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Effect of concentration of *Osteochilus hasselti* (Valenciennes, 1842) skin gelatin on ice cream's preferences level

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ABSTRACT

This research aims to determine the concentration of the use of nilem skin gelatin in order to obtain the most preferred ice cream. The treatment is the concentration of the use of nilem skin gelatin 0.2%, 0.3%, 0.4%, and CMC 0.4% (control) of the total mixture of ice cream ingredients (full cream milk powder, skim, stabilizer, emulsifier, and water) with 4 repetitions. The parameters observed were the level of preference for the color, aroma, texture, and taste of ice cream. The most preferred ice cream is obtained by using nilem skin gelatin at a concentration of 0.4%.

Keywords: Javakarp, gelatin, skin, nilem fish, ice cream, preference level, *Osteochilus hasselti*, *Osteochilus vittatus*

1. INTRODUCTION

Nilem is a family of Cyprinidea freshwater fish, and can be seen in Figure 1. Cultivation of nilem fish is almost abandoned because its utilization is not optimal [25]. The part of nilem fish which is eggs is generally used to make caviar so that there is fish skin waste. To maximize the utilization of nilem fish, it is necessary to diversify through processing nilem skin gelatin. Nilem fish's skin is one of the potential wastes to be the basic ingredient in making gelatin [13]. The classification of nilem fish is given below [1-45]:

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Classification

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Osteochilus* Günther, 1868
Species: *Osteochilus hasselti* (Valenciennes, 1842)
Synonym for *Osteochilus vittatus* (Valenciennes, 1842)

The occurrence: China, Vietnam, Thailand, Burma, Malaysia, and Indonesia.

Figure 1. Nilem fish - *Osteochilus hasselti* (Valenciennes, 1842) [38-45].
Source: personal documentation

Fresh nilem contains protein content 15.95%, moisture content 77.37%, ash content 1.32%, and fat content 4.35% [32]. Fish skin consists of two main layers, and they are epidermis and dermis. The dermis layer contains collagen fibres and the binding tissue is quite thick [16]. The main part of skin layers which is needed in the manufacture of gelatin is the dermis layer. About 80% of this layer consists of a network of collagen fibres constructed by bonding layer [27].

Gelatin is a hydrocolloid compound that results from the hydrolysis of skin collagen of mammals (cows and pigs), poultry, and fish [15]. Gelatin is a polypeptide consisting of covalent bonds and peptide bonds between amino acids obtained from natural collagen found in the skin and bone [35]. This polypeptide has two terminal atoms, the left end contains an amino group

and the right end contains a carboxyl group. Both ends allow gelatin to form hydrogen bonds with other gelatin molecules, or with water molecules [33].

So far the needs of Indonesian gelatin have been imported from several countries such as France, Japan, India, Brazil, Germany, China, Argentina, and Australia. Gelatin imports in 2014 reached 255,822 kg with a value of 2,059,329 USD [4]. The spread of gelatin made from skin and pork bones is not right in the majority Muslim countries like Indonesia, because pigs are animals that are not consumed. The use of cow-based gelatin is still worrying because of the outbreak of diseases carried by livestock in the form of anthrax and mad cow disease [9]. Therefore fish waste such as bone and skin containing a lot of collagen is now a safer alternative choice [24].

Ice cream is a frozen food product as an appetizer and made from milk ingredients, emulsifiers, stabilizers, and sweeteners such as sucrose or dextrose [2]. The type of ice cream made in this research is Ice cream Base (Ice cream), which is ice cream based on milk and fresh cream, with the addition of stabilizers [26]. The thing that often becomes a problem in making ice cream is the formation of ice crystals which causes the ice cream to be coarse or sandy. To overcome this problem, an effort is needed to get the most preferred quality of ice cream by adding stabilizers [18].

The stabilizer is one of the food additives used in small quantities. The stabilizer serves to maintain emulsion stability while improving product softness, improving product properties, providing uniformity in product shape, preventing the formation of large ice crystals, and providing resistance to not melt or melt.

The stabilizer in ice cream coiling has a function in helping to resist the crystallization of ice cream during storage and stabilizing stirring during the process of mixing ice cream raw materials [5]. Stabilizers work by reducing the surface tension by forming a protective layer covering the dispersed phase globules, so that insoluble compounds will be more easily dispersed in the system and have stable properties [8].

