



## Characteristics of Yogurt with Added Cream using Reconstituted Milk as a Base Ingredient

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### ABSTRACT

Low fat content weakens gel structure and sensory acceptance, milk cream addition improves yogurt quality. This study aims to analyze the effect of adding cream on the characteristics of yogurt made from reconstituted skim milk powder. The treatment consisted of five cream concentrations (0%, 3%, 4%, 5%, and 6%) using a completely randomized design (CRD) with three replicates. The parameters observed included physicochemical properties (pH,  $a_w$ , viscosity, total acid titratable, syneresis, moisture content, and ash content), organoleptic properties (hedonic test and scale), microbiological properties (total lactic acid bacteria and total plate count), and microstructure using polarized and non-polarized light microscopes. The result showed that all treatments met the yogurt quality standards based on SNI 2981:2009. The addition of milk cream had a significant effect on the physical, chemical, organoleptic, and microstructure characteristics, but had no effect on color and total microbes. Increasing the milk cream concentration produced yogurt with a thicker texture, milder taste, and aroma that was more preferred by the panelists. Microscopically, the distribution of fat globules was more even and the protein-fat interaction was more integrated in the gel matrix, enhancing viscosity and reducing syneresis.

**Keywords:** characteristics, milk cream, reconstituted milk, yogurt

### ABSTRAK

Kadar lemak rendah melemahkan struktur gel dan penerimaan sensoris, penambahan krim susu meningkatkan kualitas yoghurt. Penelitian ini bertujuan untuk menganalisis pengaruh penambahan krim susu terhadap karakteristik yoghurt berbahan dasar susu rekonstitusi dari susu skim bubuk. Perlakuan terdiri atas lima konsentrasi krim susu (0%, 3%, 4%, 5%, dan 6%) menggunakan rancangan acak lengkap (RAL) dengan tiga ulangan. Parameter yang diamati meliputi sifat fisikokimia (pH,  $a_w$ , viskositas, total asam tertitrasi, sineresis, kadar air, dan kadar abu), organoleptik (uji hedonik dan skala), mikrobiologi (total bakteri asam laktat dan *total plate count*), serta mikrostruktur menggunakan mikroskop cahaya polarisasi dan non-polarisasi. Hasil menunjukkan bahwa seluruh perlakuan memenuhi standar mutu yoghurt berdasarkan SNI 2981:2009. Penambahan krim susu berpengaruh nyata terhadap karakteristik fisik, kimia, organoleptik, dan mikrostruktur, tetapi tidak berpengaruh terhadap warna dan total mikroba. Peningkatan konsentrasi krim susu menghasilkan yoghurt dengan tekstur lebih kental, rasa lebih lembut, dan aroma lebih disukai panelis. Secara mikroskopis, distribusi globula lemak lebih merata sehingga interaksi protein-lemak yang lebih terintegrasi dalam matriks gel, sehingga meningkatkan viskositas dan menurunkan sineresis.

**Kata kunci:** karakteristik, krim susu, susu rekonstitusi, yoghurt

## INTRODUCTION

Milk is an important source of animal protein, providing essential nutrients such as protein, fatty acids, vitamins, and minerals. Population growth, increased incomes levels, and greater nutritional awareness have led to an increase in demand for animal protein, especially milk (Nugroho *et al.* 2023). Moreover, in order to support this demand, the government has launched a free nutritious food program, which means that milk production needs to be increased. However, domestic supply is currently insufficient, with consumption recorded at 16.27 kg/capita/year (BPS 2020). Therefore, importing skim milk powder is proposed as an alternative, as it can be dissolved into liquid milk and processed into products such as yogurt a nutritious fermented milk product made from dissolved milk.

Yogurt is a dairy product obtained through fermentation by Lactic Acid Bacteria (LAB), namely *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, which transform lactose into lactic acid. It contains high levels of calcium and essential micronutrients such as potassium, zinc, phosphorus, magnesium, and several vitamins. The probiotics present in yogurt offer various health benefits, including boosting the immune system, promoting cardiovascular and metabolic health, enhancing digestion, preventing colon cancer, and reducing toxin absorption (Damri *et al.* 2024).

