

# Effectiveness of White Galangal Extract (*Alpinia galanga* W.) AS a Reducer on Formalin of Milkfish Fillets (*Chanos chanos* F.)

Shela Ariyawati<sup>1</sup>, Fadjar Kurnia Hartati<sup>2\*</sup>, Achmadi Susilo<sup>3</sup>, Bambang Sigit Sucahyo<sup>4</sup>, Nunuk Hariyani<sup>5</sup>

Food Technology Department, Faculty of Agriculture, Dr. Seotomo University, Surabaya, Indonesia

Email: [ariyawatishela3@gmail.com](mailto:ariyawatishela3@gmail.com)<sup>1</sup>, [fadjar.kurnia@unitomo.ac.id](mailto:fadjar.kurnia@unitomo.ac.id)<sup>2\*</sup>, [achmadisusilo@uwks.ac.id](mailto:achmadisusilo@uwks.ac.id)<sup>3</sup>, [unitomoatom@gmail.com](mailto:unitomoatom@gmail.com)<sup>4</sup>, [nunukhariyani195@yahoo.com](mailto:nunukhariyani195@yahoo.com)<sup>5</sup>

Orchid: <https://orcid.org/0000-0002-9039-21612><sup>2\*</sup>

**Abstract.** This study aims to determine the effectiveness of white galangal extract (*Alpinia galanga* W.) as a reducer of formalin levels in milkfish fillets (*Chanos chanos* F.) with concentrations of 20%, 25%, 30% and soaking times of 30 minutes, 60 minutes. This study uses an experimental method. Data were analyzed using parametric statistics using Analysis of Variant (ANOVA) using Statistic Product and Service Solution (SPSS) version 24. Different concentrations and soaking times of white galangal extract (*Alpinia galanga* W.) had a very significant effect on reducing formalin levels, increasing protein levels and organoleptic properties of milkfish fillets. Based on the results of the study, L3P2 treatment with a concentration of 30% and a soaking time of 60 minutes was the best treatment in reducing formalin levels with a reduction efficiency of 63,42%, while the protein content of milkfish fillets increased by 17,85%. Organoleptic test results of the appearance of the best milkfish fillets in the L1P1 treatment amounted to 7,72, the best aroma in the L2P1 treatment amounted to 7,56 and the best texture in the L1P1 treatment amounted to 7,56.

**Keywords:** Formaldehyde, Galangal, Milkfish

## 1 Introduction

Milkfish is a fish that lives in brackish water, contains 20 g of protein and 74 g of water. Filet is a piece of fish meat without bones, spines and fins removed. Microorganisms such as bacteria, mold and yeast usually grow and reproduce in fish that contain high protein and water, causing the fish to be damaged[1]. The freshness of fish is usually preserved by producers using dangerous chemical preservatives such as formalin. Formalin is a preservative used to preserve corpses and is an additive that is not allowed in food.

Formalin is a clear solution, has a pungent odor and contains 37% formaldehyde in water[2]. Formalin has an aldehyde group that can bind to proteins in food and form methylene compounds so that formalin can preserve food[3]. The use of formalin in food can threaten human health, so efforts need to be made to reduce the levels of formalin in food. Research related to reducing formalin levels using galangal extract has been conducted on food ingredients, including white shrimp[4], salted fish[5], salted fish[6], salted stonehead fish[7]. The decrease in formalin levels in the above study may occur due to saponin compounds in galangal.

White galangal is a type of tuber plant that is usually used as a spice in traditional Indonesian cooking and as a meat tenderizer[8]. White galangal is also known as one of the plants that has antibacterial properties because of its ability to inhibit microbial activity. The active antibacterial compounds contained in white galangal are alkaloids, saponins, phenols, flavonoids[9], tannin[10] and essential oils[11]. Saponin works as a natural surfactant that can bind formalin and dissolve in water so that it can reduce the levels of formalin in food ingredients[12]. Saponins are a group of glycoside compounds with astringent taste and antibacterial properties[13]. Saponin is also known as a natural surfactant because it has soap-like properties[14].