Stabilizers that commonly used are carboxy methyl cellulose (CMC), gelatin stabilizer, alginate, carrageenan, and agar with concentration 0.2–0.5% [21]. From several stabilizers used in ice cream, gelatin has an average score of acceptance tends to be high. Gelatin is well used as a stabilizer in ice cream because it improves the body and texture of ice cream, builds air cell structures during freezing, prevents the growth of ice crystals, prevents sandy texture, and provides resistance to sudden temperature rise [7].

Addition of stabilizers should not be too little or too much, if less or too much will affect the quality of the ice cream. This research aims to determine the concentration of the use of nilem skin gelatin to get the most preferred ice cream.

2. MATERIALS AND METHODS

2. 1. Materials And Tools

Tools used: scales, beaker glass, pots, spatulas, stoves, stainless steel bowls, refrigerators, mixers, freezers, thermometers, ice cream boxes, timers, and stationery. Ice cream dough ingredients are used: full cream milk powder, skim, granulated sugar, SP (emulsifying ingredients), nilem skin gelatin, CMC, and water. Ice cream production auxiliaries ingredients: ice cubes and salt.

2. 2. Research Methods

The research method is experimental with four treatments; the use of nilem skin gelatin on ice cream at different concentrations, are:

1. Treatment A: the use of gelatin as much as 0.2%.
2. Treatment B: the use of gelatin as much as 0.3%.
3. Treatment C: the use of gelatin as much as 0.4%.
4. Control (D): the use of CMC as much as 0.4%.

Repetition 4 times in each treatment was used. The formulations that used in this research are presented in Table 1.

Table 1. Formulation of Ice Cream Making.

Bahan	Treatment Percentage (%)		
	Gelatin 0.2 (A)	Gelatin 0.3 (B)	Gelatin 0.4 (C)
Full cream milk powder	10	10	10
Skim	12	12	12
Sweetener	12	12	12
Stabilizer	0.20	0.30	0.40
Emulsifier	0.25	0.25	0.25
Water	65.55	65.45	65.35
Total	100	100	100

Source: [12] modificated

The process of making ice cream refers to [12] with modification. The process of making ice cream includes dough preparation, mixing full cream milk powder, skim, and water, then heated to 40-50 ºC. After that, put sugar, stabilizer, and emulsifier while stirring, then pasteurize at 60-65 ºC for 25 minutes. Homogenization is done using spatula until mixed well, aging in the refrigerator for 24 hours with temperatures below 4 ºC, foaming and freezing conventionally. Ice cubes and salt are placed around the ice cream dough container while stirred using a mixer for 15 minutes, packing it into a plastic container, and hardening it in the freezer at a temperature below –18 ºC.

2. 3. Parameters Observation

The parameters observed were the level of preference for the color, aroma, texture, and taste of ice cream. The test was carried out by 15 semi-trained panelists. Panelists were asked

to fill the preferences Level Test Questionnaire according to personal opinion. The numerical scale consists of five types: 1 (very dislike), 3 (dislike), 5 (neutral / normal), 7 (like), and 9 (really like).

2. 4. Data Analysis

Preference level test data were analyzed by parametric statistics using the Kruskal Wallis Test (α 5%) through SPSS. The provision of the Kruskal Wallis Test is if the value of P (Asymp.Sig)> 0.05 means that the treatment does not give a real difference to the observed response, and vice versa [14]. If there are significant differences, further analysis is carried out by Duncan's multiple comparison test through the SPSS application. The mathematical formulae are as follows:

$$D = d_{a,p,v} \times \sqrt{\frac{KTG}{n}}$$

Description: D = Duncan
p = Distance rank two treatments p
v = Degree of error free
α = Real level.

Determination of the best treatment was based on the parameters of color, aroma, texture, and taste using the Bayes test. It is done by changing the comparison in pairs with a set of numbers that present the priorities of the criteria and alternatives (treatment). The geometric formula is as follows:

$$X_G = \sqrt[n]{\sqcap, \mathrm{Xi}}$$

Description; X_G = Geometric average
⊓ = Permutation
n = Number of panelists
Xi = Evaluation by panelists to i.

Completion of the results of the comparison is done by matrix manipulation to determine the criteria weight [10].

3. RESULT

3. 1. Colour

Colour is the main determinant of a product to be liked or not by consumers. This is because the main response is physiologically and the objective stimulus of the sense of sight is more reflex in assessing [6]. Test results of the level of preference for the colour of ice cream are shown in Table 2.

