CHAPTER IV

RESULTS AND DISCUSSION

4.1 Color Properties

The results of the color analysis of vegan cream cheese made with coconut milk and formulated with different concentrations of jackfruit seed flour are presented in Table 6. The complete analytical data are provided in Appendix 3, while the results of the ANOVA and DMRT are presented in Appendix 4. The increased use of jackfruit seed flour significantly influenced all color parameters of the vegan cream cheese samples at < 0.05.

Table 6. Color Analysis of Coconut Vegan Cream Cheese Made with Coconut Milk and Formulated with Different Concentrations of Jackfruit Seed Flour

Jackfruit Seed Flour Concentration (%)	L*	a*	b*	C*
2	72.35±0.69^{a}	-6.30±0.21^{e}	2.52±0.13^{e}	6.78 ± 0.17^{b}
3	70.96±0.18^{b}	-4.95±0.29^{d}	4.34±0.29^{d}	6.60 ± 0.24^{bc}
4	69.56±0.19^{c}	-3.50±0.10^{c}	5.12±0.66^{c}	6.21 ± 0.53^{c}
5	68.50±0.13^{d}	-2.69±0.13^{b}	6.41±0.11^{b}	6.96 ± 0.13^{b}
6	67.31±0.11^{e}	-1.64±0.09^{a}	8.65±0.10^{a}	8.81 ± 0.11^{a}

Note: Values are expressed as mean ± standard deviation (n = 4). Means within the same column with different superscript letters are significantly different ($p < 0.05$) according to DMRT. CIELAB color parameters are defined as follows: **L*** = lightness, **a*** = redness/greenness, **b*** = yellowness/blueness, and **C* =** chroma.

As shown in Table 6, the L* values represent sample lightness, significantly decreased with increasing jackfruit seed flour concentration, ranging from 72.35 in 2% to 67.31 in 6%. DMRT showed that each formulation exhibited significantly

different lightness values as jackfruit seed flour addition increased, resulting in darker products.

The reduction in L* values is attributed to the increased incorporation of jackfruit seed flour into the coconut milk matrix. Coconut milk naturally exhibits a high lightness value due to its white appearance. According to Yulindha *et al.*, (2021), coconut milk is an oil-in-water emulsion extracted from fresh coconut flesh. The dispersed fat globules and emulsified components effectively scatter incident light. This results in high opacity and light reflectance. As the concentration of jackfruit seed flour increased, the proportion of the white coconut milk matrix decreased. This reduces light scattering and produces lower L* values.

The a* values, that represent the redness/greenness color coordinate, were significantly affected by jackfruit seed flour concentration. All samples exhibited negative a* values, ranging from -6.30 in 2% to -1.64 in 6%. These indicate a slight green tendency. Increasing jackfruit seed flour concentration gradually shifted the a* values toward zero, indicating reduced greenness.

According to Cheng *et al.*, (2019), the a* value represents the redness/greenness color coordinate of a sample, where positive values indicate redness and negative values indicate greenness. The negative a* values observed in the vegan cream cheese formulations may be attributed to the slightly greenish hue of the coconut milk matrix. This greenish appearance may be related to naturally occurring enzymatic activity in coconut milk. Peroxidase and polyphenol oxidase

may promote oxidative reactions that contribute to color changes during processing and storage (Shari *et al.*, 2024).

Although the a* values increased with increasing jackfruit seed flour concentration, all formulations remained within the negative range. This indicates that the samples retained a slight greenish appearance rather than developing a reddish color. Furthermore, a* value approaching zero represents a more neutral position between red and green, indicating that the degree of greenness becomes less pronounced (Scarso *et al.*, 2017).

The b* values, which represent the yellowness/blueness color coordinate, increased significantly with increasing jackfruit seed flour concentration, ranging from 2.52 in 2% to 8.65 in 6%. The increase in b* values indicates that higher concentrations of jackfruit seed flour contributed to greater yellowness in the vegan cream cheese.

The chroma (C*) values, which represent color saturation or vividness, were also significantly affected by jackfruit seed flour concentration. Chroma is derived from the a* and b* coordinates, with higher C* values indicating greater color saturation (Milovanovic *et al.*, 2020). Chroma initially decreased from 6.78 in 2% to 6.21 in 4% formulations and subsequently increased at higher jackfruit seed flour concentrations, with the highest C* value observed in the 6% formulation at 8.81. DMRT showed that the 6% formulation had a significantly higher C* value than all other formulations.

The nonlinear changes in C* may be explained by the simultaneous changes in the a* and b* coordinates. At lower and intermediate jackfruit seed flour concentrations, the decreasing magnitude of the negative a* values occurred simultaneously with increasing positive b* values, resulting in relatively small changes in overall color saturation. At the highest jackfruit seed flour concentration, the substantially higher b* value contributed to the highest C* value, indicating greater color saturation in the 6% formulation.

The observed changes in the CIELAB color parameters are associated with the thermal treatment applied during jackfruit seed flour preparation. Jackfruit seeds contain high levels of protein, starch, and various bioactive compounds (Dhani *et al.*, 2025). During roasting, amino compounds and reducing sugars present in jackfruit seeds may undergo the Maillard reaction, resulting in the formation of brown-colored Maillard reaction products. Previous research by Cicilia *et al.*, (2021), reported that the incorporation of jackfruit seed flour decreased the lightness of biscuits due to Maillard browning during processing and the naturally yellowish to brown color of the flour. As the concentration of jackfruit seed flour increased, the melanoidins that are responsible for the brown pigment became more abundant within the vegan cream cheese matrix. This resulted in lower L* values, negative a* values that shifted toward positive a* values, and higher b* values.