Based on the explanation above, the main objective of this study was to determine the effectiveness of white galangal extract (*Alpinia galanga* W.) as a reducer of formalin levels in milkfish fillets (*Chanos chanos* F.). In addition, the mechanism of formalin as a preservative can inhibit bacterial growth because formalin reacts with protein which causes the protein to become hard and insoluble[15], it is necessary to conduct a protein test in this study to determine the effect of galangal extract about the protein content of milkfish fillets and to conduct organoleptic tests (appearance, aroma and texture).

## 2 Methods

### 2.1 Types of Research

The type of research used in this study is the experimental method. The experimental method is a research method that is carried out on two groups where group one is without any treatment or is stated as the control group and the second group is the group that will be given treatment or stated as the control group test[16].

### 2.2 Place and Time of Research

The research was conducted at the Food Technology Chemistry Laboratory, Faculty of Agriculture, Dr. Soetomo University, Surabaya and the Marine and Fisheries Laboratory, Faculty of Agriculture, Trunojoyo University, Madura. This research was conducted from June 3 to June 26, 2024.

### 2.3 Tools and Materials

The equipment used in the study were beaker glass, measuring flask, measuring cup, stirring rod, dropper pipette, Erlenmeyer flask, analytical balance, hot plate, blender, digital balance, filter cloth, knife, cutting board, basin, stopwatch, mortar, pestle, burette and stand.

The main material used in the study was 1.5 kg of white galangal rhizome obtained from farmers in the Trawas area, Mojokerto Regency. The sample material used was 4 kg of milkfish obtained from pond farmers in the Sedati area, Sidoarjo Regency. The materials used for chemical analysis were 37% formalin solution, dilute hydrogen peroxide, 1 N NaOH, pp indicator, 0.1 N HCl, K oxalate and distilled water.

### 2.4 Research Design

The research design used was a Completely Randomized Design (CRD) which consisted of 7 treatments and was repeated 3 times. The treatments used are as follows:

- L0P0 = galangal extract concentration 0%, soaking time 0 minutes
- L1P1 = galangal extract concentration 20%, soaking time 30 minutes
- L2P1 = galangal extract concentration 25%, soaking time 30 minutes
- L3P1 = galangal extract concentration 30%, soaking time 30 minutes
- L1P2 = galangal extract concentration 20%, soaking time 60 minutes
- L2P2 = galangal extract concentration 25%, soaking time 60 minutes
- L3P2 = galangal extract concentration 30%, soaking time 60 minutes

### 2.5 Research Procedure

The stages in implementing this research consist of:

a. Making White Galangal Extract

White galangal rhizomes are sorted, peeled, cut into 1 cm thick pieces, weighed as much as 300 g for a concentration of 20%, 375 g for a concentration of 25% and 450 g for a concentration of 30%. Blended (speed 1, for 60 seconds) with the addition of distilled water according to the required concentration, which is as much as 1200 ml (L1), 1125 ml (L2) and 1050 ml (L3), then filtered with tofu filter cloth.

b. Soaking Milkfish Fillets in White Galangal Extract

Formalin-treated milkfish fillets were cut into 50 g pieces, then soaked in galangal extract according to the concentration of 20%, 25%, 30% and soaking time of 30 minutes and 60 minutes.

c. Chemical and Sensory Analysis

The next process is to carry out a chemical analysis of each treatment, which includes determining the formalin levels using the Acidi-Alkalimetry method[17], protein content measurement using the formol titration method[18]. Sensory analysis was carried out using a scoring test, namely a test method that provides values using a numerical scale ranging from 1-9 on the assessment sheet[19].

### 2.6 Data Analysis Technique

The parametric data obtained were analyzed using Analysis of Variant (ANOVA) using Statistic Product and Service Solution (SPSS) version 24. If the analysis results show a significant difference between treatments ( $p < 0.05$ ), then further testing was carried out using the Least Significant Difference (LSD)/Honest Significant Difference (HSD)/Duncan test at a confidence level of  $\alpha = 5\%$  depending on the value of the Coefficient of Diversity (KK). If the KK value is below 5% the LSD test is used, if the KK value is 5-10% the HSD test is used

and if the KK value is above 10% the Duncan test is used. The organoleptic test results were analyzed based on non-parametric data and tested using the Kruskal-Wallis test[20].

### 3 Results and Discussion

#### 3.1 Formalin

The percentage and average reduction in formalin levels in milkfish fillets using white galangal extract can be seen in Table 1.