The results of data analysis using the Kruskal Wallis Test indicate that the Asymp. value Sig> 0.05 means that there is no influence from the treatment given. Treatment A (Gelatin

0.2%), B (Gelatin 0.3%), and C (Gelatin 0.4%) resulted in a median value 7 (likes). Ice cream using gelatin stabilizer produces ivory white, while the ice cream that used CMC 0.4% as stabilizer gives a median value 9 (very like) and milky white colour. This is because gelatin undergoes fat oxidation resulting in highly coloured products [37].

Supported by the statement [1] that ice cream uses gelatin as a stabilizer can produce better colours because the color is not too bright. The concentration of the use of nilem skin gelatin is 0.4% most appropriate because it has an average value of colour preference (7.00) higher than concentration 0.2-0.3% (6.50).

Table 2. Colour Preferences Test Results.

Treatment	Median	Color Average
A (Gelatin 0.2%)	7	6.50±0.50 [a]
B (Gelatin 0.3%)	7	6.50±0.50 [a]
C (Gelatin 0.4%)	7	7.00±0.82 [a]

Remarks: Numbers given the same letters indicate no significant effect based on the Kruskal Wallis Test (P> 0.05)

3. 2. Aroma

The aroma of a food product is very important because it can determine decisions about consumer preferences for products quickly [28]. The test results for the level of ice cream aroma are shown in Table 3.

Table 3. Aroma Preferences Test Results.

Treatment	Median	Aroma Average
A (Gelatin 0.2%)	5	5.50±0.50 [a]
B (Gelatin 0.3%)	5	6.00±0.58 [a]
C (Gelatin 0.4%)	7	6.50±0.50 [a]

Remarks: Numbers given the same letters indicate no significant effect based on the Kruskal Wallis Test (P> 0.05)

Based on the results of the Kruskal Wallis Test (α 5%) showed that the concentration of nilem skin gelatin did not significantly affect the level of ice cream aroma. The smell of ice cream is the distinctive smell of milk produced by the cream content in milk as a raw material

for making ice cream. The median value of the aroma of ice cream with the use of nilem skin gelatin is 5-7 (normal-like). In agreement with [31], the use of CMC and gelatin in ice cream did not significantly affect the aroma of corn ice cream. Because ice cream is a type of frozen food, the intensity of the aroma produced is not too high when taken out of the freezer [34].

According to [11] the average score of ice cream aroma preference made by adding gelatin stabilizers tends to be higher than CMC. The use of nilem skin gelatin with concentration 0.4% is the best treatment because it has the highest median value and is the same as the control (CMC 0.4%) which is 7 (likes).

3. 3 Texture

Texture is one of the physical properties of food which is important to determine the consumer's preferences for a product [3]. Test results on the level of preference for the texture of ice cream are shown in Table 4.

Table 4. Texture Preferences Test Results.

Treatment	Median	Texture Average
A (Gelatin 0.2%)	5	5.00±0.00 [a]
B (Gelatin 0.3%)	7	6.50±0.50 [b]
C (Gelatin 0.4%)	7	6.50±0.50 [b]

Remarks: Numbers followed by the same letters show no significant difference based on Duncan Test at 95% confidence level (P <0.05)

The results of data analysis using the Kruskal Wallis Test indicate that the Asymp. value Sig <0.05 means that there is an effect of the treatment given, so Duncan's Advanced Test is carried out with a confidence level of 95%. Based on the results of advanced tests, there were significant differences between treatment A (5, normal) and treatment B and C (7, like). The texture of ice cream with treatment A is flaky/snowy and sandy, while the texture of treatment B and C is smooth/soft when tasted and not hard.

The median value of preferences texture with treatment A and B (7, like) is close to the value of the control ice cream texture (CMC 0.4%) which is 9 (very like). The concentration of nilem skin gelatin in 0.4% is the most appropriate treatment because it produces the most preferred texture and most resembles ice cream control (smooth and not hard). Supported by the opinion of [36], the highest texture preference score was obtained from ice cream with the addition of cow gelatin stabilizer 0.4%.

The stabilizer can reduce the concentration of free water by absorbing water so that it will reduce crystallization of ice, reduce the size of ice crystals, and increase the smoothness of the texture produced [19]. Increasing the concentration of gelatin as a stabilizer will increase the viscosity of ice cream. As viscosity increases, the melting power and softness of the texture will increase as well, but the expanding/foaming power decreases [17].

