

Organoleptic Quality of Goat's Milk Ice Cream with the Addition of Moringa Leaf Flour (*Moringa oleifera*)

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ABSTRACT

The utilisation of goat's milk and moringa leaves as processed ice cream food products is one alternative that can be done by goat milk farmer community. This study aims to determine the effect of the addition of moringa leaf flour (*Moringa oleifera*) on the organoleptic quality of ice cream. The research was conducted at the Production Laboratory of the Universitas Sumatera Utara in September-October 2023. The study used a completely randomised design (CRD) with 4 treatments and 3 replication where P0 without the addition of moringa flour, P1 = 20 grams of moringa flour, P2 = 25 grams of moringa flour, P3 = 30 grams of moringa flour. The parameters observed were organoleptic tests, namely colour, aroma, texture, taste and liking. The results showed that the addition of moringa flour (*Moringa oleifera*) with the treatment of 20 grams to the making of goat milk ice cream was liked by panelists in terms of colour, aroma, texture, taste and liking compared to the treatment of 25 grams and 30 grams. In conclusion that ice cream with goat's milk added with 20% moringa leaf flour has preferable organoleptic quality.

Keywords: Aroma, Colour, Ice cream, *Moringa oleifera*, Texture

1. Introduction

In general, people consume more cow's milk than goat's milk. Only a few people know that goat's milk has excellent nutritional content. Goat's milk has a high content of fat and minerals, namely Calcium, Phosphorus, Vitamin A, E and B Complex. In addition to protein content, goat's milk also contains more short-chain fatty acids than cow's milk, this causes the fat in goat's milk to be more easily digested by the body to produce energy, so it is not deposited as cholesterol. In addition to having good nutritional content, goat milk also has many benefits in the health sector and can cure various diseases including heart disease, tuberculosis, asthma, lungs, and others.

Processing goat milk into ice cream products is expected to reduce the rancid odour of goat milk because the freezing process can inhibit the evaporation of volatile fatty acids in goat milk. The use of low temperatures in making ice cream is expected not to damage the nutritional content of goat milk. The innovation of processed goat milk products into ice cream provides a variety of product choices to consumers without reducing its benefits [1].

According to data from the Central Bureau of Statistics (BPS) goat milk production in North Sumatra has increased from 2020 to 2022. In 2020 goat milk production in North Sumatra was 3,566.16 tonnes, in 2021 goat milk production was 8.7 tonnes. 2021 goat milk production was 8,745.02 tonnes, and in 2022 goat milk production increased to 8,980.41 tonnes [2].

Ice cream is one of the food products that everyone likes from children to adults. The making of this ice cream uses a new innovation, namely by adding goat milk and moringa flour which can increase its

nutritional content. Moringa leaves were chosen to be added in making ice cream because of their good nutritional content, especially protein and calcium.

Moringa leaves have high nutritional content and are easily available in the surrounding environment, but there is still a lack of variety in its utilisation. People generally only utilise moringa leaves as food processed into clear vegetables. Therefore, diversification of food processing needs to be applied which aims to increase the nutritional content and added value of food commodities to make them more useful for human needs. Associated with moringa as a food diversification, study by [3] added moringa in ice cream showed that panellists disliked the taste of moringa, although there were no problems with colour, aroma and texture. Meanwhile, the nutritional content, especially protein from moringa, provides health benefits [3].

Based on research by [4], moringa flour contains rich nutrients such as protein of 28.25 grams, vitamin A in the form of beta carotene 11.92 mg, calcium 2241, 19 mg, and magnesium of 28.03 mg (micronutrient). The high content of protein and micronutrients in moringa leaves is the main reason for its use in overcoming the problem of malnutrition in toddlers, pregnant women, and lactating mothers [5].

On the basis of the nutritional content of moringa leaves, it is necessary to study the effect of the addition of moringa leaf flour on the organoleptic quality of ice cream.

2. Materials and Methods

2.1. Place and Time

This study was conducted at the Livestock Production Laboratory of the Animal Husbandry Study Programme, Faculty of Agriculture, Universitas Sumatera Utara for organoleptic tests on ice cream. This study lasted for 2 months and this research was conducted from September to October 2023.