Overall, increasing the concentration of jackfruit seed flour significantly influenced the color characteristics of vegan cream cheese made with coconut milk. Lower L* values, negative a* values approaching positive a* values, and higher b*

values demonstrated that increasing flour concentration produced darker, less green, and more yellow formulations. Chroma exhibited a non-linear response to jackfruit seed flour concentration, with the highest color saturation observed in the 6% formulation. These color changes may be associated with reduced light scattering from the coconut milk matrix and the increased contribution of colored compounds from roasted jackfruit seed flour.

4.2 Proximate Characterization of Vegan Cream Cheese Made with Coconut Milk and Formulated with Different Concentrations of Jackfruit Seed Flour

The proximate composition of jackfruit seed flour, coconut milk, and vegan cream cheese formulated with different concentrations of jackfruit seed flour was evaluated to characterize their nutritional composition. The parameters analyzed included moisture, protein, fat, ash, and carbohydrate contents. The proximate composition of the raw materials is presented in Table 7, and the raw data are provided in Appendix 5. Meanwhile the proximate characteristics of the vegan cream cheese are presented and discussed in the following sections.

Table 7. Proximate Results of Jackfruit Seed Flour and Coconut Milk

Proximate Result	Jackfruit Seed Flour	Coconut Milk
Moisture (%)	10.42 ± 0.10	68.50 ± 0.17
Protein (%)	13.79 ± 0.17	2.65 ± 0.04
Fat (%)	1.12 ± 0.02	24.47 ± 0.19
Ash (%)	3.68 ± 0.16	0.69 ± 0.09
Carbohydrate (by difference) (%)	70.99 ± 0.19	3.70 ± 0.39

Note: Values are expressed as mean ± standard deviation (n = 4).

The results showed distinct differences in the proximate composition of the two raw materials. Jackfruit seed flour was characterized by higher protein, ash,

and carbohydrate contents, whereas coconut milk had substantially higher moisture and fat contents. These compositional differences were considered in interpreting the changes in the proximate characteristics of vegan cream cheese with increasing concentrations of jackfruit seed flour.

4.2.1 Moisture Content

The results of the moisture content of vegan cream cheese made with coconut milk and formulated with different concentrations of jackfruit seed flour are presented in Table 8. The raw data are provided in Appendix 6, while the results of the ANOVA and DMRT are presented in Appendix 7. The increased use of jackfruit seed flour significantly influenced all moisture content parameters of the vegan cream cheese samples at (< 0.05).

Table 8. Moisture Content of Vegan Cream Cheese Made with Coconut Milk and Formulated with Different Concentrations of Jackfruit Seed Flour

Jackfruit Seed Flour Concentration (%)	Moisture Content (%)
2	56.40 ± 0.23^{e}
3	57.70 ± 0.31^{d}
4	59.05 ± 0.23^{c}
5	60.49 ± 0.20^{b}
6	61.57 ± 0.25^{a}

Note: Values are expressed as mean ± standard deviation (n = 4). Means within the same column with different superscript letters are significantly different ($p < 0.05$) according to DMRT.

As shown in Table 8, the concentration of jackfruit seed flour significantly affected the moisture content of vegan cream cheese ($p < 0.05$). DMRT showed that all treatments differed significantly from one another ($p < 0.05$). The highest moisture content was observed at a concentration of 61.57% in 6%, while the lowest

was recorded at 56.40 in 2%. Overall, the moisture content increased progressively as the concentration of jackfruit seed flour increased from 2% to 6%.

Moisture content is an important quality parameter of cream cheese because it influences the texture and shelf life. Higher moisture levels generally produce a softer product, but excessive moisture may reduce storage stability by promoting microbial growth (Zambrano *et al.*, 2019). Water also plays a critical role in determining the rheological properties of semi-solid food systems by affecting viscosity, viscoelasticity, and molecular mobility (Cheng *et al.*, 2019). Consequently, the moisture content of vegan cream cheese is largely influenced by the ability of its structural matrix to absorb and retain water during processing and storage.

The increase in moisture content observed with increasing concentrations of jackfruit seed flour is attributed to the high starch content of the flour and its ability to retain water during heating. Jackfruit seed flour is rich in starch, and its relatively high amylose content contributes to its ability to absorb water (Novita *et al.*, 2023). During heating, starch granules initially absorb water and swell before undergoing gelatinization as the temperature increases (Zhang *et al.*, 2024). During this process, amylose leaches from the starch granules while amylopectin contributes to the formation of a three-dimensional gel network. The formation of this gel network improves the ability of the vegan cream cheese matrix to retain water and increases its water holding capacity. As the concentration of jackfruit seed flour increased, a great amount of gelatinized starch was able to retain water within the cream cheese matrix. This resulted in a progressive increase in moisture content from 2% to 6%.

A similar phenomenon was reported by Hasnita *et al.*, (2021), found that increasing the concentration of jackfruit seed flour in chicken meatballs increased the moisture content. The authors attributed this effect to starch gelatinization during heating. This enables starch to absorb several times more water than in its raw state, called native starch. It is able to promote starch granule swelling and enhance water retention within the food matrix. This is supported by Antuma *et al.*, (2026), reported that native starch granules are insoluble and must be heated to disrupt their structure. This enables starch molecules to interact and form a network that enhances water retention. The present findings suggest that a similar mechanism occurred in vegan cream cheese.

