

Physical Quality Test of Ice Cream Sweetened Using Honey

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ABSTRACT

Ice cream is usually made using sugar (sucrose) as a sweetener, but the use of too much sugar in food can cause obesity and increase blood sugar so it is not good for diabetics. This study aims to determine the effect of adding honey with different levels on the sensory test of ice cream. This research was conducted at the Laboratory of Animal Products Technology, Department of Animal Husbandry, Faculty of Animal Husbandry, Halu Oleo University. This study used a completely randomized design (CRD) with 4 treatments and 4 replications. The treatments consisted of P1: ice cream without honey, P2: ice cream with added 5% honey, P3: ice cream with added 7.5% honey, P4: ice cream with added 10% honey. Parameters observed in this study include: overrun, melting time and pH. The results showed that the best appearance of ice cream was shown on 10% added honey with an average of overrun exceeding 145.75%, 60.35 minutes melting time and pH. 6.1 as well as good sensory test results.

Keywords: Ice Cream, overrun, freezing point, melting rate and pH.

1. INTRODUCTION

Ice cream is a frozen food product that generally made from cow's milk and processed through a combination of freezing and stirring of ingredients consisting of milk, sweetener, stabilizer, emulsifier, and flavor enhancer [1]. Factors that affect the quality of ice cream include raw materials, manufacturing processes, freezing and packaging. The thickness of the ice cream dough affects the level of smoothness of the texture and the resistance of the ice cream to melting [2].

The process of making ice cream includes mixing ingredients, pasteurization, homogenization, maturation (aging), homogenization, packaging, freezing and storage [3]. The principle of making ice cream is to form air cavities in the mixture of ice cream ingredients or Ice Cream Mix (ICM) so that a volume expansion is obtained which makes the ice cream lighter, not too dense and has a soft texture [4]. Ice cream produced by modern industry (commercial) is made from a mixture of ingredients, namely 10-16% milk fat, 9-12% solid

non-fat, 12-16% sugar (a combination of sucrose and or sweetener corn syrup contains glucose), 0.2-0.5% stabilizer and emulsifier (e.g., jelly or carrageenan from seaweed), 55-64% water derived from solid milk or other materials [5].

Sweetener is a more important factor in consumer acceptance mainly because of its effect on the viscosity and texture of ice cream. Sugar in ice cream will give a sweet taste and a smoother and softer texture so that consumer acceptance increases [2]. The addition of sugar can increase the viscosity of ice cream [6]. Sugar can affect the texture and aroma of ice cream and can also affect melting when in the mouth [7]. Sweeteners in ice cream can affect ice crystallization, especially at lowering the freezing point and can have an inhibitory effect on ice crystal formation. Sweeteners commonly used in making ice cream are sucrose, corn syrup, and high fructose. The sweetener can increase the viscosity of the ice cream mixture because it can bind water [8].

The use of too much sugar in the diet can increase the effects that are not good for the body such as obesity and increased blood sugar and are not good for people who have diabetes. Therefore, to avoid this effect, sugar can be replaced with natural sweeteners such as honey. Honey is a good source of food. The dominant type of sugar in almost all honey is fructose (levulose) and only a small portion of honey has a higher glucose content than fructose [9].

The use of honey in addition to providing a sweet taste can also increase the freezing point which can form fine crystals, and slow down the rate of destruction of ice cream [4]. The addition of honey as a sweetener has been used, among others, in dragon fruit juice [10], yogurt [11], green bean ice cream [12] and tomato [13]. Related to this, it is necessary to study the use of honey as a sweetener in the ice cream making process.

2. MATERIALS AND METHODS

The raw materials used in making ice cream include: Ultra High Temperature (UHT) milk, sugar, vegetable fat (whipping cream), quick emulsifier (TBM), jelly, *Apis dorsata* honey. The equipment used in making ice cream is a digital scale (gr), hand mixer, freezer, spoon, plastic container, and ice cream cup.

2.1. Methods

Ice Cream Making.

The process of making ice cream in this study refers to as follows: (1) Weighing the ingredients for making ice cream according to the formulation (Table 1). (2) Put the ice cream ingredients into the container. (3) The dough is mixed for ± 15 minutes then added honey until homogeneous. (4) Aging in the freezer at 4 for ± 24 hours. (5) The second stirring of the ice cream is done for 10 minutes or until the dough expands completely (6) Pack the ice cream dough into the ice cream cup. (7)

Table 1. Ice Cream Formulation

Ingredients	Composition (%)			
	P1	P2	P3	P4
UHT milk	68	68	68	68
Jelly	0.5	0.5	0.5	0.5
Whipping cream	18.5	18.5	18.5	18.5
Sugar	12	7	4.5	2
Quick emulsifier	1	1	1	1
Honey	0	5	7,5	10
Total	100	100	100	100

Harden in the freezer at -15 for 24 hours [14].

Parameters

The parameters observed in this study include the physical quality (overrun, melting time and pH) [15] [16] [17]. Procedure for testing ice cream pH samples according to SNI 01-2891-1992.

The research design used was a completely randomized design (CRD) with 4 treatments and 4 replications. The data obtained were analyzed using analysis of variance (ANOVA). Furthermore, the treatment showed a significant effect, continued analyzed with the smallest significant difference test [18].

3. RESULTS AND DISCUSSIONS

The use of honey as a sweetener in ice cream has a significant effect (P<0.05) on the average value of Overrun, Melting Time and pH of Ice Cream (Table 2).