Reconstituted milk is produced by rehydrating skim milk powder, followed by pasteurization, sterilization, or UHT processing. Skim milk powder, which is produced from fat-free milk through a drying process, can retain important nutrients such as protein, minerals, and vitamins (Diputra *et al.* 2016). The use of reconstituted milk in yogurt production can improve texture, while the addition of milk cream extracted from milk fat using centrifugation (Hawa *et al.* 2019) can increase the fat content, resulting in a richer and creamier yogurt consistency.

Innovative products such as yogurt with added milk cream using reconstituted milk as a base can be an alternative for people who want to stay healthy. In addition, this product is also a practical solution for people in lowland areas where there are few dairy farms, because it is easier to make and has a longer shelf life. However, there is no specific data related to testing the quality of yogurt made from reconstituted milk. Therefore, further research is needed on the quality of yogurt made from reconstituted milk.

## MATERIALS AND METHODS

### Materials and Instruments

The raw materials used in this research were skim milk powder (pRolac, Malaysia), milk cream (Greenfields, Indonesia), and *Lactobacillus bulgaricus* and *Streptococcus thermophilus* bacterial cultures (Daff Yoghurt, Indonesia), pH buffers 4 and 7, Plate Count Agar (PCA), deMann Rogosa Sharpe Agar (MRSA), and NaCl 0.15 M (Sodium Chloride). The instruments used in the testing were a pH meter (Ionix, China),  $a_w$  meter (Novasiana, Switzerland),

viscotester (Rion VT-04F, China), centrifuge, polarizing and non-polarizing microscopes, soxhlet extractor, electric furnace, oven, kjeldahl distillation, centrifuge tubes, erlenmeyer flasks (Iwaki, Thailand), laminar air flow (Esco, China), digital colony counter (Kayagaki, Japan), incubator (NuAire, China), refrigerator (Gea, China), autoclave (Hirayama, Japan), and organoleptic test questionnaires.

### Method

**Reconstituted milk production.** This process is based on research by Maulani *et al.* (2018) with several modifications. 50 g of skim milk powder is dissolved in 400 mL of warm water at 55-60 °C. Then, stir until all the skim milk powder dissolves and there are no lumps. Then, the reconstituted milk is stored in the refrigerator.

**Yogurt production and milk cream addition.** The reconstituted milk is heated using an autoclave at a temperature 85 °C for 35 minutes, after which the cow's milk is cooled to a temperature of 40-45 °C. Starter cultures of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* are added at a rate of 1% (v/v). The milk is then incubated at 37 °C for 16 hours until coagulation occurs. After becoming yogurt, add milk cream at 0% (P1), 3% (P2), 4% (P3), 5% (P4), and 6% (P5) of the milk volume. Then the yogurt is stored at a cold temperature ( $\pm 4$  °C) for different storage times (Donker *et al.* 2006). The percentage of yogurt formulation with added milk cream can be seen in Table 1 and 2.

Table 1. Percentage of yogurt formulation with added milk cream

Type of material	Formula				
	P1	P2	P3	P4	P5
Reconstituted milk (mL)	400	320	280	240	200
<i>Streptococcus thermophilus</i> (mL)	2	2	2	2	2
<i>Lactobacillus bulgaricus</i> (mL)	2	2	2	2	2

Note: The formulation used is the percentage of reconstituted milk weight; P1= 0% Milk cream; P2= 3% Milk cream; P3= 4% Milk cream; P4= 5% Milk cream; and P5= 6% Milk cream. The percentage of milk cream is based on the weight of reconstituted milk processed using the Pearson square formula.

Table 2. Percentage of yogurt formulation with added milk cream

Type of material	Formula				
	P1	P2	P3	P4	P5
Milk cream (mL)	0	80	120	160	200
Yogurt (mL)	400	400	400	400	400

Note: The formulation used is the percentage of reconstituted milk weight; P1= 0% Milk cream; P2= 3% Milk cream; P3= 4% Milk cream; P4= 5% Milk cream; and P5= 6% Milk cream. The percentage of milk cream is based on the weight of reconstituted milk processed using the Pearson square formula.