The increase in concentration of jackfruit seed flour likely enhanced the ability of the product matrix to retain water through starch gelatinization and gel network formation, thereby contributing to the higher moisture content.

4.2.2 Protein Content

The results of the protein content of vegan cream cheese made with coconut milk and formulated with different concentrations of jackfruit seed flour are presented in Table 9. The raw data are provided in Appendix 8, while the results of the ANOVA and DMRT are presented in Appendix 9. The increased use of jackfruit seed flour significantly influenced all protein content parameters of the vegan cream cheese samples at (< 0.05).

Table 9. Protein Content of Vegan Cream Cheese Made with Coconut Milk and Formulated with Different Concentrations of Jackfruit Seed Flour

Jackfruit Seed Flour Concentration (%)	Protein Content (%)
2	2.95 ± 0.21^{d}
3	3.26 ± 0.27^{cd}
4	3.52 ± 0.17^{bc}
5	3.72 ± 0.21^{ab}
6	3.95 ± 0.16^{a}

Note: Values are expressed as mean ± standard deviation (n = 4). Means within the same column with different superscript letters are significantly different ($p < 0.05$) according to DMRT.

Protein is an important nutritional component of cream cheese because it contributes not only to the nutritional value of the product but also to its structural characteristics. Cream cheese is an acid coagulated microgel consisting of milk fat globules coated with proteins and arranged in clusters of different sizes. The spaces within this protein matrix are filled with whey, and this contributes to the characteristic creamy texture and spreadability of cream cheese (Pombo, 2021). Previous studies have also demonstrated that interactions among protein, fat, and moisture are key determinants of cream cheese quality and shelf life. The contribution of proteins to the overall structure is further influenced by processing conditions, including temperature, homogenization, and the type of hydrocolloid incorporated into the formulation (Macdougall *et al.*, 2019).

In vegan cream cheese, the protein content and functionality depend largely on the protein sources used in the formulation. Plant proteins not only improve the nutritional quality of the product but also play an important role in developing its structural properties (Antuma *et al.*, 2026). Increasing the protein concentration generally leads to the formation of a denser and firmer gel matrix. Furthermore, the

structure of plant-based cheese analogues is established primarily through the formation of protein networks during processing. This emphasizes the importance of protein in determining the texture and stability of the final product (Antuma *et al.*, 2026).

The protein content of the vegan cream cheese made with coconut milk increased significantly with increasing concentrations of jackfruit seed flour ($p < 0.05$), as shown in Table 9. Protein content increased from 2.95% in 2% to 3.95 in 6%. According to DMRT, T1 showed no significant difference compared with T2. While 6% had significantly higher protein content than 2% and 3%. The 4% and 5% concentrations showed overlapping groups. This indicates that their protein contents were not significantly different from those of the surrounding treatments. Overall, protein content gradually increased as the concentration of jackfruit seed flour increased from 2% to 6%.

The increase in protein content can be attributed to the relatively high protein content of jackfruit seed flour. As presented in Table 7, the jackfruit seed flour produced in this study contained 13.79% protein. This value is consistent with the findings of Borgis and Bharati, (2020), reported that the protein content of jackfruit seed flour ranged from 11.68% in unprocessed flour to 14.42% in baked flour.

As the concentration of jackfruit seed flour increased, more protein was incorporated into the vegan cream cheese formulation. This resulted in a progressive increase in the protein content of the final product. In contrast, coconut milk contributed relatively little protein because its composition is dominated by

moisture and fat. As presented in Table 7, the coconut milk produced in this study contained 2,65% protein. This value is consistent with the findings of Darsana *et al.*, (2026) reported that coconut milk contains approximately 2.83% protein. The increase in protein content can be primarily attributed to the increasing concentration of jackfruit seed flour, because the amount of coconut milk was kept constant at all treatments. Therefore, increasing the proportion of jackfruit seed flour increased the overall protein concentration of the vegan cream cheese.

4.2.3 Fat Content

The results of the fat content of vegan cream cheese made with coconut milk and formulated with different concentrations of jackfruit seed flour are presented in Table 10. The raw data are provided in Appendix 10, while the results of the ANOVA and DMRT are presented in Appendix 11. The increased use of jackfruit seed flour significantly influenced all protein content parameters of the vegan cream cheese samples at (< 0.05).

Table 10. Fat Content of Vegan Cream Cheese Made with Coconut Milk and Formulated with Different Concentrations of Jackfruit Seed Flour

Jackfruit Seed Flour Concentration (%)	Fat Content (%)
2	24.68 ± 0.10^{c}
3	24.76 ± 0.12^{bc}
4	24.82 ± 0.09^{bc}
5	24.93 ± 0.17^{b}
6	25.11 ± 0.10^{a}

Note: Values are expressed as mean ± standard deviation (n = 4). Means within the same column with different superscript letters are significantly different ($p < 0.05$) according to DMRT.

Fat is an important component in cream cheese products because it contributes to mouthfeel and structural characteristics (Prabowo, 2024 ; Mu *et al.*,

2022). Thus, the overall moisture content, fat content, and fat composition collectively influence the physical properties of cream cheese, particularly its hardness and spreadability (Macdougall *et al.*, 2019). Similarly, in vegan cream cheese, the fat plays a crucial role in enhancing sensory quality by providing a creamy texture and reducing the perception of dryness.