3.1. Overrun

Overrun is an increase in the volume of ice cream mix (ice cream mix) due to air trapped in the ice cream mixture due to the aging process. The use of honey showed a significant difference (P<0.05) to the overrun of ice cream (Table 2). This is presumably due to the difference in the percentage of honey used so that each treatment has a different ability to trap air during the aging and freezing process.

The average overrun of ice cream with the addition of honey in this study ranged from 145.75 to 221.47%. The control treatment P1 without the use of honey had the largest average overrun value of 221.47%, while the smallest average value of overrun is 145.75% obtained from treatment P4 (10%- or 20-ml honey addition). The overrun value decreased as the percentage of honey increased.

The decrease in the overrun value in this study is thought to be because honey can bind water so that it will narrow the air space in the ice cream mixture which results in less air entering during the agitation process [19]. [20] stated that the decrease in the overrun value was also caused by the ice cream viscosity increasing along with the increase in the percentage of honey. The high viscosity causes the air that enters the ice cream to decrease and results in the expansion of the ice cream volume being limited. If the viscosity value is low, then the viscosity level is low (watery) the surface tension is smaller so that the air cavities are wider, more air enters and the ice cream develops. The overrun value is inversely proportional to the viscosity value where a

Table 2. Average Overrun, Freezing Point, Melting Rate, pH of Ice Cream with Honey Use (%)

Parameters	Treatment			
	P1	P2	P3	P4
Overrun (%)	221.47 ^b ± 7.3	148.25 ^a ± 4.7	149.50 ^a ± 7.07	145.75 ^a ± 11.8
Melting time (minute)	60.15 ^a ± 0.005	60.21 ^b ± 0.000	60.28 ^c ± 0.005	60.35 ^d ± 0.005
pH	6.5 ^c ± 0.05	6.4 ^b ± 0.00	6.2 ^a ± 0.00	6.1 ^a ± 0.05

Note: Different superscripts in the same column show a significant difference in effect ($P < 0.05$).

high viscosity value will complicate the development of ice cream and reduce the overrun value.

The higher the viscosity, the harder the ice cream is to expand. This is due to the presence of a stabilizer that functions to increase the viscosity of the dough by forming a gel matrix and retaining the liquid phase of the diffuser [19].

The amount of air incorporated in ice cream is expressed as % overrun in other words the volume expansion is the increase in ice cream between before and after freezing [21]. A low overrun ($< 30\%$) will make the ice cream, while a high overrun ($> 140\%$) will make the ice cream too soft.

3.2. Melting Time

Melting time is identical to the time it takes for ice cream to melt completely [22]. The use of honey had a very significant effect ($P < 0.01$) on the melting time of ice cream. The average melting time of ice cream ranged from 60.15 to 60.35 minutes (Table 2).

The results showed that the addition of honey to the melting time of ice cream in each treatment was very significantly different ($P < 0.01$). The higher the addition of honey in the ice cream, the longer the melting time of the ice cream. The control treatment (P1) or without honey had the fastest average melting time of 60.15 minutes/50g, while the longest average melting time was obtained from treatment P4 (addition of 10% honey) of 60.35 minutes/50g. This is because the increasing percentage of the addition of honey will cause the melting time to be longer. The addition of honey will affect the strength of the ice cream which is weak and less firm. The fast-melting time of ice cream is indicated by weak and less sturdy ice cream [23]. The use of stabilizers can also slow down the melting of the ice cream while serving.

The addition of honey can bind water in the ice cream mixture so that it is suspected that the ice crystals formed do not melt quickly because honey increases the viscosity of the resulting product. Ice cream with a high viscosity coefficient value will have a greater melting resistance [2]. The overrun value will affect the density of the ice cream. High overrun creates a lot of air voids

and ice cream that is formed too soft will melt quickly. The ice cream produced in this study can be said to be good because it has an average melting speed value of more than 60 minutes so it has met Indonesian national standards. According to SNI No. 01-3713-1995, a good melting range for ice cream is 15-25 minutes. Ice cream with the addition of honey in each treatment was classified as good. Good quality ice cream has a melting speed of 25-30 minutes [24].

3.3. pH

pH is a value that indicates the level of acidity of the ice cream. The addition of honey gave a very significant difference ($P < 0.01$) on the pH of ice cream (Table 2). The pH of ice cream ranges from 6.1 to 6.5. The control treatment (P1) or without honey had the highest average pH value of 6.5 while the lowest average pH value was obtained from treatment P4 (10% honey) which was 6.1). The best pH in this study was seen in the P3 treatment (7.5% honey) which was 6.2. Normal ice cream dough has a pH of 6.3 [25]. The increase in the percentage of addition of honey causes the pH of the ice cream to decrease (Table 2).

Honey's pH ranges from 3.4 to 6.1. The lower the pH, the smaller the bacterial growth in honey because the low pH (pH 3.2–4.5) will inhibit the growth and viability of bacteria, so the bacteria will die. PH also affects the level of taste and aroma [26].

A pH value that is too low will make the ice cream taste too sour so that it can reduce the palatability of the ice cream. Acidity that is too high can cause a decrease in the quality of ice cream, namely increasing viscosity, reducing overrun and can cause an unpleasant taste [27].

4. CONCLUSION

The best physical quality (overrun, melting time, pH) of ice cream in this study was shown in the treatment with the addition of 10% honey (P4).

AUTHORS' CONTRIBUTIONS

Nur Santy Asminaya, was responsible for the whole research activity and writing articles for publication. Widhi Kurniawan writing a research report. Asma Bio Kimestri was responsible for data analysis and Apriansyah helped to collect data during research.

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