**Table 1.** Percentage and Average Reduction in Formalin Levels in Milkfish Fillets

Treatment Code	Treatment	Average (ppm)	Percentage of formalin reduction (%)
L0P0	Concentration 0%, soaking time 0 minutes	0,0073 <sup>d</sup>	-
L1P1	Concentration 20%, soaking time 30 minutes	0,0056 <sup>c</sup>	23,02
L1P2	Concentration 20%, soaking time 60 minutes	0,0050 <sup>bc</sup>	32,20
L2P1	Concentration 25%, soaking time 30 minutes	0,0046 <sup>bc</sup>	37,14
L2P2	Concentration 25%, soaking time 60 minutes	0,0037 <sup>ab</sup>	48,96
L3P1	Concentration 30%, soaking time 30 minutes	0,0033 <sup>a</sup>	54,44
L3P2	Concentration 30%, soaking time 60 minutes	0,0026 <sup>a</sup>	63,42

Information: the same symbol after the number in the mean indicates no difference in the 5% HSD test.

The results of the Analysis of Variant (ANOVA) showed that different concentrations and soaking times had a very significant effect on the formalin content of milkfish fillets. The formalin content in milkfish fillets decreased after soaking using white galangal extract. The decrease in formalin levels can be seen by comparing the control with each galangal extract treatment. The highest percentage decrease in formalin levels in milkfish fillets was obtained in the L3P2 treatment of 63,43%, while the lowest percentage decrease in formalin levels was obtained in the L1P1 treatment of 23,02%. Based on the research results, show that the higher concentration of galangal extract and the longer soaking, the greater reduction in formalin levels in milkfish fillets.

The decrease in formalin levels in milkfish fillets can occur due to the presence of saponin compounds contained in galangal. Saponin is a glycoside compound consisting of glycone and aglycone[21]. Saponins have properties like soap or detergent, so saponins are often referred to as natural surfactants[14]. The mechanism of saponin compounds in reducing formalin levels through saponification reactions. Surfactants have two groups, namely hydrophilic (polar) and hydrophobic (non-polar) which can bind formalin by reducing its surface tension, so that it can produce a soap solution that has a role as a cleaner better than water. Saponin compounds that have bound to formalin will dissolve and then form micelles. The round and oval shaped micelle head will face outward and interact with water and formalin (polar), so that formalin also dissolves with water[22].

#### 3.2 Protein

The percentage and average increase in protein content of milkfish fillets using white galangal extract can be seen in Table 2.

**Table 2.** Percentage and Average Increase in Protein Content Of Milkfish Fillets

Treatment Code	Treatment	Average (ppm)	Percentage increase in protein (%)
L0P0	Concentration 0%, soaking time 0 minutes	10,6642 <sup>a</sup>	-
L1P1	Concentration 20%, soaking time 30 minutes	10,7656 <sup>ab</sup>	0,94
L1P2	Concentration 20%, soaking time 60 minutes	10,8783 <sup>b</sup>	1,91
L2P1	Concentration 25%, soaking time 30 minutes	11,0733 <sup>c</sup>	3,69
L2P2	Concentration 25%, soaking time 60 minutes	11,4453 <sup>d</sup>	6,82
L3P1	Concentration 30%, soaking time 30 minutes	11,6938 <sup>e</sup>	8,80
L3P2	Concentration 30%, soaking time 60 minutes	12,9808 <sup>f</sup>	17,85

Information: the same symbol after the number in the mean indicates no difference in the 5% LSD test.

The results of the Analysis of Variant (ANOVA) showed that different concentrations and soaking times had a very significant effect on the protein content of milkfish fillets. The protein content of milkfish fillets increased

after being given a soaking treatment using galangal extract. The highest increase in protein content was obtained in the L3P2 treatment, namely a concentration of 30% and a soaking time of 60 minutes, increasing by 17,85%, while the lowest increase in protein content was in the L1P1 treatment, namely a concentration of 20% and a soaking time of 30 minutes, which was 0,94%. The results of the study showed that the higher concentration and soaking time, the higher protein content. This event is by the research conducted by Hartati and Trivena (2024) which states that the higher the basil leaf solution and soaking time, the greater the effect on increasing the protein content of white tofu[21].

