The effect of kappa-carrageenan fortification on the physicochemical and organoleptic properties of milkfish galantin

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Abstract. Galantin milkfish are a processed fish fillet-based milkfish that has a brownish color and a cylindrical shape with a savory taste. Galantin milkfish are rich in protein from eggs but the fat content is also high. Too much egg consumption can trigger the nature of alegi. The high content of eggs in a product causes the product to become softer because the water content in eggs reaches 88.57% in egg whites and 48.50% in egg yolk. There is a need for fortification with carrageenan, which aims to improve the nutritional value and product quality. Carrageenan has a sulfate content and 3,6-anhydro-D-galactose content which can influence the gel strength in order to improve texture. This research aims to know the effect of kappa-carrageenan fortification on the physical, chemical, and organoleptic properties of milkfish galantine. The result of this research was that the fortification of carrageenan has an influence on the physical properties (hardness, adherence, and elasticity), chemical components (moisture content, ash content, protein, and carbohydrate) and organoleptic qualities (texture). The average result of the organoleptic value indicates that the milkfish products can be accepted by consumers and that higher carrageenan concentrations may influence the panelists concerning the texture of milkfish galantine texture.

1. Introduction
The processing of milkfish (Chanos chanos) is usually often processed as milkfish, thorns, soft thorn milkfish, milkfish presto, milkfish brains, smoked milkfish, and milkfish galantine [1]. Galantin milkfish can be used as an alternative to extend product storage quality. The processing of milkfish as galantine is also able to increase the variety of the consumption of processed milkfish. Galantin Bandeng is a raw material made from fillets or surimi from milkfish meat using eggs; the product is rich in protein but the fat content is also high. The texture of the milkfish galantine is chewy but easily destroyed during the product cuts, which can affect the level of public consumption. According to [2], in order to increase the elasticity of the product, Arab gum can be added. Too much flour content will make the product drier.

The egg content in galantine has a high saturated fat content, which can trigger cholesterol [3]. Eggs in food products are often used as emulsifiers to maintain texture, but too much egg consumption can trigger alegi. The 2007 Allergy Immunology Polyclinic at RSCM noted that allergy cases involving eggs reached 9% in Indonesia. The high egg content of a product causes the product to be
softer; this is because the moisture content in eggs reaches 88.57% in egg white and 48.50% in egg yolk [4].

Fortification is the addition of nutrients to one or several food ingredients with the aim of increasing the nutritional value and improving the products [5]. Carrageenan fortification in milkfish galantine is an alternative in food (food grade) and can improve product quality. The main content of carrageenan is a fiber that can improve the nutritional content and texture of milkfish galantine. Carrageenan is a hydrocolloid compound that is widely used as an emulsifier and that has a fiber content of 68.55% [6].

Carrageenan has been widely used in the food industry and there has been a lot of research on processed sausage and meatball products [7]. However, milkfish galantine products have a different gel texture and strength to sausages and the ingredients use other carrageenan emulsions. This is the basis of this research on the effect of adding kappa-carrageenan to the physical, chemical and organoleptic properties of milkfish galantine.

2. Material and method
This research was carried out at the Food Laboratory of the Faculty of Fisheries and Maritime Affairs of Airlangga University. The testing of fat and protein levels was carried out in the Chemical Laboratory of the Faculty of Science and Technology of Airlangga University.

2.1 Material
The research material used was milkfish milk PT. Kelola Mina Laut, Gresik. Carrageenan from red Algae (Kappaphycus Alvarezii) was obtained from PT. Kappa Carrageenan Nusantara Pasuruan (Indonesia) with a gel strength of 700 g / cm2. The material used for the manufacture of milkfish galantine was milkfish meat, bread flour, seasoning flour, garlic, milk, salt, java sugar, pepper, nutmeg, cooking oil and carrageenan PT. Kappa Karaginan Nusantara. The materials used for the analysis of the proximate levels in proteins were Kjeldahl Tablet (VWR Chemicals), concentrated H2SO4 (MERCK), 50% NaOH (MERCK), 0.1 N HCL (MERCK), 0.1 N NaOH (MERCK), Methyl Indicator red (MERCK), and for fat it was hexane solvent (Sigma Aldrich).

The tools needed in this study were masks, gloves, trays, buckets, knives, plastic bags, volume pipettes, funnels, glass bottles, label paper, newsprint, filter cloth, Erlenmeyer tubes (IWAKI), tweezers, dropper pipettes, stirring rod, Beaker glass (IWAKI), porcelain cup (made in China), crush pliers (crush pliers), analytic scales (OHAUS PA 214), Philips food processor 650 watts, moisture analyzer (MAX), texture analyze (CT Brookfield, USA), desiccators and an oven (MEMMERT UN 55).

2.2 Procedure
2.2.1 Manufacture of milkfish galantin
The process of making milkfish aims to separate the fish meat from its bones. In other words, meaning that the meat can be eaten by removing the skin. The meat will be crushed to produce half-cooked ingredients (surimi). Making surimi can cause the process of gel formation due to the washing process of the cold water preventing the protein denaturation of actomyosin [8]. Milk fish meat is separated from the soft spines using a meat bone separator.