2.2. Materials and Equipment

The ingredients used for making ice cream include goat milk purchased from a dairy goat farmer in Medan as much as 2 litres, moringa leaf flour according to the treatment of 20, 25 and 30 grams, thick coconut milk 200 ml, water 200 ml, cornstarch 2 tablespoons, sweetened condensed milk 2 sachets, salt half a teaspoon, granulated sugar 200 grams, and emulsifier as much as half a tablespoon serves to soften and develop ice cream dough when in the mixer.

The tools used for making ice cream include a gas stove to cook ice cream dough, a mixer to stir the dough into ice cream, a basin as a container for stirring ice cream ingredients for mexer, a pan for cooking ice cream dough, tupperware as a container of ice cream dough that has been finished and ready in the freezer, spatula, ice cream cup, sieve, label paper, spoon, measuring cup, digital scales and freezer.

2.3. Research Methods

This research was conducted experimentally using the Completely Randomised Design (CRD) method with one variable, namely variations in the provision of moringa leaf flour with 4 treatments and 3 replicates. This study started from the 20g level of mooringa flour addition. This is based on research [6] that at the addition of 20 g of moringa, it is known that the nutritional content, especially protein, increases and is liked by panellists. Therefore, it is expected that increasing the level of moringa will produce even better nutrition and favoured by panellists.

The treatments studied are as follows:

P0 : Goat milk plus 0 grams of moringa leaf flour

P1 : Goat milk plus 20 grams of moringa leaf flour

P2 : Goat's milk plus 25 grams of moringa flour

P3 : Goat's milk plus 30 grams of moringa flour

2.3. Research Parameters

2.3.1. Acceptability Test (Organoleptic)

Acceptability testing (organoleptic) can be done with the Hedonic Scale Test. This test is carried out to see the level of liking or dislike for the colour, aroma, texture, taste and liking of the processed ice

cream with or without the addition of moringa flour. The data on the level of liking is obtained from the results of the panellists' assessment based on a predetermined scale, namely :

- 1 = Dislike
- 2 = Less Like
- 3 = Like
- 4 = Very Like [6]

The acceptability test was conducted by 40 untrained panellists, where the panellists were students of the Faculty of Agriculture, University of North Sumatra.

2.3.5. *Making Moringa Leaf Flour*

Moringa leaves used are young moringa leaves picked from the first petiole to the seventh petiole that is still green, then the moringa leaves are washed with clean water and then picked from the petiole, then spread on a wire mesh and dried at room temperature for approximately 3x24 hours (already dry enough). Making flour from dried moringa leaves is often used a dry blender and sieved with a 100 mesh sieve to separate small stems that cannot be crushed with a blender, then stored in an airtight plastic container [4].

2.3.6. *Making Ice Cream*

The flow of ice cream making can briefly be seen starting from the preparation process, implementation, freezing, packaging and storage. This ice cream processing consists of several stages, namely: 1) Prepare tools and materials for ice cream making. 2) Put half litre goat milk, 200 grams sugar, 200 ml thick coconut milk, 200 ml water, 2 sachets sweetened condensed milk, 3 tablespoons cornstarch, half teaspoon salt into the pot. 3) Homogenise the ingredients until evenly mixed. 4) Turn on the gas stove over medium heat and start cooking the ice cream mixture, stirring continuously until it boils and thickens for about 15 minutes. 5) After boiling and thickening, the ice cream mixture is put into a tupperware container and put into the frezeer for about 6 hours until the dough hardens slightly. 6) After the ice cream dough hardens, prepare tools such as a mixer, basin, moringa flour, and SP. 7) Put the dough into a basin and given SP then mxer until it expands for about 5 minutes. 8) After rising, enter the moringa treatment according to the doses of 20, 25, and 30 grams. 9) After mixing evenly move into the dough that has become ice cream into a tupperware container. 10) Put the ice cream in the freezer until it hardens and ready to serve moringa flour ice cream.

