WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Effects of Saline Tilapia (Oreochromis Niloticus) Meat Concentration Variations on Dim Sum Quality Attributes

Novalia Ayundita[1], Eko Susanto[2]*, Lukita Purnamayati[1]

[1]Study Program of Fishery Product Technology, Faculty of Fisheries and Marine Science
Jl. Prof. Jacub Rais, Tembalang, Semarang, Indonesia 50275
[2]Study Program of Fisheries and Marine Business Technology, Faculty of Fisheries and Marine Science, Jl. Undip, Telukawur, Tahunan District, Jepara Regency, Central Java 59427
Email: eko.susanto@live.undip.ac.id

A B S T R A C T

Saline tilapia is a type of tilapia fish that lives in brackish water. There are various food products that can be made from Saline tilapia raw materials, one of which is dim sum. However, there has been no research that examines the effect of different concentrations of raw meat materials on the characteristics of dim sum. The purpose of this study was to determine the effect of different concentrations of Saline tilapia meat on the characteristics of dim sum and to determine the best concentration. The research method used was an experimental laboratory with a completely randomized design, one factor of variation of Saline tilapia meat concentration, namely 0% (A1), 15% (A2), and 30% (A3), 45% (A4), and 60% (A5). The testing methods used were Texture Profile Analysis using a Texture Analyzer, organoleptic test, protein content test, fat content test, water content test, ash content test, bite test, and color test. The data obtained were analyzed using analysis of variance (ANOVA) with a further test of Tukey. The results showed that differences in the concentration of saline tilapia fish meat affected the levels of hardness, springiness, gumminess, and chewiness; but did not affect the levels of cohesiveness and adhesiveness. Differences in the concentration of saline tilapia fish meat affected the levels of protein, fat, water, ash, appearance, odor, taste, texture, bite value, and color; but did not affect the mucus. The best concentration was found in A5 (60% meat concentration) because it met all standards of organoleptic values, protein content, fat content, water content, ash content, and bite value of dim sum.

Keywords: saline tilapia, dim sum, Texture Profile Analysis, organoleptic

Introduction

Tilapia is one of the most widely consumed fish in Indonesia due to its favorable nutritional profile and pleasant taste. Tilapia contains calories, protein, fat, vitamins B3 and B12, potassium, phosphorus, and selenium. Its chemical composition consists of 21.3% protein, 4.74% fat, 71.59% moisture, 1.54% ash, and 0.83% carbohydrates (Thenu et al., 2021). Saline tilapia is a variety of tilapia cultivated in brackish water by utilizing its euryhaline nature, which allows the fish to tolerate a wide range of salinity fluctuations (Nurchayati et al., 2021).

A variety of food products can be made using saline tilapia as the main ingredient, one of which is dim sum. Dim sum is a type of traditional food originating from China and is commonly enjoyed as a light meal, especially during lunchtime in restaurants. Dim sum is nutritionally rich because it contains various ingredients such as flour, seafood, and vegetables (Guo et al., 2023). The fish meat component plays a crucial role in determining the overall characteristics of dim sum. Therefore, the concentration of fish meat used in dim sum preparation is an important factor, as it affects the final quality of the product. According to Apriansyah et al. (2021), higher proportions of fish meat lead to increased protein content. To date, no study has specifically examined the effect of different fish meat concentrations on dim sum characteristics. The objective of this research is to determine the influence of varying concentrations of saline tilapia meat on the characteristics of dim sum and to identify the optimal fish meat concentration for the best product quality.

Methods

The primary materials used in this study were saline tilapia meat, tapioca flour, and cornstarch. The saline tilapia meat used as the main raw material was obtained in a coarsely chopped form. The equipment used for Dim Sum preparation included a blender, rice cooker, spatula, mixing bowl, and mold. The instrument used for the Texture Profile Analysis (TPA) was a Texture Analyzer. The formulation of the materials used is presented in Table 1.