The next process is the kneading process. This is done by mixing other ingredients until they were homogeneous or evenly mixed. The kneading process is the process of adding ingredients that have binding and filling properties. The process of making dough is strongly influenced by the ability of the meat, with the addition of salt, water and auxiliary materials such as polyphosphates and other ingredients that function to form emulsions, with stable fat [9]. Dough with a good consistency, elasticity, viscosity, and elasticity can affect the product’s characteristics [10]. The mixing process of this mixture does not use eggs as an additive but instead, substitutes it using carrageenan.
Galantin filling on the sleeves made of plastic are not edible, can be made porous or not, and the shape and size can be re-arranged. Plastic packaging used when filling dough and fish meat must have heat-resistant properties, and can be printed. The last stage in making milkfish galantine is the steaming process. Gelatinization will occur in the steaming process. The process of gel formation is influenced by temperature. The critical temperature in the steaming process will make the texture of the milkfish galantine supple and stiff. A high amylopectin content or low amylose content will make the product sticky. Steaming has the purpose of reducing the moisture content of the ingredients so then the texture becomes compact.

2.2.2 Texture analysis
The texture tests in this study include the nature of violence, stickiness, and elasticity. This test used Brookfield Texture ProCT with a probe speed of 10 mm / s and the sample was pressed to 30%. The results of this analysis were obtained from the TXT 32 texture analyzer software macro-program. The data analysis was done using texture analysis and then the researcher carried out the DMRT test to determine differences in each treatment [11].

P1: Addition of Carrageenan 0.0%
P2: Addition of Carrageenan 1.0%
P3: Addition of Carrageenan 1.5%
P4: Addition of Carrageenan 2.0%
P5: Addition of Carrageenan 2.5%

2.2.3 Chemical test
The chemical test is a test where the quality of the product is measured objectively based on the chemical content of the product itself. This chemical test included the moisture content, ash content, fat, protein and carbohydrate. The water content test used a Moisture Analyzer. The product’s water content can reduce product quality. The ash level test [12] conducted on the galangan milkfish involved weighing the remaining minerals as a result of the combustion of organic matter at temperatures of around 550°C. The porcelain cup was dried in an oven for one hour at 105 °C and then cooled for 30 minutes in a desiccator to absorb the moisture in the cup to allow it to be weighed at a fixed weight (A). A sample of one gram (B) was inserted into a porcelain cup and put into an electric furnace at 600 °C for approximately six hours. The testing of the 2005 AOAC protein content resulted in 0.1 g; the sample was placed in a 100 mL kjeldahl flask and selenium was added in a 1: 1 ratio with samples and 3 mL concentrated H2 SO4. The sample was drained until the solution became clear for one hour. The destructive flask was cooled and then 50 mL of aquadest and 20 mL 40% NaOH was added. It was then distilled. The distillation results in an erlenmeyer contain a mixture of 10 mL of 2% H 3 BO3 solution and 2 drops of pink Cresol Green Methyl Red. After the distillate volume became 10 mL and a bluish green, the distillation was stopped and the distillate was titrat ed with 0.1 N HCl until pink.

2.2.4 Organoleptic test
The results of the testing of the organoleptic values for appearance, smell, taste and texture were found with the help of 25 panelists. The value specifications were as follows: very very like 9; really like 8; like 7; rather like 6; neutral 5; rather dislike 4; do not like 3; very dislike 2 and very very dislike 1. [13].

2.2.5 Data analysis
The data obtained from the research results in the form of physical and chemical properties were then analyzed using ANOVA (Analysis of Variance) to determine whether or not there were differences in the results of each treatment. The results of the analysis were continued to be analyzed with the
Duncan Multiple Range Test (DMRT) in order to determine the value of the critical point in each treatment.

3. Results and discussion

3.1 Physical analysis

| Treatment | Hardness (g) | Adhesiveness (mJ) | Elasticity (mm) |
|-----------|--------------|-------------------|-----------------|
| P1        | 187.27±1.91 | 2.05±0.03         | 7.24±0.01       |
| P2        | 182.52±1.19 | 1.93±0.05         | 7.52±0.01       |
| P3        | 146.92±1.80 | 1.75±0.03         | 7.58±0.12       |
| P4        | 144.82±1.53 | 1.72±0.03         | 7.65±0.41       |
| P5        | 110.20±0.94 | 1.59±0.01         | 8.18±0.12       |

Table 1. Physical Analysis

Note: P1 (Addition of Carrageenan 0%), P2 (Addition of Carrageenan 1%), P3 (Addition of Carrageenan 1.5%), P4 (Addition of Carrageenan 2%) and P5 (Addition of Carrageenan 2.5%). The notations shown in different superscript letters in the same column show that the comparison between the treatments has a significant difference (P <0.05).