The fat content of vegan cream cheese made with coconut milk increased significantly with increasing concentrations of jackfruit seed flour ($p < 0.05$), as shown in Table 10. It increased slightly from 24.68 in 2% to 25.12 in 6%. According to DMRT, 2% showed no significant difference compared with 3% and 4%, while the 6% treatment exhibited significantly higher fat content than all other treatments. The 5% treatment was not significantly different from the 3% and 4% treatments. Overall, fat content showed a gradual increase with increasing jackfruit seed flour concentration from 2% to 6%.

The slight increase in fat content may be attributed to the contribution of fats from jackfruit seed flour. However, this effect was limited because jackfruit seed flour contains considerably less fat than coconut milk. As shown in Table 7, the jackfruit seed flour produced in this study contained approximately 1.12% fat. This value is consistent with the findings of Borgis and Bharati, (2020), reported that the fat content of jackfruit seed flour ranged from 1.15% in unprocessed flour to 1.21% in baked flour. In contrast, the amount of coconut milk remained constant across all treatments, and its fat content was 24.47%, as shown in Table 7. This value is consistent with the findings of Darsana *et al.*, (2026), reported that coconut milk contains approximately 20.14% fat. Coconut milk is well known for its naturally

high fat content and making it the primary source of fat. This characteristic is largely due to its lipid composition that is dominated by medium-chain triglycerides (Zhou *et al.*, 2022). Therefore, coconut milk remained the primary contributor to the fat content of the vegan cream cheese formulation. While the contribution of jackfruit seed flour to the overall fat content was relatively small.

4.2.4 Ash Content

The results of the ash content of vegan cream cheese made with coconut milk and formulated with different concentrations of jackfruit seed flour are presented in Table 11. The raw data are provided in Appendix 12, while the results of the ANOVA and DMRT are presented in Appendix 13. The increased use of jackfruit seed flour significantly influenced ash content parameters of the vegan cream cheese samples at (< 0.05).

Table 11. Ash Content of Vegan Cream Cheese Made with Coconut Milk and Formulated with Different Concentrations of Jackfruit Seed Flour.

Jackfruit Seed Flour Concentration (%)	Ash Content (%)
2	0.93 ± 0.03^{e}
3	1.15 ± 0.03^{d}
4	1.28 ± 0.02^{c}
5	1.40 ± 0.02^{b}
6	1.57 ± 0.03^{a}

Note: Values are expressed as mean ± standard deviation (n = 4). Means within the same column with different superscript letters are significantly different ($p < 0.05$) according to DMRT.

Ash content represents the total amount of inorganic residue or mineral components remaining after complete combustion of organic matter in food materials (Liu, 2019 ; Fikriyah and Nasution, 2022). Although minerals are present in relatively small amounts but they are essential nutrients that contribute to the

nutritional quality of food products (Smith *et al.*, 2023). Therefore, ash content is commonly used as an indicator of the total mineral content of food products (Liu *et al.,* 2019).

The ash content of vegan cream cheese made with coconut milk increased significantly ($p < 0.05$) with increasing concentrations of jackfruit seed flour, as presented in Table 11. The ash content increased from 0.93% at 2% jackfruit seed flour to 1.57% at 6%. Based on DMRT, each treatment differed significantly from one another. This indicates that every increase in jackfruit seed flour concentration resulted in a significant increase in the ash content of the vegan cream cheese.

The increase in ash content can be attributed to the higher mineral content of jackfruit seed flour compared to coconut milk. As presented in Table 7, the jackfruit seed flour produced in this study contained 3.68% ash. This value is consistent with the findings of Borgis *et al.* (2020), reported that the ash 3.66% content of jackfruit seed flour ranged from 1.15% in unprocessed flour to 3.73 % in baked flour. In contrast, the amount of coconut milk remained constant across all treatments, and its ash content was 0.69%, as shown in Table 7. This value is consistent with the findings of Darsana *et al.* (2026), reported that coconut milk contains approximately 0.63% ash. Therefore, jackfruit seed flour remained the primary contributor to the ash content of the vegan cream cheese formulation. While the contribution of coconut milk to the overall fat content was relatively small.

4.2.5 Carbohydrate Content

The results of the carbohydrate content of vegan cream cheese made with coconut milk and formulated with different concentrations of jackfruit seed flour are presented in Table 12. The raw data are provided in Appendix 14, while the results of the ANOVA and DMRT are presented in Appendix 15. The increased use of jackfruit seed flour significantly influenced carbohydrate content parameters of the vegan cream cheese samples at (< 0.05).

Table 12. Carbohydrate Content of Vegan Cream Cheese Made with Coconut Milk and Formulated with Different Concentrations of Jackfruit Seed Flour

Jackfruit Seed Flour Concentration (%)	Carbohydrate Content (%)
2	15.05 ± 0.30^{a}
3	13.13 ± 0.58^{b}
4	11.30 ± 0.32^{c}
5	9.45 ± 0.44^{d}
6	7.84 ± 0.48^{e}

Note: Values are expressed as mean ± standard deviation (n = 4). Means within the same column with different superscript letters are significantly different ($p < 0.05$) according to DMRT.

The carbohydrate content in this study was determined using the by difference method and was first introduced by Atwater and Woods in 1896. In this method, carbohydrate is calculated by subtracting the measured percentages of moisture, protein, fat, and ash from 100%. It is obtained as the remaining fraction rather than being measured directly, and the calculated value is influenced by changes in the other proximate components. This may also include small amounts of noncarbohydrate components, such as lignin, organic acids, tannins, waxes, and Maillard reaction products (McLoughlin *et al.*, 2023). Therefore, increases in

moisture, protein, fat, and ash collectively reduce the calculated carbohydrate percentage.

