



Nutritional Quality and Total Bacterial Colonies in Goat Milk Yoghurt-Based Ice Cream with the Addition of Salak Pondoh Puree (*Salacca Edulis Reinw*)

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ABSTRACT

Ice cream is one of products that is widely favored by various groups of people. This study aims to determine and evaluate organoleptic and nutritional properties and determine the total number of bacterial colonies in goat milk yogurt-based ice cream with different concentrations with the addition of salak pondoh puree using a Completely Randomized Design (CRD) with 4 levels of treatment with 5 replications, namely (P): (0 mL; 150 mL; 300 mL; 450 mL). The parameters analyzed included fat content, protein content, total bacterial colonies, organoleptic color, aroma, texture, and taste. The results showed that the addition of salak pondoh puree to goat milk yoghurt-based ice cream can increase organoleptic values in the form of color, aroma, texture, and also color so that it is preferred by panelists. The addition of salak pondoh puree provides fat content, protein content, and total bacterial colonies in goat milk yogurt. In conclusion the addition of salak pondoh puree to goat milk yoghurt-based ice cream is accordance with the standards so that it is suitable for consumption.

Keywords: Aroma, Goat milk, Ice cream, Salak pondoh, Yoghurt



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1. Introduction

Ice cream is one of the processed products with a soft texture that also has a high nutritional content so that it is widely favored by various groups of people [1]. According to [2], ice cream is a semi-solid food made by freezing ice cream flour or milk, animal or vegetable fat, sugar, with or without other food ingredients and permitted food ingredients. A very prospective milk processing effort is to combine ice cream and yogurt. The combination of ice cream and yoghurt is expected to minimize to eliminate the rancid aroma but not damage the quality of goat milk. The presence of yoghurt fermentation aroma is obtained from the activity of yoghurt microorganisms during fermentation.

Yoghurt is a drink derived from fermented milk that has a slightly sour taste, made by fermentation using *Lactobacillus bulgaricus* and *Streptococcus thermophilus* bacteria. The bacteria are inoculated in milk to produce a semi-solid milk consistency and a slightly sweet and sour taste [3]. Combining ice cream with yogurt can not only increase the nutritional value of ice cream but also provide functional properties of the final ice cream product.

The addition of salak pondoh (*Salacca edulis* Reinw) puree can be used as a natural sweetener and also improve the taste and quality of yoghurt ice cream. Fruit puree is a fruit product made from fresh fruit or frozen or refrigerated fruit with a sufficient level of maturity and crushed without extracting the juice [4]. According to [5] salak pondoh fruit contains simple sugars namely glucose, fructose, and sucrose, the highest sugar content is sucrose.

2. Method

This research was conducted at the Laboratory of Animal Production Science, Faculty of Agriculture, University of North Sumatra, Balai Standardization dan Pelayanan Jasa Industri Medan for 2 months from November to December 2024.

2.1. Tools

The tools used in this research are a mixer, freezer, digital scales, stopwatch, thermometer and a set of organoleptic test equipment.

2.2. Population and Sample

The main ingredients used in this study were goat milk obtained from dairy goat farmers in Medan City, salak fruit obtained from traditional markets in Medan City, commercial yoghurt culture (Biokul Plain Set), sugar (sweetener), cornstarch (stabilizer), salt, coconut milk, SP (emulsifier), and water.

2.3. Data Analysis Methods

The method used in this research is experimental method with a research design of Completely Randomized Design (CRD) with 4 levels of treatment with 5 replicates. The treatment used in this study was the addition of yogurt and salak fruit puree to ice cream with different concentrations. The research treatments carried out are as follows:

P0 : Goat milk yogurt ice cream without salak fruit puree (control)

P1 : Goat milk yogurt ice cream + 150 ml salak fruit puree

P2 : Goat milk yogurt ice cream + 300 ml salak fruit puree

P3 : Goat milk yogurt ice cream + 450 ml salak fruit puree

Table 1. Goat's milk yogurt ice cream dough with added salak fruit puree

	Treatment			
Composition	P0	P1	P2	P3
Yoghurt (mL)	250	250	250	250
Sugar (g)	65	65	65	65
Fullcream milk(mL)	35	35	35	35
Maizena (g)	12	12	12	12
Salt (g)	5	5	5	5
SP (g)	5	5	5	5
Water (mL)	75	75	75	75
Coconut milk (mL)	250	250	250	250
Salak fruit puree (mL)	0	150	300	450

The linear equation used in the study is as follows. $Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$
 $i = 1, 2, \dots, a : j = 1, 2, \dots, b$

Note :

Y_{ij} = Observation result for the i-th treatment and j-th replication

μ = Common center value

α_i = Effect of i-th treatment

ε_{ij} = Effect of experimental error on i-th treatment, j-th replication

3. Result and discussion

3.1. Total Fat Content

According to [6] milk fat is the main component in the ice cream mixture to contribute to improving flavor and aroma, forming a smooth texture and producing long melting properties. Fat content analysis aims to measure the amount of total fat in a food product [7]. The fat content of goat milk yogurt ice cream is shown in Table 2.