### Analysis of Physical Characteristics

**pH values.** The pH values were measured using a pH meter. The pH of yoghurt was determined using the AOAC method (AOAC 2005).

**Viscosity.** The viscosity value is measured using a viscometer. The viscosity of yoghurt was measured using the method described by (Wibawanti and Rinawidiastuti (2018).

**Total acid titratable (TAT).** The total titratable acidity of yogurt was determined using the AOAC method (AOAC 2005).

**$a_w$  values.** Water activity ( $a_w$ ) was measured using an aw meter manufactured by Novasiana (Switzerland). The water activity of yogurt was measured using the method described by (Syarif and Halid (1992).

**Syneresis.** The syneresis test for yogurt is performed by centrifugation. The yogurt syneresis was performed according to the method of Nurbaeti *et al.* (2024).

**Analysis of chemical characteristics.** Proximate analysis was performed using a modified AOAC (2005) method. The proximate analysis performed was protein content, fat content, carbohydrate content, water content, and ash content. The percentages of protein, fat, water, and ash content are calculated using manual formulas. The carbohydrate content of the sample was determined using a carbohydrate analysis method calculated based on the results of a proximate analysis of protein content, fat content, water content, and ash content.

**Analysis of organoleptic characteristics.** Organoleptic testing uses hedonic (liking) and scale tests. The hedonic test aims to determine the panelist's level of liking for the research object, namely the reconstituted milk yogurt formula. Meanwhile, scale testing is similar to hedonic quality testing, which identifies important sensory characteristics in products and provides information about the level or intensity of these characteristics (Permadi *et al.* 2018). The number of panelists required for this test was 35 moderately trained panelists, with regard to color, taste, viscosity, and aroma attributes so that the results obtained were unbiased. On the form, the hedonic test and scale consisted of 4 rating scales for each attribute assessed.

**Analysis of microbiological characteristics.** Total lactic acid bacteria were tested by counting the total colonies at dilutions of 10<sup>-5</sup>, 10<sup>-6</sup>, and 10<sup>-7</sup> after incubation for 48 hours. Meanwhile, the total plate count was tested by counting the total colonies at dilutions of 10<sup>-4</sup>, 10<sup>-5</sup>, 10<sup>-6</sup> after incubation for 24 hours. This test used the (BAM 2001) method.

**Microstructure characteristic analysis.** Microstructure testing of yogurt using a modification of the method (Mustafa and Widjanarko 2015). The analysis was performed using a light microscope. The steps taken included pipetting 1 ml of the yogurt sample and placing it in a tube containing 1 ml of 96% ethanol in a 1:1 ratio. The dissolved sample was then vortexed for 1 minute until homogeneous. After that, the sample preparation was covered with a cover glass, and immersion oil was dripped on the cover glass. The sample was then observed at 1000X magnification and a picture of the resulting sample was taken.

**Data analysis.** The data were analyzed using analysis of variance (ANOVA) for a completely randomized design (CRD) with the treatment of adding milk cream at different concentrations and with three replicates (Steel and Torrie 1997). Treatments with significant or very significant effects were subjected to Tukey's post hoc test. Data from the organoleptic test were analyzed using the Kruskal-Wallis test. If the analysis showed significant differences between treatments, the Tukey was performed.

## RESULTS AND DISCUSSION

### Physical Characteristics

The physical characteristics of measured in this study included pH value, viscosity, water activity ( $a_w$ ), total acid titratable (TAT), and syneresis. The test results of the physical characteristics of yogurt with added milk cream using reconstituted milk as a base are shown in Table 3.

**pH value.** Based on the research results presented in Table 3, the pH of milk cream yogurt with different percentages ranges from 3.81 to 4.23. Based on the Indonesia National Standard for yogurt quality (2009), the pH range for yogurt products is 3.80 to 4.50. The addition of milk cream to the raw materials is known to affect the pH values of yogurt because the fat components in it can reduce the availability of free lactic acid, thereby reducing the concentration of H<sup>+</sup> ions in the solution.