The method used in this study differs from the approach described by Menezes *et al.*, (2004), who distinguished available carbohydrate from total carbohydrate by additionally subtracting dietary fiber or indigestible fraction. Since dietary fiber was not quantified separately in the present study, the calculated carbohydrate represents total carbohydrate, including starch, sugars, and dietary fiber. Despite this difference, both approaches are based on the same by-difference principle. The carbohydrate is calculated as the remaining fraction after the other measured components are subtracted from 100%. Menezes *et al.*, (2004), further noted that carbohydrate values obtained by difference are sensitive to the number and magnitude of the components included in the calculation and may not necessarily represent the actual carbohydrate or starch content of the food.

Carbohydrates are among the major macronutrients present in many food materials and are particularly abundant in foods rich in starch and sugars (Mukarramah *et al.*, 2021). In the present study, jackfruit seed flour served as the primary carbohydrate source in the vegan cream cheese formulation. Starch represented its predominant carbohydrate component. The calculated carbohydrate values should be interpreted alongside changes in the other proximate components because it was determined using the by difference method.

As shown in Table 12, the progressive reduction in carbohydrate content observed as jackfruit seed flour concentration increases can be attributed to changes

in the overall proximate composition of the vegan cream cheese. As the concentration of jackfruit seed flour increased, the moisture, protein, fat, and ash contents also increased. Because carbohydrate was calculated by difference, thus the combined increase in these measured components resulted in a lower calculated carbohydrate percentage. Among these components, moisture exhibited the greatest increase. As shown in Table 8, the increase in moisture content was from 56.40% in the 2% treatment to 61.57% in the 6% treatment. Therefore, likely contributed most substantially to the reduction in the calculated carbohydrate value.

Therefore, the lower carbohydrate values observed at higher concentrations of jackfruit seed flour in the vegan cream cheese made with coconut milk should not be interpreted as a reduction in the actual starch added to the product. As shown in Table 7, jackfruit seed flour contained 70.99% carbohydrate. This finding is consistent with the proximate composition reported by Islam *et al.*, (2025) found that raw jackfruit seed flour contains approximately 66.2% carbohydrate. While coconut milk contained 3.70% of total carbohydrates, as shown in Table 7. This finding is consistent with (Antunes *et al.*, 2025) reported that coconut milk total carbohydrate is 5.6%

This indicates that jackfruit seed flour remained a rich source of carbohydrate throughout the formulation. The lower carbohydrate values obtained in the vegan cream cheese mainly reflect the by difference calculation method. They also reflect the increase in moisture, protein, fat, and ash contents during formulation. Consequently, although the calculated carbohydrate percentage decreased, starch derived from jackfruit seed flour continued to play an essential role in determining

the structural properties of the product. Previous studies have reported that starch-based analogue cheese serves as the main structuring carbohydrate and contributes to gel formation and fat contents (Awasthi *et al.*, 2025). Therefore, its functional role remains important even when the calculated carbohydrate content appears lower because of the increased percentage of moisture, protein, fat, and ash contents.

4.3 Sensory Properties

The sensory properties of vegan cream cheese made with coconut milk and formulated with different concentrations of jackfruit seed flour were assessed through an organoleptic scoring test and a hedonic test. The organoleptic scoring test evaluated the sensory attributes of the vegan cream cheese, including color, saltiness, savoriness, creaminess, and spreadability. The hedonic test evaluated the panelists' overall acceptance of the products. The results of the sensory evaluation and their discussion are presented in the following sections.

4.3.1 Organoleptic Scoring Test

The results of the organoleptic scoring test of vegan cream cheese made with coconut milk and formulated with different concentrations of jackfruit seed flour are presented in Table 13. The raw data are provided in Appendix 16. While the results of the Kruskal-Wallis and Mann-Whitney tests are presented in Appendix 17. Among the evaluated organoleptic attributes, only color was significantly affected by the concentration of jackfruit seed flour ($p < 0.05$). No significant

differences were observed in savoriness, saltiness, creaminess, or spreadability ($p > 0.05$).

Table 13. Organoleptic Scoring Test of Vegan Cream Cheese Made with Coconut Milk with Different Concentrations of Jackfruit Seed Flour

Jackfruit Seed Flour Concentration (%)	Attribute				
	Color	Savoriness^{ns}	Saltiness^{ns}	Creaminess^{ns}	Spreadability^{ns}
2	1.97 ± 0.56^{d}	3.77 ± 0.97	2.73 ± 0.69	3.33 ± 0.54	4.00 ± 0.87
3	2.43 ± 0.50^{c}	3.60 ± 0.72	2.47 ± 0.68	3.43 ± 0.86	4.23 ± 0.90
4	3.17 ± 0.46^{b}	3.53 ± 1.07	2.57 ± 0.82	3.67 ± 0.76	4.30 ± 0.53
5	3.53 ± 0.63^{a}	3.47 ± 1.14	2.40 ± 0.81	3.70 ± 0.75	4.43 ± 0.63
6	3.60 ± 0.81^{a}	3.13 ± 0.86	2.33 ± 0.92	3.87 ± 1.07	4.53 ± 0.51

Note: Values are expressed as mean ± standard deviation. ^{ns} indicates that there was no significant difference among treatments ($p \geq 0.05$). Means within the same column with different superscript letters are significantly different ($p < 0.05$) according to the Mann-Whitney post hoc test.