3. Result and Discussion

3.1. *Sensoric Test of Moringa Ice Cream*

3.1.1. *Colour Aspect*

Colour plays an important role in processed food products, and has an attractive nature to a food product. Colour affects food ingredients or natural or chemical dyes that are added to the processing process either before or after, so that the colour formed can give an impression of the final result of processed food.

Data on colour quality assessment of goat milk ice cream with moringa flour addition is shown in Table 1.

Table 1. Average colour score of goat's milk ice cream with added moringa flour

| Treatments | Score | | | | Total Score | Average Score |
|------------|-------|----|----|----|-------------|-------------------|
| | 4 | 3 | 2 | 1 | | |
| P0 | 0 | 0 | 0 | 40 | 40 | 1.00 ^c |
| P1 | 8 | 14 | 18 | 0 | 110 | 2.75 ^b |
| P2 | 11 | 16 | 13 | 0 | 118 | 2.95 ^b |
| P3 | 16 | 17 | 7 | 0 | 129 | 3.23 ^a |

Notes: Different superscript letters in a column indicate significant differences.

0.00 ≤ Not Green ≤ 1.00
 1.00 < Slightly Green ≤ 2.00

| | | | | |
|------|---|---------------|---|------|
| 2.00 | < | Green | ≤ | 3.00 |
| 3.00 | < | Intense Green | ≤ | 4.00 |

Based on Table 1, it can be seen that the score of the panelists' assessment of the colour criteria for each sample of goat milk ice cream with the addition of moringa flour, namely the highest total colour assessment at score 4 is in the P3 treatment which has selected 16 panelists with an average score of 3.23 so as to produce a colour with intense green colour criteria and the lowest total colour score is in the P0 treatment which has selected, with a total of 0 panelists with an average score of 1.00 and in the treatment that uses moringa flour P0 which has selected score 1 there are 40 panelists with an average score of 1.00 so as to produce a white or not green colour. In score 3, the highest assessment was in the P3 treatment, namely 17 panellists with an average score of 3.23 and the lowest assessment was in the P1 treatment, namely 14 panellists with an average score of 2.75.

The results of the assessment conducted by 40 untrained panelists showed a significant difference in the colour of the ice cream, from the calculation of a single classification analysis of variance then compared with the F table. It is known that F count 204.53 and F table 3.95 then $F_{hit} > F_{tab}$ with a significant level of 0.01 which means that there is a very real difference in colour treatment.

Based on the results of the DMRT (Duncant Multiple Range Test) 0.01 further test, it shows that the P3 treatment has a higher colour than P0, P1, and P2. The addition of moringa flour in making goat milk ice cream, P3 has a significant effect with P2, P1 and P0, but P2 has no significant effect with P1. The more the addition of moringa flour in the manufacture of goat's milk ice cream, the better the acceptability in the aspect of the colour of the ice cream which produces a concentrated green colour that is more attractive because it resembles the green colour of greentea, so that many panelists like the colour aspect of ice cream given moringa leaf flour. The results of this study are different from the research of [7], which shows that the addition of moringa flour can reduce the acceptability of ice cream from the colour aspect, resulting in ice cream with the best colour acceptability is ice cream without the addition of 0 grams of moringa flour (X0) at 2.36 (usual-like), the lowest colour acceptability is ice cream with the addition of 30 grams of moringa flour (X3) at 1.8 (dislike-ordinary). The results of the percentage score on the colour aspect of goat milk ice cream with the addition of moringa leaf flour are shown in Table 9.

3.1.2. Aroma Aspect

Aroma greatly affects the level of consumer liking for a processed food product. Because with aroma, consumers can smell which products are suitable and which products are not suitable for consumption and whether or not they are suitable for marketing based on the aroma they smell. The aroma quality assessment data on goat milk ice cream with the addition of moringa flour is shown in Table 2.