**Viscosity.** Based on the analysis results, the addition of milk cream had a significant effect ( $P < 0.05$ ) on the viscosity content of yogurt. The viscosity value measured in this study ranged from 3.67 to 11.40 dPa.s. The viscosity of milk cream yogurt increased with the addition of milk cream. The bond between the fat globules and the protein matrix contributed to the yogurt's increased viscosity. Based on

Table 3. Physical characteristics of yogurt with added cream using a reconstituted milk as a base ingredient

Variable	Treatments					SNI Yogurt Quality (2009)
	P1	P2	P3	P4	P5	
pH	3.81±0.11c	3.84±0.04c	3.93±0.13bc	4.09±0.02ab	4.23±0.05a	3.80 – 4.50
Viscosity (dPa)	3.67±0.47d	6.50±0.50c	8.90±0.36b	9.73±0.40b	11.40±0.53a	–
TAT (%)	0.79±0.05a	0.67±0.05ab	0.73±0.00ab	0.61±0.10b	0.61±0.06b	0.5% – 2.0%
$a_w$	0.87±0.00b	0.87±0.01b	0.88±0.01ab	0.88±0.00ab	0.89±0.01a	–
Syneresis (%)	40.03±0.01a	34.87±0.01ab	31.50±0.04b	34.87±0.02ab	33.63±0.01b	–

Note: Different letters in the same row indicate significant differences ( $P < 0.05$ ). P1= 0% Milk cream; P2= 3% Milk cream; P3= 4% Milk cream; P4= 5% Milk cream; and P5= 6% Milk cream.

the results of the study by Safari *et al.* (2023), the addition of skim milk and milk cream can increase yogurt viscosity through the formation of a stronger gel structure due to fat-protein interactions. The result in a denser, smoother yogurt texture that is sensory preferred.

**Total acid titrated (TAT).** The addition of milk cream had a significant effect ( $P < 0.05$ ) on the total acid titrated of yogurt, ranged from 0.61%–0.79%. These results are in accordance with the SNI yogurt (2009) standard of 0.5%–2%. The addition of milk cream to yogurt made from reconstituted skim milk powder lowers the TAT value, because fat binds acid and slows down lactose fermentation. According to Djali *et al.* (2018), higher fat content and lower casein levels in yogurt contribute to reduced in acidity.

**Water activity values ( $a_w$ ).** Based on the analysis results the addition of milk cream had a significant effect ( $P < 0.05$ ) on the water activity content of yogurt, ranged from 0.87 to 0.89, within the standard range of 0.91 to 0.99 reported by (Tamime and Robinson 2007). These results indicate that yogurt maintains a safe moisture level for consumption. According to Belitz *et al.* (2009), mold grows at  $a_w$  0.6–0.7, yeast at 0.8–0.9, and bacteria at 0.9. This indicates that yogurt is more susceptible to spoilage by yeast or mold. In general, higher water activity values reduce the shelf life of food products.

**Syneresis.** Based on the analysis results, the addition of milk cream had a significant effect ( $P < 0.05$ ) on the syneresis of yogurt, which ranged from 31.50% to 40.03%. The addition of cream was found to reduce the level of syneresis, although at high concentrations (P4 and P5) the reduction did not show a significant difference. The presence at fat globules plays a role in strengthening the gel structure and suppressing whey release, while protein content, especially casein in skim milk powder, contributes to gel formation. This is in line with the findings of Krisnaningsih *et al.* (2020), who stated that increasing the concentration of thickening agents can significantly reduce syneresis, but excessive accumulation of fat globules can inhibit protein network formation.

### Chemical Characteristics

The chemical characteristics tested in this study included protein, fat, carbohydrates, water content, and ash content. The test results of the chemical characteristics of yogurt added with milk cream using reconstituted milk as a base are shown in Table 4.