As shown in Table 13, the concentration of jackfruit seed flour significantly influenced the perceived color of vegan cream cheese made with coconut milk ($p < 0.05$). The mean color scores increased from 1.97–3.60. This indicates a gradual shift in panelists' perception from white to beige colored samples. The Mann-Whitney post hoc test revealed that 2%, 3%, and 4% differed significantly from one another, but no significant difference was observed between 5% and 6%. This result suggests that increasing the concentration of jackfruit seed flour enhanced the perceived beige appearance of the vegan cream cheese. However, further increases in flour concentration did not produce a distinguishable change in color perception.

The color scores were consistent with the color analysis as shown in Table 6 . This demonstrated L* values decreasing and b* values increasing with increasing jackfruit seed flour concentration. Lower L* values indicated reduced lightness, whereas higher b* values reflected greater yellowness. This resulted in samples that appeared progressively less white and beiger colored. Therefore, the descriptive sensory evaluation accurately reflected the objective color changes measured instrumentally. This correspondence between the sensory and instrumental evaluations demonstrates that the descriptive scoring method was able to reliably characterize the perceived color differences among the formulations. This finding is consistent with the purpose of descriptive sensory analysis, which provides objective descriptions of the nature and intensity of sensory attributes *(Marques et al., 2022).*

No significant differences were observed in the perceived savoriness and saltiness of vegan cream cheese made with coconut milk with different concentrations of jackfruit seed flour among the treatments ($p > 0.05$). The mean savoriness scores ranged from 3.13–3.77. Similarly, the mean saltiness scores ranged from 2.33–2.73. Although both attributes showed slight decreases as the concentration of jackfruit seed flour increased but the differences were not statistically significant. These results indicate that increasing the concentration of jackfruit seed flour did not noticeably influence the flavor profile of the vegan cream cheese.

The absence of significant differences in saltiness may be attributed to the constant amount of salt used in all formulations. This resulted in a relatively similar

perception of salty taste among the samples. Meanwhile, similar savoriness scores are associated with the constant proportion of coconut milk used in each formulation. Coconut milk is widely used in food preparation to enhance the overall flavor and impart a characteristic savory taste due to its high fat content (Sahara and Hudi, 2024 ; Su'i *et al.*, 2022). The high fat content of coconut milk contributes to a rich mouthfeel and enhances the perception of savory flavor (Martadjaja, 2022). Therefore, maintaining the same proportion of coconut milk across all treatments likely resulted in similar perceptions of savoriness and saltiness despite the different concentrations of jackfruit seed flour. A similar finding was reported by Elen and Handoko (2024), observed that increasing the proportion of coconut milk in red beet velva enhanced the savory taste and improved panelists' acceptance. In contrast, lower levels of coconut milk resulted in a less preferred flavor. Therefore, maintaining the same proportion of coconut milk across all treatments in the present study contributed to the similar savoriness scores despite the different concentrations of jackfruit seed flour.

Creaminess is a mouthfeel attribute characterized by the perception of a smooth, thick, and fluid texture in the oral cavity (Jowitt, 1974). This mouthfeel attribute is associated with the physical sensations generated by the texture, viscosity, and other mechanical properties of food that are perceived through somatosensory receptors in the oral cavity (van Eck *et al.*, 2019). Based on the Kruskal-Wallis's test, no significant differences were observed in the creaminess scores among the treatments ($p > 0.05$). Although the mean creaminess scores gradually increased from 3.33–3.87, the differences were not statistically

significant. These results indicate that increasing the concentration of jackfruit seed flour from 2%–6% did not result in statistically significant differences in the perceived creaminess of the vegan cream cheese.

The consistently high creaminess scores across all formulations were likely attributed to the naturally high fat content of coconut milk. This contributes to a rich and smooth mouthfeel. During consumption, the fat enhances creaminess by promoting lubrication within the oral cavity and facilitating the spreading of fat over oral surfaces to generate a richer creamy sensation (Pang *et al.*, 2022). This is reported by Mu *et al.* (2022), that increasing fat content enhanced the perceived creaminess, smoothness, thickness, and mouth coating properties of food products. A similar observation was reported by Andriyani and Widiarto (2025), stated that the high fat and lauric acid contents of coconut milk contribute to a richer and more pleasant mouthfeel. The other variable, such as jackfruit seed flour is rich in starch. This can increase viscosity and contribute to a creamier texture after gelatinization. The concentration range evaluated in the present study from 2%–6% may not have been sufficient to produce significant differences in creaminess among the formulations.

Spreadability is an important textural attribute of cream cheese that reflects its consistency and ease of spreading onto a surface such as bread (Purnamayati and Dewi, 2024; Wang *et al.*, 2024). Based on the Kruskal-Wallis test it shows no significant differences were observed in spreadability among the treatments ($p > 0.05$). The mean spreadability scores increased slightly from 4.00–4.53. This indicates a tendency toward improved spreadability with increasing jackfruit seed

flour concentration. However, these differences were not statistically significant and suggested that the concentration range of jackfruit seed flour evaluated in this study 2%–6% had only a limited influence on the perceived spreadability of the vegan cream cheese.