The mechanism of increasing protein levels can occur due to the presence of saponin content in galangal extract which causes the methylene bond to break. Methylene compounds are a type of chemical compound bond that is easily broken down, so that formalin and protein can be broken down back into their original form[23].

### 3.3 Organoleptic

The organoleptic test is used to measure the product's acceptability including appearance, aroma and texture by testing using the human senses. The method used in this study is the organoleptic test scoring method using a number scale ranging from 1-9 on the assessment sheet[19].

#### 3.1.1 Appearance

The results of the organoleptic test of the appearance of milkfish fillets showed that the L1P1 treatment obtained the highest score of 7,72, while the lowest organoleptic of milkfish fillets was obtained in the L3P2 treatment with a score of 7,32. The specifications of the appearance of milkfish fillets with the treatment are that they have a specific type of color and are less bright[24]. The average appearance of milkfish fillets can be seen in Figure 1.

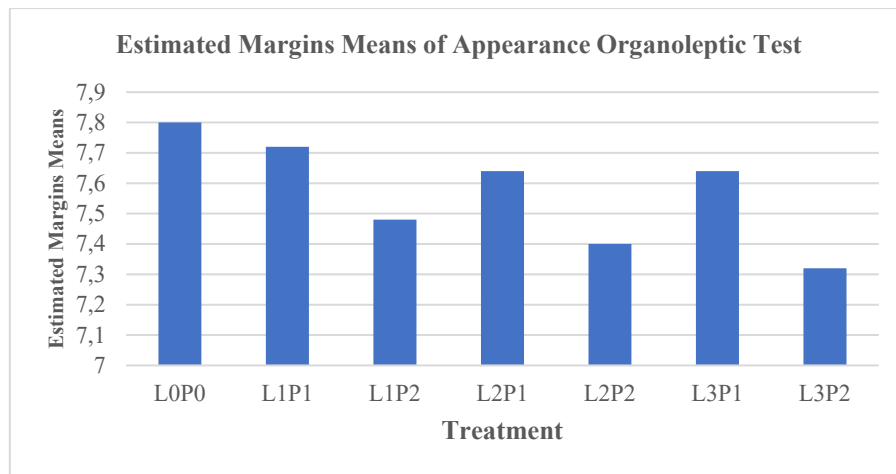
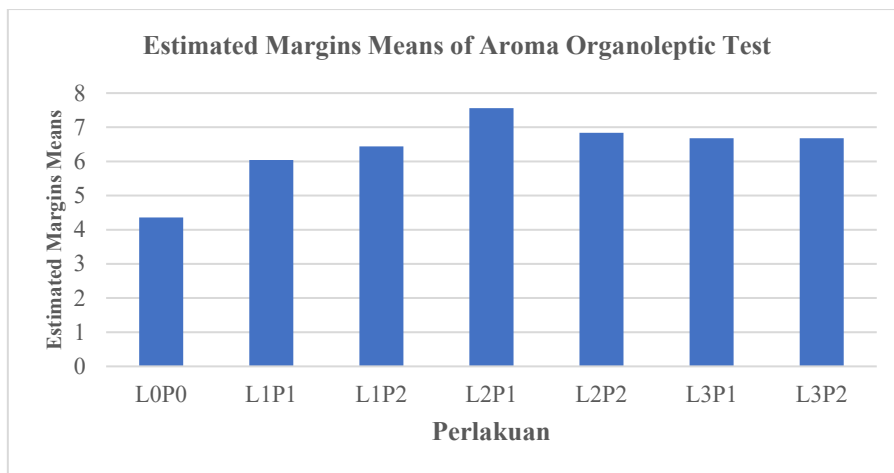


Figure 1. Appearance Organoleptic Histogram

Based on the Kuskal Wallis test, the appearance of milkfish fillets ( $p = 0,028 \geq \alpha = 0,05$ ) shows that there is a real difference between each treatment, meaning that different concentrations and soaking times affect the level of panelist acceptance about the appearance of milkfish fillets. The results of the study showed that the appearance of milkfish fillets decreased due to the process of soaking milkfish fillets in galangal extract for too long, this is similar to the opinion of Insani, et al (2016) who stated that fish fillets that were soaked had a paler color, this occurs because the solution binds to the meat tissue which causes the color to change[19].

