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# The Organoleptic and Physicochemical Characteristic of Gelato by Fish Bone Gelatin Addition

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## ABSTRACT

This study aims to determine the effect of fish bone gelatin addition on physical, chemical, and organoleptic characteristics of gelato. This research was done on three stages: fish bone gelatin extraction, gelato production and analysis. The treatment factor consists of concentration: 0%, 0.4%, 0.8% and 1.2% of fish bone gelatin additions. Data were analyzed by one way analysis of variant (ANOVA) at level 5% and then continued by Tukey HSD (Honestly Significant Different) test or Tukey's range test. The result shown that fish bone gelatin addition has effect to organoleptic, physical, and chemical characteristics of gelato. The best concentration was 1.2% for fish bone gelatin addition. Gelato with concentration 1.2 % fish bone gelatin have texture, taste, colour, aroma and aftertaste range in neutral until like slightly in organoleptic (hedonic) value range i.e. between 2.62 until 3.70. This gelato have overrun, melting point and pH in 30.48%, 38.4 minutes and 6.6 respectively. It was contains 3.62% protein, 6.32% fat, and 15.62% sucrose. This nutrition contents was confirm with the Indonesian National for Standardization (SNI) for ice cream groups.

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## INTRODUCTION

Ice cream is a food which made from milk and then blended with water, sweeteners, stabilizers, air, and milk solids without fat (skim milk), as well as flavor [18]. The concentration of each ingredient of ice cream may different depending on the country where the ice cream is produced [5]. Gelato is ice cream from Italian origin with low fat and slight high sugar content. The advantages of gelato compared to general ice cream are the gelato has a more high density and melting time point [8].

Unfortunately, the weaknesses in the ice cream processing is relatively has been low melting time. Therefore it is necessary attempt to achieve the condition of melting time that accordance with ice cream quality. It is provide

by the addition of stabilizer [14]. Latifah [8] stated that usually stabilizer which used in gelato processing has been an egg yolks. It was produced preferred gelato texture which soft and smooth. Alfaifi & Stathopoulos [2] study also was use an egg yolk in order as stabilizer for gelato preparation. It was increase the hardness and density of the texture in gelato. However, based our preliminary research sometimes still found that the hardness of gelato was too hard in the presence of an egg yolk as a stabilizer. It was probably due to protein lecithin complex. So that is needed the additional stabilizer to stabilize and neutralize the hardness and make the balance in texture. This is in accordance with some literature that stated previously [6]. The use of additional stabilizers as thickening agent in gelato preparation could provide more supple texture. One of the stabilizers that can be utilized is gelatin.

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Gelatin is a protein produced from the hydrolysis of animal collagen. Gelatin that developed in the industrial field has been a gelatin derived from animals that are not as halal as pigs, though have also developed halal gelatin derived from cows. However, with the issue of diseases that infect cows such as mad cow disease, mouth and nail disease as well as prohibition for the Hindu community to consume cows, it is become consideration to provide alternative gelatin derived from halal sources and less risk of disease [7]. Alternative sources of gelatin that have great potential to develop are gelatin from fish body parts such as bone and skin. According to Mahmoodhani et al. [9], gelatin from *Pangasius catfish* bones have characteristics that resemble with cow gelatin so that this a great opportunity to be developed. The result of research Atma & Ramdhani [3] has been obtained gelatin from *Pangaisus catfish* bone which has physical and proximate characteristics according to standard [19].

In consideration, the use of fish bone gelatin as a stabilizer could affects the physical, chemical, and organoleptic properties of gelato. Similar to other processed food products, physic-chemical and organoleptic parameters are important parameters that affect the quality of gelato. The organoleptic parameters are the easiest and efficient to be done and can represent the acceptance of the product by the consumer such as hedonic test. The physical and chemical analysis of the product was conducted and done in the best formulated treatment based on the organoleptic test. It is also an efficient way to ensure that the gelato quality parameters that was analyzed representative.

## EXPERIMENTAL METHOD

### Materials and Methods

The materials used in this study consisted of reagen for the extraction of fish bone gelatin, ingredients for gelato preparation, and analysis materials. The materials was used to make gelatin including catfish bones, pineapple skin, aquadest. The ingredients was used to making gelato including fresh liquid milk, skim milk, granulated sugar, egg yolk, and fish bone gelatin (FBG). The chemicals was used for the analysis such as hexane,

H<sub>2</sub>SO<sub>4</sub>, HCl, H<sub>3</sub>BO<sub>3</sub>, (NH<sub>4</sub>)<sub>2</sub>HPO<sub>4</sub>, KI, Pb-acetate, and Luff solution. The equipment that used in this research was equipment used to extraction bone gelatin and gelato processing. The equipment for gelatin extraction such as the analytical balance, food dehydrator, waterbath, shaker, and grinder. The equipment for gelato processing including ice cream maker, analytical balance, mixer, and stainless steel kitchen appliance. While, the equipment that used for analysis was sochlet, Kjeldahl, pH meter, Refractometer, and other laboratory apparatus.