**Protein content.** Based on the analysis results, the addition of milk cream had a significant effect ( $P < 0.05$ ) on the protein content of yogurt, with values ranging from 3.17–4.57%, which is in accordance with the minimum limit of SNI (2009), which is 2.7%. The results showed that the addition of milk cream reduced the protein percentage compared to the treatment without milk cream addition. Septiani *et al.* (2020) reported that the addition of skim milk can increase the protein content of yogurt, but the addition of cream to skim milk can actually reduce the protein content.

**Fat content.** Based on the analysis results, there was a significant difference ( $P < 0.05$ ) on fat content, which ranged from 1.78–12.28%. Yogurt with added cream met the SNI (2009) standard for yogurt products ( $\geq 3\%$ ), while yogurt without cream fell into the low-fat yogurt category (0.6–2.9%). According to Akgun *et al.* (2016), increasing the fat content can improve the physicochemical characteristics of yogurt, such as increasing viscosity, providing a creamier texture, and reducing the level of syneresis.

**Carbohydrates.** Based on the analysis results, there was a significant difference ( $P < 0.05$ ) in the carbohydrate content of yogurt, which ranged from 1.00–3.57%. An increase in milk cream concentration caused an increase in the fat fraction and a decrease in the proportion of skim milk as the main source of lactose, resulting in a decrease in carbohydrate content.

**Water content.** The addition of milk cream had a significant effect ( $P < 0.05$ ) on the water content of yogurt, ranging from 79.89–89.39%. Milk cream has a high fat content and contains less water compared to skim milk. The high fat content in milk cream reduced the water content. According to Zhu and Miura (2024), homogenization reduces fat globules, strengthens the gel structure, and reduces free water.

**Ash content.** Based on the analysis results, the addition of milk cream had a significant effect ( $P < 0.05$ ) on the ash content of yogurt, with values ranging from 0.76% to 0.93%. These results are still in accordance with the SNI (2009) standard, which sets a maximum ash content limit of 1%. The ash content of yogurt reduced with increasing milk cream addition, as cream is high in fat but low in minerals. According to Juandini (2023), ash content of a material.

### Organoleptic Characteristics

The organoleptic tests conducted in this study consisted of two tests, namely hedonic tests and scale tests

Table 4. Chemical characteristics of yogurt with added cream using reconstituted milk as a base ingredient

Variable	Treatments					SNI Yogurt Quality (2009)
	P1	P2	P3	P4	P5	
Protein (b/b)	4.42±0.02a	3.59±0.12b	4.57±0.27a	3.49±0.05b	3.17±0.19b	Min 2.7
Fat (b/b)	1.78±0.20e	6.28±0.02d	7.66±0.27c	12.28±0.18a	11.70±0.01b	Min 3.0
Carbohydrates (%)	3.48±0.32a	3.10±0.10a	1.25±0.18b	3.57±0.17a	1.00±0.17b	–
Water content (b/b)	89.39±0.16a	86.15±0.17b	85.66±0.15c	79.89±0.24e	83.37±0.01d	–
Ash content (b/b)	0.93±0.00a	0.89±0.01b	0.87±0.01c	0.78±0.01d	0.76±0.01d	Maks 1.0

Note: Different letters in the same row indicate significant differences ( $P < 0.05$ ). P1= 0% Milk cream; P2= 3% Milk cream; P3= 4% Milk cream; P4= 5% Milk cream; and P5= 6% Milk cream.

(Table 5). The number of panelists required for these tests was 35 moderately trained panelists, who assessed the color, taste, viscosity, and aroma of the samples.

**Color.** Based on the hedonic test results, the addition of milk cream had no significant effect ( $P>0.05$ ) on the panelists liking of the yogurt color, with average scores ranging from 3.14–3.37. All treatments scored above 3, indicating that the panelists still liked the yogurt color and that the addition of milk cream was still within acceptable limits.

Based on the results of the scale test analysis, the addition of milk cream had a significant effect ( $P<0.05$ ) on the color of yogurt, with a range of 1.60–2.83. The increase in cream content changed the color from white to yellowish white. This is line with Pamela *et al.* (2022), who stated that the low-fat content in skim milk results in low levels of color forming carotene and riboflavin.