#### 3.1.2 Aroma

The results of the organoleptic test of the aroma of milkfish fillets showed that the L2P1 treatment obtained the highest score of 7.56. The specifications of the aroma of milkfish fillets in this treatment are that they have a neutral aroma and are still suitable for consumption. The average aroma of milkfish fillets can be seen in Figure 2.

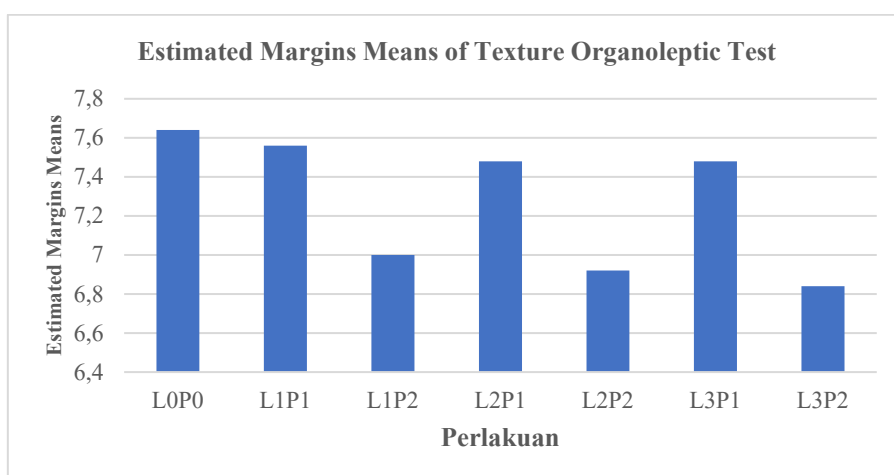


**Figure 2.** Organoleptic Aroma Histogram

The results of the Kruskal Wallis test on the aroma of milkfish fillets ( $p = 0,006 \leq \alpha = 0,05$ ) indicate that there is a very significant difference between each treatment, meaning that different concentrations and soaking times greatly affect the level of panelist acceptance about the aroma of milkfish fillets. The results of the study showed that the aroma of milkfish fillets without treatment and milkfish fillets with L1P1 and L1P2 treatments had a pungent sour aroma caused by the addition of 5% formalin. The aroma of milkfish fillets increased in the L2P1 treatment, which had a neutral aroma and was still suitable for consumption because it had a high score [25]. There was a decrease in the L2P2, L3P1 and L3P2 treatments, namely the galangal aroma was quite sharp so that it covered 30 typical aromas of fish meat. Jannah et al., (2014) stated that the distinctive aroma of this plant is due to the presence of terpenoid compounds. In galangal essential oil and has water-soluble properties [4].

### 3.1.3 Texture

The results of the organoleptic test of the milkfish fillet texture showed that the L1P1 treatment obtained the highest score of 7,56, while the lowest organoleptic texture was in the L3P2 treatment with a score of 6,84. Based on the results of the Kruskal Wallis test, the texture of milkfish fillets ( $p = 0,012 \geq \alpha = 0,05$ ) indicates that there is a significant difference between each treatment, meaning that different concentrations and soaking times affect the level of panelist acceptance about the texture of milkfish fillets. The results of the study showed that the longer the soaking time of the galangal extract, the lower the texture of the fish fillets. The texture of milkfish fillets in the L3P2 treatment obtained a score of 6,84, which shows that the texture of the fish fillets is still dense, somewhat elastic but slightly watery. Insani et al., (2016) stated that the texture of fish that experiences changes is also influenced by the amount of water in the fish's body, the main thing that causes changes in texture in fish is that the fish's flesh tissue is unable to maintain its water content [19]. The average texture of milkfish fillets can be seen in Figure 3.



**Figure 3.** Texture Organoleptic Histogram

## 4 Conclusion

The results of the study proved that white galangal extract with a concentration of 30% and a soaking time of 60 minutes was the most effective treatment in reducing the level of formalin in milkfish fillets with a reduction efficiency of 63,42%, while the protein content of milkfish fillets increased by 17,85%. The results of the organoleptic test of the appearance of the best milkfish fillets were obtained in the L1P1 treatment of 7,72 which means the color is specific to the type and less bright, the best aroma in the L2P1 treatment of 7,56 which means it has a neutral aroma and the best texture in the L1P1 treatment of 7,56 which means dense, less compact and less elastic.

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