3. 4. Taste

Taste greatly influences consumers preference for ice cream, and can even be said to be the main determining factor [22]. The results of testing the level of preference for ice cream taste are given in Table 5.

Table 5. Taste Preferences Test Results.

Treatment	Median	Taste Average
A (Gelatin 0.2%)	7	6.50±0.50 [a]
B (Gelatin 0.3%)	7	7.00±0.00 [a]
C (Gelatin 0.4%)	7	6.50±0.50 [a]

Remarks: Numbers given the same letters indicate no significant effect based on the Kruskal Wallis Test (P> 0.05)

Based on the results of the Kruskal Wallis Test (α 5%), the concentration of the stabilizer did not significantly affect the level of preference for ice cream's taste. The median value of preference for the taste of ice cream treatments A, B, and C is 7 (likes) near the control median value of 9 (very like).

The taste of ice cream using nilem skin gelatin stabilizer with concentration 0.2-0.4% can be accepted by the panelists. The use of different concentrations gelatin and CMC does not have a significant effect on the level of taste of ice cream. The taste of ice cream in this research was sweet from sugar and milk (lactose). Agree with [30] that the addition of sugar and gelatin does not affect the taste of pepino ice cream. According to [23] stabilizers do not significantly affect the taste of ice cream because stabilizer is a substance that does not taste and smell.

3. 5. Bayes Method

The Bayes method aims to determine the best treatment based on the characteristics of color, aroma, texture, and taste. This method is one of the best decision-making techniques that aims to produce the most appropriate decisions [29]. Taking the decision on the best ice cream is by using the Bayes method. The results of calculating the weight values of the ice cream criteria are presented in Table 6.

Based on the calculation of criteria weights it appears that taste is the most important criterion for determining the final decision of the panelists in choosing ice cream products with a criterion weight 0.48, followed by texture 0.31, aroma 0.11, and color 0.10. This shows that the taste of ice cream is the most important criterion in determining the final decision of the panelists. Data from the calculation of color, aroma, taste and texture weighting criteria are presented in Table 7.

Based on the calculation results using the Bayes Method, C treatment with 0.4% use of nilem skin gelatin has the highest alternative value 7.00 followed by treatment B. The use of nilem fish gelatin 0.3% has an alternative value 6.79, and treatment A, the use of nilem skin

gelatin 0.2% has the lowest alternative value 6.16. The recapitulation results of the ice cream are presented in Table 8.

Table 6. Ice Cream Criteria Weight Value.

Criteria	Colour	Aroma	Taste	Texture	Total	Criteria Value
Colour	1.00	1.20	0.19	0.19	2.58	0.10
Aroma	0.83	1.00	0.42	0.58	2.83	0.11
Taste	5.40	2.40	1.00	3.96	**12.75**	**0.48**
Texture	5.28	1.72	0.25	1.00	8.25	0.31
Total					26.41	1

Table 7. Decision Matrix of Ice Cream with Bayes Method.

Treatment	Criteria				Alternative Value	Priority Value
	Color	Aroma	Taste	Texture		
A (Gelatin 0.2%)	7	5	7	5	6.16	17.52
B (Gelatin 0.3%)	7	5	7	7	6.79	19.29
C (Gelatin 0.4%)	7	7	7	7	**7.00**	**19.90**
Bobot	0.10	0.11	**0.48**	0.31	0.35	1.00

Table 8. Recapitulation of Research Results.

Parameters	Treatment		
	A	B	C
Preferences level	7	7	7
Colour			
Aroma	5	5	7
Texture	5	7	7

Taste	7	7	7
Bayes Method	6.16	6.79	7.00
Alternative Value			

Based on the results of recapitulation of the preference level test using the Bayes method, it can be noticed that treatment C with the use of nilem skin gelatin as much as 0.4% had the organoleptic characteristics most preferred by panelists with the highest values of colour, aroma, texture, and taste compared to other treatments. This result is in accordance with the hypothesis. Criteria for colour, aroma, taste, and texture play a role in determining the best treatment based on the Bayes method.

4. CONCLUSION

The study results show that the taste product with 0.4% concentration of nilem skin gelatin as a stabilizer creates the most preferred ice cream.

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