Hardness is the amount of compressive force needed to break solid products [14]. Based on the hardness test, it shows that the higher carrageenan concentration can make the texture tenderer. This is in accordance with [15]’s statement that the addition of carrageenan can affect product hardness due to the binding power of water. The biggest carrageenan concentration treatment has a smaller hardness value than the other treatments. This shows that the addition of carrageenan at an optimal concentration can provide the texture of a supple galantine.

Adhesiveness shows that it is inversely proportional to the value of hardness treatment without adding carrageenan, and that it was the smallest compared to the other treatments. The addition of carrageenan means that the starch content will be able to fill the space. The galantine will therefore be more dense [16]. Carrageenan is hydrocolloid, so then it has the ability to reduce the free water content in food which can cause carrageenan to function as an adhesive [17].

The elasticity of a product can be affected due to trapped water forming a gel due to galantine products undergoing a heating process with a temperature of 90 °C. This is in accordance with [18]’s statement that the gel formation can be formed up to temperatures above 70°C. The myofibril fibers and proteins form a strong mesh structure and the water is trapped inside. Carrageenan has the ability to form a gel thermo-reversible, so it is widely used as a gelling agent.

3.2 Chemical analysis

| Water | Protein | Lipid | Ash   | Carbohydrate |
|-------|---------|-------|-------|--------------|
| P1    | 56.81±0.51 | 13.66±0.48 | 4.82±0.59 | 1.04±0.13 | 22.99±1.12 |
| P2    | 47.11±0.21 | 14.37±0.13 | 4.45±0.21 | 1.32±0.17 | 32.69±0.36 |
| P3    | 48.22±0.83 | 14.11±0.46 | 4.48±0.12 | 1.36±0.04 | 31.81±0.56 |
| P4    | 54.73±0.63 | 14.69±0.35 | 3.71±0.21 | 1.37±0.11 | 25.54±0.31 |
| P5    | 59.08±0.85 | 15.46±0.43 | 4.26±0.40 | 1.73±0.07 | 20.16±0.94 |

Note: P1 (Addition of Carrageenan 0%), P2 (Addition of Carrageenan 1%), P3 (Addition of Carrageenan 1.5%), P4 (Addition of Carrageenan 2%) and P5 (Addition of Carrageenan 2.5%). The notations shown in different superscript letters in the same column show that the comparison between the treatments has a significant difference (P <0.05).
The water content, with a high enough value, can be caused by the content of the raw materials derived from the milkfish itself, which has a water content of 60% - 80% [19]. The basic content of carrageenan is sulfate, which is a polysaccharide and therefore able to bind water, prompting the formation of the gel.

The fat test results conducted on the milkfish galantine products do not have an influence on the milkfish galantine itself. The decrease in fat content can be caused due to the heating process involved in processing the milkfish; the fat can be hydrolyzed into glycerol and fatty acids [20].

The ash content describes the total amount of minerals contained in the product where the treatment of the ash content is inversely proportional to the water content. By increasing the carrageenan concentration, there is an increase in the ash content.

Carbohydrates are one of the main sources of calories for humans, other than protein and fat [21]. The results of the study of carbohydrate in difference levels of galantine milkfish shows that when the addition of carrageenan gets bigger, the carbohydrate nugget levels get smaller. This is in accordance with [22], which utilizes carrageenan when making dodol. This decrease in carbohydrates is thought to be due to this analysis, albeit using only a rough calculation method.

3.3 Organoleptic

![Figure 1. Organoleptic of milkfish galantine](image)

The appearance of the milkfish galantine products is affected by the addition of carrageenan due to the white carrageenan properties fusing with the mixture [23]. Brownish color changes from the galantine can be caused by the addition of brown sugar which can cause a maillard reaction due to steaming [24].

The smell was determined by directly smelling the good milkfish galantine in order to determine the odor of the fish without any additional odors. The addition of carrageenan to mayung fish meatballs showed results that were not significantly different from the aroma criteria originally; the addition of carrageenan flour did not affect the aroma [25].

The results of the organoleptic taste test with the addition of the highest concentration of carrageenan and without carrageenan were both included in the category of a fish-specific taste. This shows that the panelists received the milkfish galantine product and that there was no significant effect
from the addition of carrageenan. The taste of milkfish galantine has a specific fish odor because carrageenan has a neutral taste; the addition of carrageenan has no effect on the taste parameters [7].

The texture parameters of the milkfish galantine in general showed that the addition of carrageenan influenced the panelist’s preference. Physically, one of the texture tests was elasticity. The addition of carrageenan with a concentration of 2.5% was the preferred texture. This shows that the higher concentrations can improve the texture, making it become supple. The texture of milkfish galantine can also be caused through the raw material of milkfish and additional ingredients such as eggs [26].

4. Conclusion
Based on the results of the carrageenan fortification studies, it has an effect on the physical, chemical and organoleptic properties involved. Fortification with the 2.5% carrageenan concentration in milkfish galantine was the one that best met the consumer criteria.

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