Table 1. Formulation of ingredients used in the preparation of saline tilapia Dim Sum

1. Bahan	2. Treatments									
	3. A1		4. A2		5. A3		6. A4		7. A5	
	8. (g)	9. (%)	10. (g)	11. (%)	12. (g)	13. (%)	14. (g)	15. (%)	16. (g)	17. (%)
18. Fish Meat	19. 0	20. 0	21. 15	22. 15	23. 30	24. 30	25. 45	26. 45	27. 60	28. 60
29. Tapioca Flour	30. 42	31. 42	32. 34.5	33. 34.5	34. 28	35. 28	36. 19	37. 19	38. 11	39. 11
40. Cornstarch	41. 32	42. 32	43. 25.5	44. 25.5	45. 21	46. 21	47. 15	48. 15	49. 8	50. 8
51. Garlic	52. 3	53. 3	54. 3	55. 3	56. 3	57. 3	58. 3	59. 3	60. 3	61. 3
62. Onion	63. 3	64. 3	65. 3	66. 3	67. 3	68. 3	69. 3	70. 3	71. 3	72. 3
73. Pepper	74. 0.3	75. 0.3	76. 0.3	77. 0.3	78. 0.3	79. 0.3	80. 0.3	81. 0.3	82. 0.3	83. 0.3
84. Shrimp brooth	85. 0.5	86. 0.5	87. 0.5	88. 0.5	89. 0.5	90. 0.5	91. 0.5	92. 0.5	93. 0.5	94. 0.5
95. Sauce	96. 2	97. 2	98. 2	99. 2	100. 2	101. 2	102. 2	103. 2	104. 2	105. 2
106. Sesame oil	107. 1.5	108. 1.5	109. 1.5	110. 1.5	111. 1.5	112. 1.5	113. 1.5	114. 1.5	115. 1.5	116. 1.5
117. Baking powder	118. 0.25	119. 0.25	120. 0.25	121. 0.25	122. 0.25	123. 0.25	124. 0.25	125. 0.25	126. 0.25	127. 0.25
128. Sugar	129. 1	130. 1	131. 1	132. 1	133. 1	134. 1	135. 1	136. 1	137. 1	138. 1
139. Salt	140. 0.5	141. 0,5	142. 0.5	143. 0.5	144. 0.5	145. 0.5	146. 0.5	147. 0.5	148. 0.5	149. 0.5
150. Ice	151. 13.95	152. 13.95	153. 12.95	154. 12.95	155. 8.95	156. 8.95	157. 8.95	158. 8.95	159. 8.95	160. 8.95
161. Total	162. 100	163. 100	164. 100	165. 100	166. 100	167. 100	168. 100	169. 100	170. 100	171. 100

Research design

This study employed a laboratory-based experimental approach using a Completely Randomized Design (CRD). Dim Sum dough was prepared using different concentrations of saline tilapia meat (0% as control, 15%, 30%, 45%, and 60%), with each treatment replicated three times. The Dim Sum preparation method followed the procedure of Falah et al. (2023) with modifications. The tilapia meat for each treatment was homogenized and mixed with ice, flour, and seasonings using a blender. A total of 20 g of dough was wrapped in Dim Sum skin. The molds were lightly coated with oil, and the Dim Sum samples were steamed for 25 minutes. Cooked Dim Sum was subsequently subjected to Texture Profile Analysis (TPA), bite test, color analysis, proximate analysis, and organoleptic evaluation.

Research analysis

Texture Profile Analysis (TPA) was performed using a Lloyd Texture Analyzer TA-TXPlus following the method described by Firmansyah et al. (2024). The bite test was conducted according to Laksono et al. (2019). Color analysis followed the procedure of Anwar and Khoirunnisaa (2024).

Proximate analyses were conducted as follows:

- **Protein content**: SNI 2354.4 (BSN, 2006)
- **Lipid content**: SNI 2354-3 (BSN, 2017)
- **Moisture content**: SNI 2354.2 (BSN, 2015)
- **Ash content**: SNI 2354.2 (BSN, 2010)
- **Carbohydrate content**: by difference using the AOAC Official Method 920.87

Organoleptic evaluation was performed following Haddad et al. (2024) with a panel of 30 assessors.