The consistently high spreadability scores across all formulations were likely associated with the naturally high fat content of coconut milk. This contributed to a soft and easily spreadable texture. Previous studies have shown that reducing fat content results in a firmer cheese structure and poorer spreadability, making the product more difficult to spread (Prabowo, 2024). The relatively high fat content of the cream cheese matrix likely maintained similar spreadability across the treatments because the coconut milk concentration remained constant in all formulations. Although jackfruit seed flour contains a high amount of starch, which may increase viscosity and form a gel upon gelatinization. It also exhibits functional properties such as high swelling power, bulk density, and oil absorption capacity (Akter and Haque, 2018). These properties may contribute to the texture of the cream cheese. However, the concentration range of jackfruit seed flour used in the present study was not sufficient to produce perceptible differences in spreadability. Lučan *et al.*, (2020) reported that poor spreadability significantly reduced consumer acceptance of low-sodium cream cheese. Therefore, the consistently high spreadability observed in the present study suggests that vegan cream cheese prepared with jackfruit seed flour and coconut milk successfully maintained a desirable spreadability comparable to that expected of conventional dairy cream cheese.

4.3.2 Hedonic Test

The results of the hedonic test of vegan cream cheese made with coconut milk and formulated with different concentrations of jackfruit seed flour are presented in Table 14. The raw data are provided in Appendix 18. While the results of the Kruskal-Wallis and Mann-Whitney tests are presented in Appendix 19. The concentration of jackfruit seed flour significantly affected the hedonic attributes of the vegan cream cheese samples ($p < 0.05$).

Table 14. Hedonic Test of Vegan Cream Cheese Made with Coconut Milk and Formulated with Different Concentrations of Jackfruit Seed Flour

Jackfruit Seed Flour Concentration (%)	Attribute					
	Color	Savoriness	Saltiness^{ns}	Creaminess	Spreadability^{ns}	Overall
2	3.87 ± 1.07^{abd}	3.80 ± 0.92^{ad}	3.50 ± 0.97	3.87 ± 0.86^{ab}	4.00 ± 0.83	3.97 ± 0.76^{ace}
3	3.63 ± 0.76^{bcd}	3.73 ± 0.83^{ab}	3.50 ± 0.94	3.70 ± 0.70^{bd}	4.13 ± 0.94	3.77 ± 0.97^{bdf}
4	3.50 ± 0.78^{bcd}	3.33 ± 0.84^{bc}	3.00 ± 0.98	3.03 ± 1.00^{cd}	4.07 ± 0.98	3.13 ± 0.86^{cdd}
5	3.40 ± 0.93^{cdd}	3.17 ± 0.79^{cd}	3.13 ± 0.90	3.00 ± 0.91^{cd}	3.90 ± 0.76	3.17 ± 0.75^{abd}
6	3.07 ± 1.01^{dcd}	3.03 ± 0.96^{cd}	3.00 ± 0.98	3.03 ± 1.07^{bd}	3.90 ± 0.96	2.93 ± 0.91^{efg}

Note: Values are expressed as mean ± standard deviation. ^{ns} indicates that there was no significant difference among treatments ($p \geq 0.05$). Means within the same column with different superscript letters are significantly different ($p < 0.05$) according to the Mann-Whitney post hoc test

Color is one of the primary sensory attributes evaluated during organoleptic assessment and plays an important role in the visual acceptance of food products by consumers (Kosaplawan *et al.*, 2025). As the first characteristic perceived by consumers, it serves as an initial visual cue and is often considered a key indicator of product quality (Khalisa *et al.*, 2021). As shown in Table 14, the Kruskal-Wallis

test result shows that the concentration of jackfruit seed flour significantly affected the hedonic color scores of vegan cream cheese made with coconut milk ($p < 0.05$). The mean color acceptance scores ranged from 3.07–3.87. These correspond to the categories of neutral to slightly like. The 2% exhibited the highest color acceptance 3.87. While 6% showed the lowest acceptance 3.07. The Mann-Whitney post hoc test indicated that 2% differed significantly from 6%. While the formulations of 3%, 4%, and 5% exhibited overlapping acceptance levels and were not significantly different from adjacent treatments.

These results indicate that increasing the concentration of jackfruit seed flour gradually reduced panelists' preference for the color of vegan cream cheese. The lower color acceptance at higher flour concentrations was consistent with the instrumental color analysis. This demonstrated that L* value decreased and b* value increased as the concentration of jackfruit seed flour increased. Consequently, the formulations became progressively less white and beiger colored. Although all formulations remained generally acceptable to the panelists, the lighter colored formulations received higher preference scores. A similar observation was reported by Foguel *et al.*, (2021) that consumers preferred commercial cream cheese samples exhibiting a whiter, matte, and milky appearance, but samples with a lighter yellow appearance were less preferred. These findings support the results that indicate that panelists favored lighter colored vegan cream cheese formulations. This result is influenced by the panelists' familiarity with conventional cheese that is generally expected to have a white appearance because it is made with dairy ingredients.

The concentration of jackfruit seed flour significantly affected the hedonic savoriness scores of vegan cream cheese ($p < 0.05$). The mean scores ranged from 3.03–3.80. These correspond to the categories of neutral to slightly like. The 2% received the highest savoriness acceptance score, while 6% received the lowest. The Mann-Whitney post hoc test showed that 2% differed significantly from 5% and 6%.

The decrease in savoriness acceptance suggests that higher concentrations of jackfruit seed flour reduced panelists' preference for the flavor. Because the coconut milk concentration remained constant, the change was unlikely to result from differences in the coconut flavor. Instead, increasing the concentration of jackfruit seed flour may have made the characteristic roasted flavor of the flour more dominant. This may have masked the savory flavor contributed by the coconut milk. The characteristic roasted flavor of the flour is likely associated with Maillard reactions. It occurs during roasting as free amino acids, peptides, and reducing sugars participate in the formation of flavor compounds (Spada *et al.*, 2021). In addition, the formation of Maillard reaction flavor compounds is influenced by the types of amino compounds and reducing sugars. It's also influenced by processing conditions such as temperature, time, and pH (S. Liu *et al.*, 2022). As a result, formulations with lower concentrations of jackfruit seed flour received higher savoriness acceptance scores.