### Research Stages

The research was done in three stages. The stage of preparation comprises the preparation stage of gelatin from *Pangasius catfish* bone and gelato processing stage.

### Extraction of Gelatin

The catfish bone washed and boiled for 15 minutes at 80 °C then dried by refrigerator and mashed using a meat grinder. The fish bone then was run into pretreatment with pineapple waste liquid extract in 1:4 (m/v) and soaked for 56 hours. Then rinsed with aquadest until neutral pH. In this this stage will be obtained an ossein. The ossein was then extracted with aquadest for 5 hours at 75 °C. Then the liquid filtrate was filtered using cheese cloth and stored in a refrigerator at 4 °C. The obtained liquid filtrate was namely liquid gelatin. Liquid gelatin was then dried using food dehydrator for 3-5 hours with a temperature of 65 °C [3].

### Gelato Processing

Making gelato in this research was made with percentage of fresh milk 65%, skim milk 7.5%, whippy cream 8%, sugar 15%, 4% yolk, gelatin used 0%, 0.4 %, 0.8 %, 1.2%. All ingredients are weighed according to the formulation specified. Dried gelatin was placed in a separate place. Skim milk and skimmed paste mixture few minutes until the temperature reaches 75-80 °C and it is namely the first dough. The egg yolks and some sucrose mixture in sugs until fluffy and then added cream and stirred until balance or evenly, it is namely second dough. When the first dough temperature reaches 80-90 °C, the second dough is put into the first dough and stirred until homogeny.

Then the mixed dough was added the fish bone gelatin treatment and stirred again as

well as cooled in room temperature. The dough was aged for 2-4 hours at 0-5 °C. After that, the aged dough was put into ice cream maker for water incorporation at -3 to -9 °C for 30 minutes. Finally, the gelato was packed on ice cream cup with 10-15 ml volume cup and stored into freezer until analysis.

## The Method of Analysis

### Organoleptic Test

Organoleptic test performed on gelato was a hedonic test. The panelists delivery for filling out a prepared questionnaire to rate the product on a scale 1) do not like 2) dislike slightly 3) neutral 4) like slightly and 5) likes. The parameters used in this hedonic test including colour, aroma, texture, taste, and aftertaste. The total panelist for this organoleptic test was 25 panelist.

### Analysis of Physical Characteristic

**Overrun**, overrun is the percentage increase in the volume of ice cream due to the process of entering the air (water incorporation) into the dough [5].

**Old Time of Melting**, the duration of the melting time was calculated by placing the sample in a beaker glass of 1 spoon. Observations were made at room temperature 25 °C with balance moisture and clean place [5].

**pH value**, the sample was prepared, then the sample pH was measured by standardized pH meters with buffer solution at pH 7. The electrode was rinsed and dried with a tissue and then immersed into the test sample. pH meter was allowed to show a stable value [1].

### Analysis of Chemical Characteristic

**Protein Content Method Foss Tecator Kjeltex 8400**, the samples was weighed as much as 1 g and put into the kjeltex tube. Then, added with 2 g of selen mixture and 12 ml of concentrated H<sub>2</sub>SO<sub>4</sub>. After that, turn this solution on the digestion block and destructed at 400 °C for 1 hour. Then the mixture turned off and cooled. Finally, the sequence samples on kjeltex with AN300 was programmed and then kjeltex tube was installed and run sequence for analysis.

**Fat Content by Hydrolysis/Weibull Method (SNI 01-2891-1992)**, samples weighed as much as 2 g into the cup glass. Then added 30 ml of 25% HCl and 20 ml of aquadest as well as some of the boiling stone. Then boiled for 15 minutes in closed a cup glass. After that, it was filtered during heat and washed with hot water until it does not react acid again. The filter paper containing samples was dried at a temperature of 100-105 °C. Then, extracted with hexane for 3 hours at 80 °C and then this solution was distilled. Finally, the extract was dried at 100-105 °C and cooled in a denticator as well as weighed until fixed weight.