Data analysis

Data for Texture Profile Analysis (TPA), protein content, lipid content, moisture content, ash content, and color were analyzed using analysis of variance (ANOVA), followed by a Honestly Significant Difference (HSD) post-hoc test. Organoleptic and bite test data were analyzed using non-parametric statistical methods, specifically the Kruskal–Wallis test, and further analyzed using the Mann–Whitney test to determine differences among treatments.

Result and Discussion

Texture Profile Analysis

The texture of the saline tilapia Dim Sum was evaluated using the Texture Profile Analysis (TPA) method with three replications. The parameters measured included hardness, springiness, gumminess, chewiness, cohesiveness, and adhesiveness.

Table 2. Texture Profile Analysis Results of Saline Tilapia Dim Sum

Parameter	Sampel				
	A1	A2	A3	A4	A5
Hardness (kgf)	8.10 ± 0.55^{c}	4.08 ± 0.73^{b}	2.31 ± 0.17^{a}	2.15 ± 0.17^{a}	1.53 ± 0.06^{a}
Springiness (mm)	6.34 ± 1.35^{a}	8.94 ± 0.76^{b}	10.70 ± 0.34^{c}	11.97 ± 0.59^{c}	10.93 ± 0.98^{c}
Gumminess (kgf)	2.34 ± 0.31^{c}	1.60 ± 0.26^{b}	0.95 ± 0.09^{a}	0.78 ± 0.05^{a}	0.51 ± 0.16^{a}
Chewiness (kgf.mm)	14.81 ± 3.48^{b}	14.46 ± 3.41^{b}	10.23 ± 1.21^{a}	9.37 ± 0.88^{a}	5.69 ± 2.33^{a}
Cohesiveness	0.29 ± 0.05^{a}	0.40 ± 0.01^{a}	0.42 ± 0.06^{a}	0.37 ± 0.02^{a}	0.33 ± 0.09^{a}
Adhesiveness (kgf.mm)	0.21 ± 0.15^{a}	0.42 ± 0.58^{a}	-0.05 ± 0.04^{a}	-0.04 ± 0.01^{a}	-0.04 ± 0.05^{a}

Note:

Data followed by different lowercase letters in the same column indicate a significant difference at the 5% level ($p < 0.05$).

The hardness value in the Texture Profile Analysis (TPA) is defined as the peak force during the first compression cycle. Based on the One-Way ANOVA results, the varying concentrations of saline tilapia meat significantly affected the hardness of the dim sum samples ($p < 0.05$). The highest mean hardness was observed in treatment A1 (0% meat), with a value of 8.1 ± 0.55 kgf, while the lowest was recorded in treatment A5 (60% meat) at 1.53 ± 0.06 kgf. This indicates that increasing the proportion of saline tilapia meat results in lower hardness, likely due to the higher moisture content of the meat compared to tapioca flour (Nuraeni et al., 2023).

Springiness represents the relative elasticity of food products. One-Way ANOVA analysis demonstrated that different concentrations of saline tilapia meat significantly influenced springiness ($p < 0.05$). The highest mean springiness was found in treatment A4 (45% meat) at 11.97 ± 0.59 mm, whereas the lowest occurred in treatment A1 (0% meat) at 6.34 ± 1.35 mm. Springiness is affected by the elasticity and flexibility of food products, which vary depending on the ingredients used. Saline tilapia meat generally provides greater elasticity than tapioca flour, contributing to a more elastic dim sum texture. The elastic texture of meat-based products is primarily determined by the presence of myofibrillar proteins, which form stronger internal networks and enhance resistance to compression (Bakhsh et al., 2021).

Gumminess in TPA is a key index reflecting the textural characteristics of fish-based products (Li et al., 2022). One-Way ANOVA showed significant differences in gumminess values among treatments ($p < 0.05$). The highest gumminess was recorded in treatment A1 (0% meat) at 2.34 ± 0.31 kgf, while the lowest occurred in treatment A5 (60% meat) at 0.51 ± 0.16 kgf. Higher meat concentrations resulted in lower gumminess values. