.01.1/02.07.2018) under the authority of the Faculty of Health Sciences Syarif Hidayatullah State Islamic University Jakarta. The selected of 9 participants as study subjects were recruited and have given their informed consent.

### Laboratory analysis

The research was done to asses formaldehyde concentration through laboratory analysis. Qualitatively, food security kit (Easy test, Indonesia) determined formaldehyde following the colorimetric method. A total 72 fish samples were taken from local market from July until September 2018. The fish were cut, 10 grams of salted fish was mashed using mortar then given sterile destilate water about 40oC and left to cool in room temperature (about 27oC). Mash salted fish transferred to tubes and centrifuged at 10.000 round per minutes (rpm) in 5 minutes. Ten millilitre of supernatant was then mixed with four drops of reagent A (phenylhydrazine hydrochloride 7.5%) and reagent B (acidic potassium ferycyanida 2%) respectively. The mixture was then shaken and left to rest for about 5 to 10 minutes. Colour changes that occur were observed to compare the control. Positive and negative control were performed by using concentration of formaldehyde 2 part per million (ppm) and zero(0) ppm of sterile distilled

water, respectively(10). The positive sample turned pink-purple, with white paper background ensured and comparing the right colour of the product analysis. This test can detect the presence of formaldehyde within food in solid or liquid form, with a detection limit of at least 2 ppm.

### Statistical analysis

Data analysis was carried out statistically by non-parametric analysis. A univariate analysis was carried out to describe the number of positive and negative result of laboratory test acording the species of fish and characteristics of the sellers; their attitudes and knowledge of preserve processing of salted fish. Non-Parametric analysis was carried out to determine a correlation between some independent variables such as sellers' education, knowledge, attitude and duration of work towards formaldehyde usage. Chi-Square, Fisher exact and Man-Whitney analysis were applied in this study and performed using the SPSS (version 22; SPSS Inc., Chicago, IL, USA).

## RESULTS

The study collected 72 salted fish samples from nine of shops in local market Ciputat. Positive or negative laboratory test results represent the behaviour of salted fish sellers for the use of formaldehyde as a fish preservative.

Table I shows the 42 (58.3%) of 72 samples of salted fish were found positive for formaldehyde. Salted fish which contained the most formaldehyde is the *Stolephorus tri* anchovy type with 9 (21.4%) samples, and the least containing formaldehyde was salted fish as much as 1 (2.4%) sample. Anchovy was the type which contained the most formaldehyde with a percentage almost 50%, each of them were genus of *Stolephorus tri*, *Stolephorus spp*, and another anchovy with composition 21.4, 16.7,

**Table I:** Formaldehyde in salted fish according to a number of sellers

Fish type	Formalin in salted fish samples				Number of sellers	
	Positive		Negative		n	%
	n	%	n	%		
Anchovy	9	21.4	0	0	9	12.5
Lampung Anchovy	7	16.7	2	6.7	9	12.5
Stolephorus indicus (rice anchovy)	5	11.9	4	13.3	9	12.5
Snakehead fish (gabus)	2	4.8	7	23.3	9	12.5
N. Thalassinus (jambal)	5	11.9	4	13.3	9	12.5
Trichogaster trichopterus (sepat)	6	14.3	3	10	9	12.5
Barbonymus gonionotus(tawes)	1	2.4	8	26.7	9	12.5
Moustached thrysa(chicken feather)	7	16.7	2	6.7	9	12.5
<b>Total</b>	<b>42</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>72</b>	<b>100</b>

and 11.9 per cent respectively.

Subject of study determined the age of most sellers into at least two age groups, the first one being 26 - 45 year-olds with 55.6% of the total number of sellers, the second one being under 17 year olds with 11.1%. Salted fish sellers in Ciputat Market are mostly male (66.7%). There are 55.6% of sellers with an educational background, ranging from secondary school up to higher education. On the other hand, minimum working experience of 0 - 5 years are for 44.4% of the sellers, while longer than that is between 11-15 years for 22.2% of the sellers. The study found of the high and low level of knowledge related with the formalin are shown mostly of respondents high knowledge were 5(55.6%) and 4(44.4%), respectively. On the other hand, the attitudes of the sellers who use and no use of formalin in salted fish indicate as positive 6 (66.7%) and 4 (44.4%), respectively. In the contrasting situation, the majority of sellers who had positive attitudes actually founded 42 (58.3%) sale salted fish containing formaldehyde (Table II).

**Table II:** Demographic characteristics of salted fish sellers

Characteristics	n	%
<b>Age</b>		
Less than 17	1	11.1
17 - 25 years old	1	11.1
26-45 years old	5	55.6
46 - 65 years old	2	22.2
<b>Sex</b>		
woman	3	33.4
man	6	66.7
<b>Education</b>		
No education up to junior high	4	44.4
Highschool up to university	5	55.6
<b>Duration of works</b>		
0-5 years	4	44.4
6-10 years	0	0
11-15 years	2	22.2
16-20 years	3	33.3
<b>Level of knowledge</b>		
low	4	44.4
high	5	55.6
<b>The behaviour of using formalin</b>		
Negative	3	33.3
Positive	6	66.7
<b>Salted fish supplier area</b>		
Kapuk	4	44.4
Muara Angke	2	22.2
Parung	1	11.1
Tanah Abang	2	22.2
<b>Total</b>	<b>9</b>	<b>100</b>

Based on Fisher analysis there is no relationship between knowledge (p-value 1.000), education level (p-value 1.000), and attitude (p-value 1.000) of the traders with the use of formaldehyde in salted fish. The Man Whitney results also found that there was no difference in the average length of selling with groups of sellers who used and groups that did not use formaldehyde (p-value 0.301). Of the nine respondents who were positive of the use of formaldehyde, the average selling time was 5.5 years, while the respondents who did not use formaldehyde had an average selling time of 3.25 years. The bivariate analysis of variables is summarised in Table III.

**Table III:** The relationship of the independent variables with the use of formalin

Variables	Formalin use				Total		Mean (median)	P value
	Positif		Negative		n	%		
	n	%	n	%				
<b>Education</b>								
low	3	75	1	25	4	100		1.000
high	4	80	1	20	5	100		
<b>Level of knowledge</b>								
low	3	75	1	25	4	100		1.000
high	4	80	1	20	5	100		
<b>Attitude</b>								
negative	2	66.7	1	33.3	3	100		1.000
positive	5	83.1	1	16.7	6	100		
<b>Duration of works</b>								
Use formaldehyde	7				9	100	5.5	0.301
No use formaldehyde			2				3.25	

\*Significant at P value < 0.05

## DISCUSSION

In any act of abuse of carcinogenic chemicals other than knowing the amount of content present in food, understanding the reasons behind these actions is very important for prevention-related policy making. The study founded carcinogenic substance in most types of salted fish that had collected. Compare to other fish type, anchovy appears to be more commonly found formaldehyde. Anchovy or other type of fish like chicken feather are marine fish which has many characteristics of the nutrient contained rich of protein which made the fish decompose easily. Moreover, it also contains saturated fatty acids which very easily oxidised the fish to decay easily(11). The reason for this, made fish at risk for additional formaldehyde as preservatives(12) The laboratory analysis has shown chicken feathers tested positive for formaldehyde 7(16.7%) of all samples. In line with other studies, in some countries, researcher also found formaldehyde in dry fish sample in Ghana(8), Malaysia(13) and Bangladesh(14).

Statistical tests has shown that respondents who have a low level of education and use formaldehyde are 75%

and the other group was 80%. The probability test results were 1.00 which had no relationship between the level of education and the existence of formaldehyde in salted fish. Education influences knowledge because with education, one can obtain information which is a source of knowledge. With education also one's awareness will increase along with the maturation of understanding that is understood by knowledge as well. Education and behaviour of a person will be related because the higher education is the easier way for someone to accept the concept to apply with his or her behaviour(15).

The study founded no relationship between the knowledge of sellers with the use of formaldehyde in salted fish. Respondents with low level of knowledge and use formaldehyde are 3(75%), while others are 80%. Respondents with high knowledge are more likely to use formaldehyde in salted fish that they sold. Thus it is inversely related to the relationship between knowledge and behaviour of using formaldehyde in salted fish.