**Sakarosa Content of Luff-Schoorl Method, SNI 01-2891-1992 [15]**, around 2 grams of sample put into 100 ml measuring flask. Then aquadest was added and homogeneous. Then as much as 5 ml of acetate was added in half base and homogenize. Thereafter, adding 1 drop of 10% (NH<sub>4</sub>)<sub>2</sub>HPO<sub>4</sub> solution was done when white precipitation arises that means some Pb acetate was added. Then, about 15 ml of 10% NaOH solution added and also few drops of H<sub>2</sub>PO<sub>4</sub> 10% (NH<sub>4</sub>) solution put into solution. Then adding again to test solution of half-base Pb-acetate and precipitated. After that continued with filtered. Next step was picked about 10 ml of the filterate and this solution put into 50 ml measuring flask. Then, around 5 ml of HCl was added and hydrolyzed. The hydraulic (thermometer plug) need in this step for keep temperature at 70 °C during 10 min. Furthermore, the 30% NaOH was added for neutralize condition as indicator and adjusted aquadest and homogenized. Then, picking 10 ml of solution into Erlenmeyer 300 ml, and 15 ml aquadest was added. It is also 25 ml of luff solution, was added and the boiling stone. The next step is heating solution in an electric bath and connecting with the coolant. It was straight up to the boiling solution within 10 minutes and then refrigerated. Finally, the 10 ml 20% KI solution was added and 25 ml of H<sub>2</sub>SO<sub>4</sub> 25% also added slowly. The titration was using tio 0.1 N indicator starch 0.5% (V1). Then the blank (V2) also titrated by using 25 ml aquadest and 25 ml luff solution.

## RESULTS AND DISCUSSION

### Organoleptic

#### 1.Texture

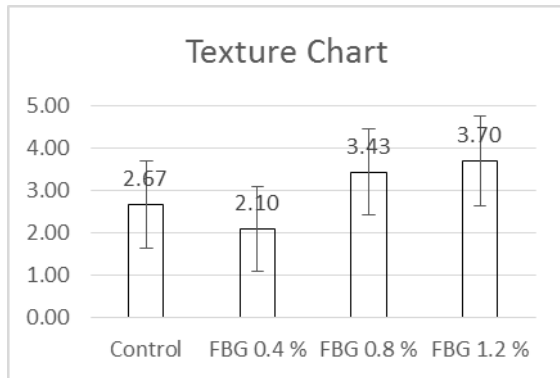


Fig. 1. Texture attributes

Based on texture attributes, the highest value of texture on fish bone gelatin (FBG) concentration was 1.2% with 3.70 value of hedonic test. This is near to mean like slightly. Research Sari [12] found that the value of texture ice cream 3.29 mean which has a neutral scale, it was using gelatin from chicken feet as stabilizer. The addition fish bone gelatin concentration was significant difference ( $P < 0,05$ ) in influence of gelato texture. Marshall *et al.* [10] States that the use of stabilizers in gelato preparation as a texture gelato control can increase the viscosity of products that allow to make crystals and increasing the aggregation of fat globules.

## 2. Taste

The highest taste value of gelato was in the treatment concentration of gelatin 1.2% that best value of 2.62. It is mean near to neutral taste. Research Sari [12] on ice cream taste value obtained the value of hedonic test about 3.45 which mean neutral until like slightly, it was using gelatin from chicken legs. Based on the significant difference ( $P < 0,05$ ), the treatment of gelatin fish bone addition had significant effect on the resulting gelato taste. The taste of gelato was a sweet milk based taste due to the addition of sucrose. The lactose that originally from milk also contribute for gelato sweet taste. The sucrose used in gelato making is around 15%. This has been one of the differences between ice cream and gelato. The gelato slightly higher sugar content which is about 15% -25% [5].