The concentration of jackfruit seed flour did not significantly affect the hedonic saltiness scores of vegan cream cheese ($p > 0.05$). The mean scores ranged from 3.00–3.50. This indicates that all formulations were rated as neutral. This

result suggests that the different flour concentrations did not influence the acceptance of saltiness.

The consistent saltiness acceptance was expected because the amount of salt added to each formulation was the same. Although jackfruit seed flour changed the composition of the product, but these changes were not sufficient to alter the perceived saltiness. Consequently, panelists evaluated the saltiness similarly across all treatments.

The concentration of jackfruit seed flour significantly affected the hedonic creaminess scores of vegan cream cheese ($p < 0.05$). The mean scores ranged from 3.03–3.87. These correspond to the categories of neutral to slightly like. The 2% showed the highest creaminess acceptance, whereas 4% and 5% received the lowest scores. The Mann-Whitney post hoc test indicated significant differences among several treatments.

Creaminess is an important sensory attribute that is generally associated with pleasant and satisfying eating experiences (Dickinson, 2018). It is also considered a desirable mouthfeel attribute that contributes positively to consumer preference (Upadhyay *et al.*, 2020). Although the descriptive sensory evaluation showed no significant differences in creaminess intensity, the panelists preferred the creaminess of formulations containing lower concentrations of jackfruit seed flour. This indicates that the perceived creaminess was relatively similar across the treatments. However, formulations with lower concentrations of jackfruit seed flour received higher acceptance scores. The higher starch content at higher

concentrations of jackfruit seed flour may have produced a thicker texture that was less preferred than the smoother consistency of formulations containing lower flour concentrations.

The concentration of jackfruit seed flour did not significantly affect the hedonic spreadability scores of vegan cream cheese ($p > 0.05$). The mean scores ranged from 3.90–4.13. This indicates that all formulations were slightly liked. These results suggest that spreadability acceptance remained similar regardless of the concentration of jackfruit seed flour.

Spreadability is an important texture attribute of cream cheese that contributes to consumer acceptance (Wang *et al.*, 2024). Likewise, the overall acceptability of cream cheese is strongly influenced by its textural characteristics (Lučan *et al.,* 2019). This finding agrees with the descriptive sensory evaluation and showed no significant differences in spreadability. The constant concentration of coconut milk likely maintained a similar fat content across all formulations. At the same time, the starch from jackfruit seed flour provided sufficient structure. As a result, all formulations exhibited similar spreading properties and received comparable spreadability acceptance scores.

The concentration of jackfruit seed flour significantly affected the overall hedonic scores of vegan cream cheese ($p < 0.05$). The mean scores ranged from 2.93–3.97. These correspond to the categories of dislike slightly to slightly like. The 2% received the highest overall acceptance score, while 6% received the lowest. The Mann-Whitney post hoc test indicated that 2% differed significantly from 6%.

Overall acceptance represents the combined evaluation of all sensory attributes and serves as an important indicator of consumer acceptance and the overall perceived quality of a food product (Breemer, 2025). The lower overall acceptance at higher concentrations of jackfruit seed flour reflected the combined effect of several sensory attributes. Acceptance of color, savoriness, and creaminess decreased as the concentration of jackfruit seed flour increased. In contrast, saltiness and spreadability remained relatively constant. Consequently, formulations containing lower concentrations of jackfruit seed flour produced sensory characteristics that were more acceptable to the panelists.

CHAPTER V

CONCLUSION AND SUGGESTION

5.1 Conclusion

Based on the results of this study, the incorporation of jackfruit seed flour significantly influenced the physicochemical and sensory properties of vegan cream cheese made with coconut milk. Increasing the concentration of jackfruit seed flour significantly increased the moisture, protein, fat, and ash contents. Although the calculated carbohydrate content decreased. This decrease reflected the by-difference calculation method rather than a reduction in the starch contributed by jackfruit seed flour.

Increasing jackfruit seed flour concentration also significantly affected the color properties of the product. The L* value decreased, while the a*, b*, and chroma (C*) values increased. This indicates a darker and more saturated color at higher concentrations of jackfruit seed flour.

In the organoleptic scoring evaluation, jackfruit seed flour concentration significantly affected only the color attribute. While savoriness, saltiness, creaminess, and spreadability were not significantly affected. In the hedonic evaluation, significant differences were observed in color, savoriness, creaminess, and overall acceptability. While saltiness and spreadability were not significantly affected. Overall, jackfruit seed flour can be incorporated into coconut milk-based vegan cream cheese, although increasing its concentration alters the

physicochemical characteristics and may influence sensory acceptance. Among the evaluated formulations, the 2% jackfruit seed flour treatment showed the highest overall sensory acceptance.

5.2 Suggestion

Future studies are recommended to further investigate the optimized texture of vegan cream cheese made with coconut milk by evaluating different concentrations of jackfruit seed flour. Comprehensive instrumental texture profile analysis, rheological measurements, and microstructural characterization are also recommended to better explain the relationship between the starch network formed by jackfruit seed flour and the resulting textural properties of the product.

In addition, comparative characterization between the optimized vegan cream cheese and commercial dairy cream cheese is recommended to evaluate their physicochemical, textural, color, and sensory properties. Such studies would provide a more comprehensive assessment of the quality of the developed vegan cream cheese and its potential as a plant-based alternative to conventional cream cheese.

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