Most of the sellers answered incorrectly to the question of formaldehyde usage; all respondents answered formaldehyde and formalin as a preservative because the information that they got came only from electronic mass media which has reported many cases according to the abuse of formaldehyde as food preservative. This situation impact to their perception and shape the knowledge. Knowledge is the result of information captured by its senses. Therefore, the respondent only knows limited knowledge because what is received by the senses only comes from television and is only limited to essential information. In line with the research, the knowledge possessed by hawker sellers in the Semarang Traditional Market is only limited to the news of television broadcasts. The reporting of formaldehyde abuse on fisheries has risen differential reaction for each side; on producers and sellers, they receive financial benefit. Negatively, on the other side consumers get loss in terms of health. However, all of them can share their knowledge regarding the abuse of formalin in food(16). On the other word, the situation caused by the lesser knowledge about the impact of formaldehyde for human health and the attitude of sellers who are more concerned about their profit maximization rather than safe food for the customer. All salted fish that are sold at the Ciputat market come from suppliers outside the city. Most sellers obtain salted fish from Kapok, North Jakarta area 4(44.4%) and at least 1 (11.1%) of sellers get salted fish from Parung, West Java province.

Statistical tests in this study found that there is no relationship between the attitudes of sellers with the existence of formaldehyde in salted fish. Around 66% of sellers had a positive attitude, 5 of them are selling salted fish containing formalin. A positive attitude means that sellers agree that formaldehyde is harmful to humans if it is used for food, while a negative attitude means that sellers do not agree that formaldehyde is dangerous,

so traders assume formaldehyde can be used for food. Some possibilities of things happening are dishonest in expressing answers regarding attitudes. The respondents answered questions carefully and not openly. In the process of answering questions, respondents tend to know what is considered true and false statements so that they are considered as positive attitudes, but in reality this is not the case.. The condition in line with some studies in some countries, sellers use the chemical preservative for economic reasons during the production(17, 18).

Often attitudes are not related to overt behaviour. An attitude that is a response from an individual to an object, the response is classified as cognitive, affective and psychomotor. While the response model was divided into verbal and non-verbal, in individual verbal cognitive responses are expressions of their beliefs. However, non-verbal produces perceptual reactions. In verbal affective response is an expression of persuasion of something as an object, and physiological reactions, facial expressions and other non-verbal reactions. In the end, the response from the conative is the tendency or intention of the individual which leads to non-verbal behaviour(19).

The average length of selling salted fish between groups that use and those who do not use formaldehyde were 5.5 and 3.25 years, respectively. The longest respondents sold salted fish for 15-20 years, the salted fish they sold contained formaldehyde. On the other hand, sellers who sold for 5 months, they sold safe products. Based on theory, experience will increase knowledge and provide lessons so that they can influence individual attitudes(20). The experience of selling salted fish for a long time will increase knowledge about the characteristics of salted fish which contain formaldehyde and not knowledge about the dangers of formaldehyde itself so that it forms a wrong attitude towards food, especially in fish preservatives.

The United States Environmental Protection Agency (21) and international cancer research institute classify formaldehyde as a first class carcinogenic compound to human(22). Formalin will disrupt the composition of proteins or RNA as a form of DNA in the human body. If the DNA structure is chaotic, it will trigger cancer cells in the human body. The important health issues rise from unsafety food are not just about a certain area but can potentially be a trigger for health problems in other places(23). The use of carcinogenic substance in adulteration of the food is very prone to the broad population and remains as a crucial issue for all sectors, not limited to agricultural and fisheries sectors. The government needs to control various uses of preservatives in food products.

In this study, there are limitations given that formaldehyde is a volatile compound. The possibility of changes in temperature when handling samples or during storage on trips can affect the concentration of formaldehyde.

Laboratory qualitative method was applied in this study, rather than the quantitative method, considering formaldehyde is a carcinogenic chemical substance and is prohibited to use as a preservative food product in Indonesia in any level of quantity. Other studies use a quantitative method with column chromatography such as GC-MS or HPLC to determine formalin in small quantity(8, 14). However, the laboratory method applied in this research could be accepted with consideration of economic and situation in Indonesia. The design of a cross-sectional study that builds hypotheses is not enough to confirm a causal relationship. The future research should be expanded to other observational study design such as cohort and also human health risk analysis.

## CONCLUSION

As long as most of the sellers sold salted fish for almost 5 years contradicted situation has appears. From 55.6% of them had high knowledge about formaldehyde and their attitude had shown a greater understanding of the danger caused by abuse of formaldehyde in food(66.7%). However, the fact that formaldehyde is still quite high (58%) is founded in the salted fish products that they sold. Statistical test results have shown no relationship between knowledge, education and attitude with existence formaldehyde in salted fish (p-value > 0.05). It also no difference in the length of works between two groups of sellers who use formaldehyde and those who do not use formaldehyde (p-value 0.301).

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