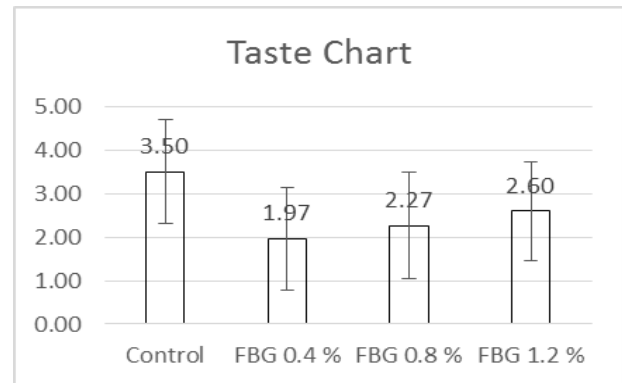


Fig. 2. The taste of gelato

## 3. Colour

In the color attribute of gelato, the value of hedonic test of gelato's color was on like slightly scale. The best hedonic value in color of gelato found in the gelatin concentration 1.2% i.e. 3.66. Research Sari [12] obtained value of color ice cream in hedonic test was 3.50 that means neutral scale, it was using gelatin from chicken legs. Based on the significant difference ( $P < 0,05$ ), the treatment with concentration gelatin addition had significant effect on gelato color. The gelato color is milky white with a slight yellowishness due to the addition of egg yolks and also carotenoid in the milk as main ingredient. There are several factors that can affect the color of gelato for example in the process of process step where are the fresh milk was pasteurized at temperature of 75-80 °C. In this process may occurs Maillard reaction. The Maillard reaction occurs due to reactions between amino acids and reducing sugars that trigger the formation of flavor and pigment melanoidin [4].

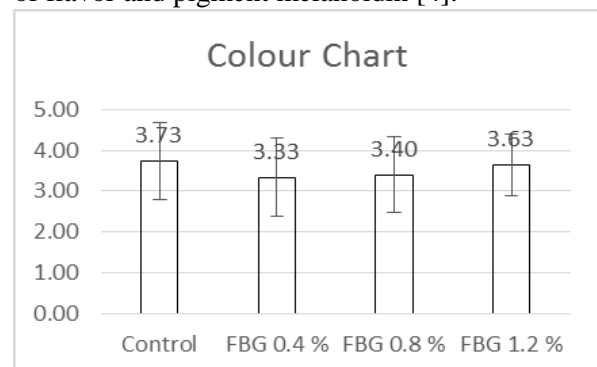


Fig. 3. The color attribute of gelato

## 4. Aroma

The aroma of gelato is a distinctive or dominantly aroma of milk due to the absence of flavor enhancement during the process [20].

The forming of aroma may also influenced by the addition of cream and it was increase due to the using of skim in this research. Preininger [11] suggests that the increasing of using the stabilizers may decrease the release of aroma due to the difficulty of the perisa component to the serum. In this hedonic test, the highest value of aroma was in 1.2% fish bone gelatin addition concentration which was 3.10 mean neutral. Based on the significant difference ( $P < 0.05$ ) test concluded that the fish bone gelatin addition had significant effect on the aroma gelato. Research Sari [12] shown that the value aroma of ice cream by gelatin from chicken legs addition was 3.24 on hedonic test, which was also mean neutral scale.

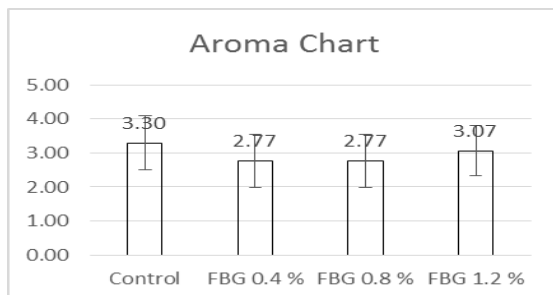


Fig. 4. The forming of aroma

### 5. Aftertaste

Aftertaste is the impression time of taste which left behind after feed test. It is generally used for organoleptic analysis. Based on this research found that the fish bone gelatin addition have significant effect with significant difference ( $P < 0.05$ ) toward aftertaste of gelato. The highest aftertaste value was 2.97 mean neutral. It was a gelato with 1.2% fish bone gelatin addition. Some reference stated that usually the sweet taste of meal has a lower aftertaste.

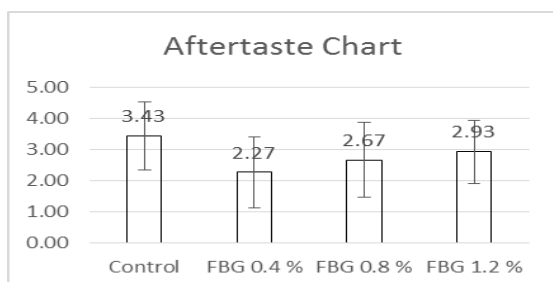


Fig. 5 Aftertaste of chart

### Physical Characteristic

Treatment of fish bone gelatin addition

with different concentrations has significantly influence to overrun of gelato. Usually, gelato has 25% until 60% overrun value [5]. The value of gelato overrun in this research was accordance with Goff & Hartel [5] theory which is 30.48%. This overrun value come from gelato with 1.2% fish bone gelatin addition. Latifah research [8] stated that the overrun value of gelato chicken based gelatin addition was 59.57%. The increasing of the air dispersion volume can lead the reduction in the density of ice crystals.