Table 2. Average aroma score on goat's milk ice cream with the addition of moringa flour

| Treatments | Score | | | | Total Score | Average Score |
|------------|-------|----|----|----|-------------|--------------------|
| | 4 | 3 | 2 | 1 | | |
| P0 | 0 | 0 | 0 | 40 | 40 | 1,000 ^d |
| P1 | 8 | 11 | 21 | 0 | 107 | 2,675 ^c |
| P2 | 12 | 15 | 13 | 0 | 119 | 2,975 ^b |
| P3 | 19 | 12 | 9 | 0 | 130 | 3,250 ^a |

Note : Different superscript letters in a column indicate significant differences

| | | | | |
|------|---|-------------------------------|---|------|
| 0.00 | ≤ | No typical moringa flour | ≤ | 1.00 |
| 1.00 | < | Less typical of moringa flour | ≤ | 2.00 |
| 2.00 | < | Moringa flour typical | ≤ | 3.00 |
| 3.00 | < | Very typical of moringa flour | ≤ | 4.00 |

Based on Table 2 it can be seen the results of the panellist assessment score on the aroma criteria for each of the goat milk ice cream treatments with the addition of moringa flour, namely the highest total aroma assessment at score 4 is in the P3 treatment which has chosen a total of 19 panellists with an average score of 3.25 so as to produce an aroma with a very distinctive criterion of moringa flour and the lowest

total score is in treatment P1 which has chosen a total of 8 panellists with an average score of 2.675 with typical moringa flour criteria.

The results of the assessment conducted by 40 untrained panellists showed that there was a significant difference in the aroma of ice cream, from the calculation of a single classification analysis of variance then compared with the F table. It is known that F count 188.69 and F table 3.95 then $F_{hit} > F_{tab}$ with a significant level of 0.01 which means that there is a very significant difference in the aroma treatment.

Based on the results of the DMRT (Duncant Multiple Range Test) 0.01 further test, it shows that the P3 treatment has a higher aroma than P0, P1, and P2. The addition of moringa flour in making goat milk ice cream, P3 has a significant effect with P2, P1 and P0. The results of the study on the aspect of ice cream aroma showed that the increasing dose of moringa flour was increasingly preferred by panellists because the aroma of moringa flour after being substituted in the manufacture of goat milk ice cream produced an aroma that strongly resembled greentea so that the panellists liked it. The results of this study are different from the research of [8] which shows that the increasing dose of moringa flour, the acceptability in the aspect of ice cream aroma decreases, the aroma produced in ice cream with the amount of skim milk 8% and moringa leaves 4% is a combination of skim milk aroma combined with the aroma of moringa leaves, so the aroma is more delicious. While ice cream with 0% skimmed milk and 12% moringa leaves showed on the scale of moringa leaf aroma. This formula has the lowest value because it is more dominated by the aroma of moringa leaves, the aroma of moringa leaves is very languorous and less tasty, so the aroma of skim milk is covered by the aroma of moringa leaves. The aroma of the ice cream produced is influenced by a sharp and distinctive smell, the smell is because moringa leaves contain essential oils and lipoxidase enzymes [9].

3.1.3. Texture Aspect

Texture is one that has an important role in the acceptability of a product. The texture test can be observed with the sense of touch and touch, so that texture can affect the assessment of whether or not a product is accepted. Data from the assessment of texture quality on goat milk ice cream with the addition of moringa flour can be seen in Table 3.

Based on Table 3. it can be seen that the highest total assessment of the texture aspect at score 4 is in the control treatment P0 which has chosen a total of 17 panellists with an average score of 3.375 so as to produce a texture with very soft criteria, and the lowest total score is in the P3 treatment which has chosen a total of 7 panellists with an average score of 2.900 with soft criteria, and the highest assessment at score 3 is in the P1 treatment with an average score of 3.200, then followed by P2 and P3. The lowest assessment was in the P0 treatment with a total of 21 panellists with an average score of 3.375.

The results of the assessment conducted by 40 untrained panellists showed that there was a significant difference in the texture of the ice cream, from the calculation of a single classification analysis of variance then compared with the F table. It is known that F count 17.63 and F table 3.95 then $F_{hit} > F_{tab}$ with a significant level of 0.01 which means that there is a very significant difference in texture treatment.