Table 2. Effect of salak pondoh puree in yoghurt ice cream on total fat content

Treatment	Replication					Mean \pm SD
	I	II	III	IV	V	
P0	6,16	6,47	6,57	6,29	7,10	6,52 ^C \pm 0,361
P1	4,64	4,83	5,04	5,04	5,03	4,92 ^{AB} \pm 0,178
P2	4,00	4,48	3,23	4,00	4,58	4,06 ^A \pm 0,534
P3	3,88	7,01	4,64	6,56	5,56	5,53 ^B \pm 1,300

Notes: Different superscripts indicate very significant differences between treatments ($P < 0.01$).

Based on Table 2 above, it was found that the average value of the highest total fat content was found in P0 which amounted to 6.52% while the average value of the lowest total fat content was found in P2 which amounted to 4.06%. Based on the results of ANOVA analysis of variance showed that the addition of salak pondoh to goat milk yogurt ice cream gave a very significant difference ($P < 0.01$) to the total fat content of goat milk yogurt ice cream. Based on the results of the DMRT further test at the 1% level, it was found that there was a very significant difference ($P < 0.01$) between P0 and other treatments. P1 treatment did not show a significant difference ($P > 0.05$) to P2 and P3, while P2 and P3 showed a very significant difference ($P < 0.01$) between the two. The average value of total fat content of goat milk yogurt ice cream produced in this study is ranked from the highest, namely P0 (6.52%) followed by P3 (5.53%), then P1 (4.92%) and the lowest is P2 (4.06%).

The decrease in fat content in P1 and P2 can be caused by the high content of dietary fiber in salak pondoh puree. The dietary fiber in salak pondoh fruit has the ability to interact with fat and water in food, thus forming a more stable emulsion. As a result, the fat content in the food is reduced. This is in line with the results of research [8] that replacing some of the fat in ice cream with inulin (food fiber) not only reduces fat content, but can also improve the organoleptic quality of the product. In addition, the presence of bioactive compounds in salak puree, such as tannins and other phenolic compounds may also affect fat stability.

3.2. Total Protein Content

The value of protein content in yogurt depends on the amount of lactic acid bacteria contained in yogurt ice cream. The main component of protein is lactic acid. The higher the lactic acid content in yogurt, the higher the protein content of the yogurt [9]. The results of protein content in yoghurt ice cream can be seen in Table 3.

Table 3. Effect of salak pondoh puree in yoghurt ice cream on total protein content.

Treatment	Replication					Mean \pm SD
	I	II	III	IV	V	
P0	1,46	0,67	0,58	0,51	0,55	0,75 ^a \pm 0,399
P1	0,87	0,82	0,96	1,11	0,86	0,92 ^a \pm 0,115

P2	1,15	0,90	0,93	1,11	1,21	1,06 ^{ab} ± 0,137
P3	1,25	1,28	1,32	1,19	1,19	1,25 ^b ± 0,056

Notes: Different superscripts indicate significant differences between treatments ($P < 0.05$).

Based on Table 3 above, it was found that the average value of the highest total protein content was found in P3 which amounted to 1.25% while the average value of the lowest total protein content was found in P0 which amounted to 0.75%. Based on the results of ANOVA analysis of variance showed that the addition of salak pondoh to goat milk yogurt ice cream gave a significant difference ($P < 0.05$) to the total protein content of goat milk yogurt ice cream. Based on the results of the DMRT further test at the 5% level, it was found that P3 had a significant difference ($P < 0.05$) to P0 and P1 but did not have a significant difference ($P > 0.05$) to P2. The average value of total protein content of goat milk yogurt ice cream produced in this study is ranked from the highest, P3 (1.25%) followed by P2 (1.06%), then P1 (0.92%) and the lowest is P0 (0.75%).

The increased protein content in P3 can be attributed to the use of goat milk as a base material, which naturally has a fairly high protein content. According to [10], peranakan etawa (PE) goat milk has a protein content of about 4.29%. This is in line with research [11] which states that the quality of milk as a base material plays an important role in determining the composition and physicochemical properties of the resulting yogurt.