The melting of gelato caused by the transfer of heat from the air around the product into the gelato, thus it is making the melting of ice crystals [16]. According to Goff & Hartel [5], the longer melting time and stabilizer addition due to fat destabilization could increase the overrun. The melting time of gelato with gelatin concentration 1.2% was 38.44 minutes. Latifah research [8] concluded that melting time was 27.17 minutes. The higher the gelatin concentration which used could longer the gelato time go through melt.

The third physical parameter of gelato is pH. The pH value of gelato with the fish bone gelatin addition was 6.6. Latifah research [8] obtained pH value 7.07 for gelato. This pH value could affected by fish bone gelatin existence. The gelatin extraction in this research using pineapple waste solution. The pineapple have acidity in high level. The acidity of the gelato also depends on the ingredients which used in the gelato mixture [5].

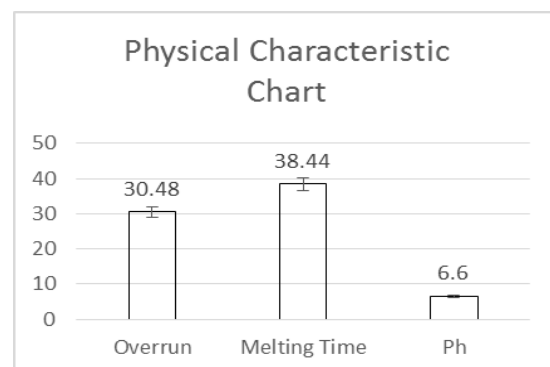


Fig. 6 Physical Characteristic of chart

### Chemical Characteristic Characteristic of Chemistry

There are three parameter for gelato nutrition including protein, fat and sucrose. This parameter was analyzed with each

methods. Generally, the protein content in ice creams is 2.5-4% (% b/b). Protein content in gelato by fish bone gelatin addition in concentration 1.2% was 3.62%. This protein content was exceeds the minimum level of protein in ice cream based on Indonesian National for Standardization (SNI) No. 01-3713-1995 [15]. The SNI require the protein content of ice cream minimal of 2.7%. Research Winarni [17] on ice cream stated that protein level of 2.5% which is using the same raw materials like skim milk, whipping cream, and egg yolks.

Fat content is a part of quality parameter of gelatin. The fat existence can improve the taste of ice cream and gelato. The addition of fat in ice cream process usually in ranges 8% to 18% [5]. Fat content of gelato with 1.2% gelatin addition was 6.32%. This fat content was also exceeds the minimum level of SNI No. 01-3713-1995 [15] about ice cream quality requirement which is 5%. The fat content in gelato comes from the raw materials for the gelato production including fresh milk, skim milk is low fat, whipping cream, and egg yolks. It is potentially increase fat content of gelato.

Saccharose content of gelato with 1.2% fish bone gelatin addition was 15.62%. It is may causes a denser-formed texture that increases the sugar content in the gelato. According to SNI No. 01-3713-1995 [15] about the quality requirement of ice cream in sugar content is minimum 8%. The sucrose addition acts as a major contributor to the saccharose content in the gelato. According Susilorini *et al.* [13] sugar that contained in cow's milk such as lactose that can only be obtained from mammals. Lactose is a disaccharides that form by two monosaccharide i.e glucose and galactose [21].

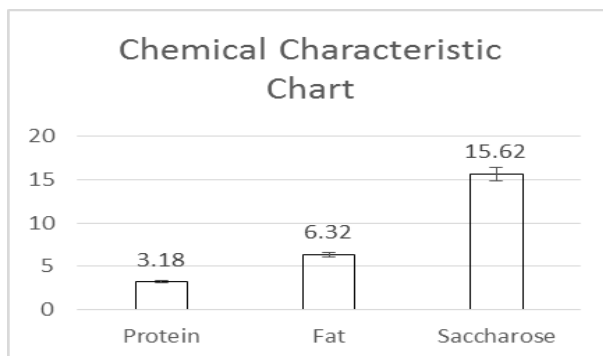


Fig. 7 Chemical Characteristic of chart

## CONCLUSION

The addition of fish bone gelatin on gelato processing step was influence the physical, chemical, and organoleptic characteristic of gelato. The best concentration of fish bone gelatin as stabilizer in gelato production was 1.2%. The 1.2% fish bone gelatin addition was obtain texture, taste, color, aroma, and aftertaste values were 3.37, 3.52, 4.00, 3.38, and 3.59, respectively. The best gelato from organoleptic test was selected for analysis of physical and chemistry characteristics. This gelato have overrun, melting time and pH in 30.48%, 38.4 minutes and 6.6 respectively. The gelato has 3.62% protein content, 6.32% fat content and 15.62% saccharose.

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