**Taste.** Based on the results of the hedonic test, the addition of milk cream had a significant effect ( $P<0.05$ ) on the taste

Table 5. Organoleptic characteristics of yogurt with added cream using reconstituted milk as a base ingredient

Variable	Treatments				
	P1	P2	P3	P4	P5
<b>Hedonic test</b>					
Color	3.14±0.60	3.17±0.51	3.14±0.49	3.26±0.44	3.37±0.49
Taste	2.37±0.84c	2.80±0.76bc	2.91±0.66b	3.17±0.71ab	3.48±0.51a
Viscosity	2.54±0.66c	2.69±0.80bc	3.03±0.62ab	3.26±0.51a	3.37±0.49a
Aroma	3.03±0.79b	3.26±0.70ab	3.14±0.69ab	3.34±0.54ab	3.51±0.61a
<b>Scale test</b>					
Color	1.60±0.60d	2.03±0.79cd	2.26±0.78bc	2.74±0.74ab	2.83±0.79a
Taste	1.20±0.63d	2.17±0.71c	2.69±0.76b	3.23±0.55a	3.54±0.56a
Viscosity	1.77±0.97d	2.57±0.85c	3.23±0.73b	3.63±0.55ab	3.89±0.32a
Aroma	1.54±0.85c	2.51±0.85b	2.94±0.68b	3.46±0.56a	3.80±0.41a

Note: Different letters in the same row indicate significant differences ( $P<0.05$ ). P1= 0% Milk cream; P2= 3% Milk cream; P3= 4% Milk cream; P4= 5% Milk cream; and P5= 6% Milk cream. Hedonic test scores 1= strongly dislike, 2= dislike, 3= like, 4= strongly like. Color scale test score 1= pale white, 2= white, 3= yellowish white, 4= yellow. Taste test scores include 1= very acid, 2= acid, 3= not acid, and 4= very not acid. Viscosity test scores include, 1= very thin, 2= thin, 3= thick, 4= very thick. The aroma scale, 1= very sour, 2= sour aroma, 3= not sour aroma, and 4= milky aroma.

Table 6. Microbiological characteristics of yogurt with added cream using reconstituted milk as a base ingredient

Variable	Treatments					SNI Yogurt Quality (2009)
	P1	P2	P3	P4	P5	
Total lactic acid bacteria (Log CFU mL <sup>-1</sup> )	7.94±0.38	7.98±0.29	7.98±0.30	7.97±0.26	7.96±0.27	Min 7 Log CFU/mL
Total plate count (Log CFU mL <sup>-1</sup> )	6.85±0.32	6.84±0.26	6.83±0.34	6.81±0.36	6.78±0.36	Max 7 Log CFU/mL

Note: Different letters in the same row indicate significant differences ( $P<0.05$ ). P1= 0% Milk cream; P2= 3% Milk cream; P3= 4% Milk cream; P4= 5% Milk cream; and P5= 6% Milk cream.

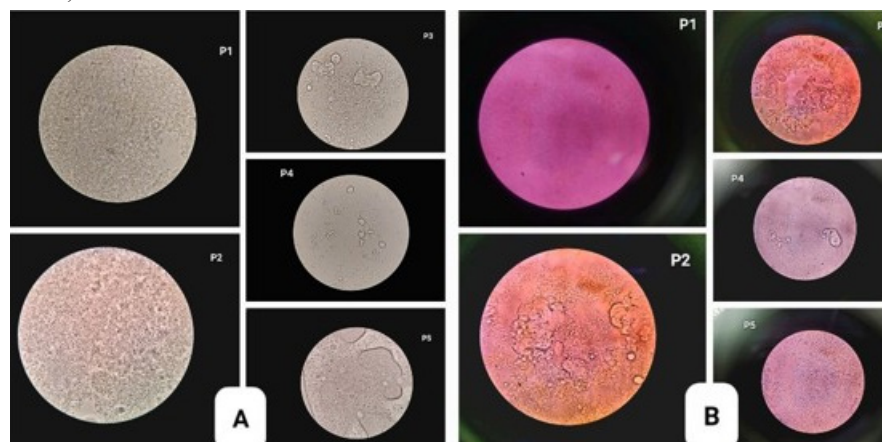


Figure 1. Photomicroscopic examination of yogurt samples to which milk cream was added using reconstituted milk as a base. A= Light microscope in non-polarized mode. B= Light microscope in polarized mode. P1= 0% Milk cream; P2= 3% Milk cream; P3= 4% Milk cream; P4= 5% Milk cream; and P5= 6% Milk cream.

of yogurt, with values ranging from 2.37 to 3.48. The higher the concentration of milk cream added, the higher the panelists acceptance of the taste of yogurt.