Based on the results of the DMRT (Duncant Multiple Range Test) 0.01 further test, it shows that the P0 treatment has a higher texture than P1, P2, and P3. The addition of moringa flour in making goat milk ice cream, P3 has a significant effect with P2 and P1 and P0. This is in line with the research of [9] showing that the level of liking in the aspect of texture that is higher is P0 with a concentration of 0%. This is due to the addition of moringa flour which is too much so as to produce ice cream with a coarser texture and not as soft compared to ice cream in general.

Table 3. Average score on goat’s milk ice cream with the addition of moringa flour

| Treatment | Score | | | | Total Score | Average Score |
|-----------|-------|----|----|---|-------------|---------------------|
| | 4 | 3 | 2 | 1 | | |
| P0 | 17 | 21 | 2 | 0 | 135 | 3,375 ^a |
| P1 | 11 | 26 | 3 | 0 | 128 | 3,200 ^{ab} |
| P2 | 9 | 25 | 6 | 0 | 123 | 3,075 ^{bc} |
| P3 | 7 | 22 | 11 | 0 | 116 | 2,900 ^c |

Note : Different letter superscripts in the column indicate a significant effect.

| | | | | |
|------|---|-----------|---|------|
| 0.00 | ≤ | Not Soft | ≤ | 1.00 |
| 1.00 | < | Less Soft | ≤ | 2.00 |
| 2.00 | < | Soft | ≤ | 3.00 |

3.00 < Very Soft ≤ 4.00

Table 4. The percentage score of texture of goat milk ice cream with moringa flour addition

| Treatments | Score | | | |
|------------|-------|------|------|---|
| | 4 | 3 | 2 | 1 |
| P0 % | 42.5 | 52.5 | 5 | 0 |
| P1 % | 27.5 | 65 | 7.5 | 0 |
| P2 % | 22.5 | 62.5 | 15 | 0 |
| P3 % | 17.5 | 55 | 27.5 | 0 |

Based on the results of the percentage score on the texture aspect, it can be seen that the highest value in score 4 is in the P0 treatment with a percentage result of 42.5% so that it is known that the resulting texture is very soft, then followed by the P1 treatment with a percentage result of 27.5%, and the lowest value is in the P3 treatment with a percentage of 17.5%, so it can be known that the resulting texture is soft. This is because P0 has a very soft texture that is very favoured by panellists. In contrast to P1, P2 and P3 which added moringa flour in ice cream, the acceptance of panellists decreased. This is because the addition of moringa flour in making ice cream has a slightly rough texture due to the high fibre content in moringa flour.

If these fibres do not dissolve properly in the ice cream mixture, the insoluble fibres can give the ice cream a rough and wrinkled impression, thus affecting the acceptability of the panelists. The amount of moringa leaves can affect the texture of ice cream, the moringa leaves used in each treatment are different, the amount of moringa leaf flour that is more will add more fibre content, so the addition of moringa leaves affects the texture of ice cream, [9].

3.1.4. Flavour Aspect

Taste has a very important role in the level of consumer liking for a processed food product, consumers can determine the taste impression of a product through the sense of taste or tongue, so taste becomes one of the important factors in processed food products. Flavour quality assessment data on goat milk ice cream with the addition of moringa flour is shown in Table 5.

Based on Table 5, it can be seen that the score of the results of the assessment of taste criteria panelists in each treatment of goat's milk ice cream with the addition of moringa leaf flour, namely the highest total taste assessment at score 4 is in the P0 treatment which has selected 11 panelists with an average score of 3.15 resulting in very sweet ice cream criteria, and the lowest total score is in the P3 treatment which has selected a total of 2 panelists with an average score of 2.25 with sweet taste criteria, and at score 3 the highest assessment is in treatment P0 which has selected 24 panellists with a mean score of 3.15, followed by treatment P2 with a mean score of 3.075 and the lowest assessment is in treatment P3 with a total of 15 panellists with a mean score of 2.25. The results of the assessment conducted by 40 untrained panelists showed that there was a significant difference in the taste of ice cream, from the calculation of a single classification analysis of variance then compared with the F table. It is known that F count 59.60 and F table 3.95 then $F_{hit} > F_{tab}$ with a significant level of 0.01 which means that there is a very real difference in the treatment of taste.