3.3. Total Bacterial Colonies (TPC)

Microbiological testing of a food product is an important aspect in ensuring food safety for consumers [12]. Total bacterial colony (TPC) analysis in the study aims to calculate the number of bacteria that grow and as a reference in determining the quality and safety of goat milk ice cream products. The results of total bacterial colony levels in yoghurt ice cream can be seen in Table 4.

Table 4. Effect of salak pondoh puree in yoghurt ice cream on total bacterial colonies (TPC)

Treat ment	Replication					Mean ± SD
	1	2	3	4	5	
P0	2,4 x 10 ⁴	2,6 x 10 ⁴	2,8 x 10 ⁴	2,4 x 10 ⁴	2,4 x 10 ⁴	(2,52 ^a ± 0,18) x 10 ⁴
P1	2,0 x 10 ⁴	2,5 x 10 ⁴	2,6 x 10 ⁴	2,2 x 10 ⁴	2,2 x 10 ⁴	(2,30 ^a ± 0,24) x 10 ⁴
P2	1,0 x 10 ⁵	1,3 x 10 ⁵	1,1 x 10 ⁵	1,0 x 10 ⁵	1,4 x 10 ⁵	(1,16 ^b ± 0,18) x 10 ⁵
P3	1,3 x 10 ⁵	2,2 x 10 ⁵	2,5 x 10 ⁵	1,5 x 10 ⁵	1,8 x 10 ⁵	(1,86 ^c ± 0,49) x 10 ⁵

Notes: Lowercase notations indicate significantly different effects ($P < 0.05$) and different notations indicate treatments are significantly different from other treatments.

Based on Table 4 above, it is found that the average value of total bacterial colonies (TPC) is lowest in P1 which is 2.30×10^4 while the average value of total bacterial colonies (TPC) is highest in P3 which is 1.86×10^5 . Based on the results of ANOVA analysis of variance, it shows that the addition of salak pondoh to goat milk yoghurt ice cream gives a significantly different effect ($P < 0.05$) on total bacterial colonies (TPC) in goat milk yoghurt ice cream. Based on the results of the DMRT further test at the 5% level, it was found that there was a very significant difference ($P < 0.05$) between P2 and P3 with other treatments. P0 treatment did not show a significant difference ($P > 0.05$) against P1. The average value of total bacterial colonies (TPC) of goat milk yogurt ice cream produced in this study is ranked from the lowest, P1 (2.30×10^4) followed by P0 (2.52×10^4), then P2 (1.16×10^5) and the highest is P3 (1.86×10^5).

The increase in the total number of bacterial colonies (TPC) in the P3 treatment can be caused by several factors, one of which is the nutrient content in salak pondoh puree which can be a growth medium for contaminant bacteria. According to [13], food fiber is an important component that is

beneficial for microorganisms, because it can stimulate the growth of bacteria, both beneficial and pathogenic. In addition, an environment rich in nutrients can support the proliferation of microorganisms, including contaminant bacteria, so it is important to pay attention to the composition of food ingredients and microbiological control in the production process [14].

The increase in total bacterial colony count (TPC) is also related to lactic acid bacteria (LAB) in breaking down carbohydrates. [15] revealed that LAB break down carbohydrates into monosaccharides to form lactic acid. Monosaccharides are useful for LAB in increasing their growth, which in turn increases the number of TPC. In addition to nutritional factors, sanitation during the production process also plays a role in determining the level of bacterial contamination, especially in fermented products such as yoghurt ice cream. Lack of sanitation control can lead to the introduction of pathogenic bacteria such as *Salmonella* sp., *Escherichia coli*, and *Staphylococcus aureus*, which can thrive in the product if not handled properly [16].

Although there was an increase in total bacterial contamination in P3, the amount was still within acceptable limits. Based on SNI No. 01-3713-1995, the maximum total plate count in ice cream is 2.0×10^5 CFU/g, so the ice cream in this study is still suitable for consumption. The total bacterial colonies in this study are low compared to the maximum limit set, which is likely due to the influence of salak pondoh puree which has natural antibacterial properties.

4. Conclusion

4.1 Conclusion

Based on the results of the study, the addition of 450 ml salak pondoh puree (P3) to goat milk yogurt ice cream produces the best quality nutritionally and organoleptically. This product has a balanced aroma, soft texture, taste and attractive color. The fat and protein content in P3 were 5.53% and 1.25%, respectively, which met the quality standards. The Total Plate Count (TPC) of 1.86×10^5 CFU/g was also within safe limits, making the product suitable for consumption.

4.2. Suggestions

It is recommended that further research can extend the shelf life of the product to see the stability of the nutritional content and microbiological quality.

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