Based on the scale test results, the addition of milk cream had a significant effect ( $P < 0.05$ ) on the taste of yogurt, with a range of 1.20–3.54. The increase in cream content increased the panelists' preference because milk fat added flavor and reduced acidity, in line with Walstra *et al.* (2005), who stated that high-fat yogurt was preferred over low-fat yogurt.

**Viscosity.** Based on the results of the hedonic test, the addition of milk cream had a significant effect ( $P < 0.05$ ) on the panelists' level of preference for yogurt thickness, with values ranging from 2.54 to 3.37. The addition of milk cream also affected the level of thickness, where the thickness that matches consumer preferences can increase product acceptance and appeal.

Milk cream addition significantly affected yogurt viscosity ( $P < 0.05$ ), increasing panelists' preference, with viscosity scale values ranging from 1.77 to 3.89. Yogurt with a denser structure and higher viscosity tends to be more preferred in terms of sensory properties.

**Aroma.** The hedonic test result showed that the addition of milk cream had a significant effect ( $P < 0.05$ ) on the aroma of yoghurt, with a score of 3.03–3.51. All treatments were preferred by the panelists because milk cream enhanced the mild aroma of milk and reduced the sharpness of the fermentation aroma.

Based on the results of the scale test, it was found that the addition of milk cream had a significant effect ( $P < 0.05$ ) on the aroma of yogurt, with an average value of 1.54–3.80. The fat content in milk cream helps to retain sharp volatile aroma compounds, thereby reducing the sour aroma and strengthening the milk aroma.

#### Microbiological Characteristics

Microbiological quality analysis is important to determine the number of microbial cultures in fermented products. The results of microbiological testing of yogurt with added cream from reconstituted milk are presented in Table 6.

Based on the test results (Table 6), the addition of milk cream had no significant effect ( $P > 0.05$ ) on the total lactic acid bacteria (LAB) and total plate count (TPC) of yogurt. The number of LAB ranged from 7.94–7.98 log cfu/ml and TPC from 6.78–6.85 log cfu/ml. Based on SNI 01-2981-2009 (BSN 2009), these results still meet quality standards and indicate that the yogurt was suitable for consumption.

#### Microstructure Characteristics

The microstructure of yogurt with added milk cream from reconstituted milk cream from reconstituted milk was analyzed using a light microscope in non-polarized and polarized modes at 1000X magnification. The results of microstructure testing of yogurt with added cream from reconstituted milk are presented in Figure 1.

Based on the results of non-polarized light microscope observations, the addition of 0–6% milk cream

affects the microstructure of reconstituted milk based yogurt. Yogurt without cream has a dense and homogeneous protein matrix, while the addition of 3–4% cream results in more and evenly distributed fat globules, which improves the softness and stability of the texture. At levels of 5–6%, the fat globules become larger and aggregate, causing the protein matrix to become loose and fragmented.

Polarizing microscope observations show that the addition of 0–6% milk cream affects the distribution and interaction of fat in the yogurt protein matrix. At 3–4%, small fat globules are evenly distributed, thereby increasing softness and viscosity, whereas at 5–6%, fat aggregation occurs, reducing protein density and gel stability. This is in line with the findings of Ichimura *et al.* (2023).

## CONCLUSION

Yogurt with added cream from reconstituted milk complies with SNI (2009) and shows changes in physical, chemical, organoleptic, and microstructural characteristics. Increased cream content improves color, taste, viscosity and sensory quality through better fat distribution and protein-fat interaction. Microbiological analysis showed no significant differences, and all samples met microbial standards.

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