Table 5. The percentage score of flavour of goat milk ice cream with moringa flour addition

| Treatments | Score | | | | Total Score | Score average |
|------------|-------|----|----|---|-------------|--------------------|
| | 4 | 3 | 2 | 1 | | |
| P0 | 11 | 24 | 5 | 0 | 126 | 3,15 ^a |
| P1 | 10 | 23 | 7 | 0 | 123 | 3,075 ^a |
| P2 | 6 | 20 | 11 | 3 | 109 | 2,725 ^b |
| P3 | 2 | 15 | 14 | 9 | 90 | 2,25 ^c |

Notes: Different letter superscripts in the column indicate the presence of a real effect effect.

- 0.00 ≤ Not Sweet ≤ 1.00
- 1.00 < Less Sweet ≤ 2.00
- 2.00 < Sweet ≤ 3.00
- 3.00 < Very Sweet ≤ 4.00

Based on the results of the DMRT (Duncant Multiple Range Test) 0.01 further test, it shows that the P0 treatment has a higher taste than P1, P2, and P3. The addition of moringa flour in the manufacture of goat milk ice cream, P1 has no significant effect with the treatment of P0, but P3 has a significant effect with P2, P1 and P0. The flavour of the ice cream produced is influenced by the dosing of different moringa flour. This is in line with the statement of [8] which states that the level of taste in moringa leaf ice cream will decrease in favourability as the dose of moringa given to ice cream increases, because moringa leaves have a distinctive taste due to the tannin content in them [9,10,11]. Tannins are widely found in nature found in every part of the plant, especially tropical plants in the leaves and bark. Tannins can cause a astringent taste because when consumed, cross-links will form between tannins and proteins or glycoproteins in the oral cavity, causing a feeling of dryness and wrinkling.

3.1.5. Favourability Aspect

To determine the level of liking of goat's milk ice cream with the addition of moringa flour, a liking test can be carried out by looking at the overall acceptance of processed goat's milk ice cream products through the aspects of colour, aroma, texture and taste, so that the highest to lowest level of the entire goat's milk ice cream treatment can be known to consumers. Data on the favourability assessment of goat's milk ice cream with the addition of moringa flour

Table 6. Average favourability score of goat's milk ice cream with added moringa flour moringa flour

| Treatments | Score | | | | Total Score | Skor Average |
|------------|-------|----|----|---|-------------|--------------------|
| | 4 | 3 | 2 | 1 | | |
| P0 | 6 | 30 | 4 | 0 | 122 | 3.05 ^a |
| P1 | 3 | 33 | 3 | 1 | 118 | 2.95 ^a |
| P2 | 2 | 26 | 7 | 5 | 105 | 2.625 ^b |
| P3 | 0 | 19 | 12 | 9 | 90 | 2.25 ^c |

Notes: Different superscripts of letters in the column indicate the presence of significant effect.

- 0.00 ≤ Dislike ≤ 1.00
- 1.00 < Dislike ≤ 2.00
- 2.00 < Like ≤ 3.00
- 3.00 < Very Like ≤ 4.00

Based on Table 6 it can be seen that the score of the results of the panellist assessment of the liking criteria in each treatment of goat's milk ice cream with the addition of moringa leaf flour, namely the P0 and P1 treatment. This means that the panellists liked the ice cream without the addition or with the addition of 20 g moringa. This research has been continued with the study of ice cream nutritional content and it is known that ice cream with the addition of moringa 20g has better protein content.

4. Conclusion

The addition of Moringa (*Moringa oleifera*) leaf flour 20g in making goat milk ice cream is preferred by panelists in terms of colour, aroma, texture, taste and liking compared to the treatment of 25g and 30g.

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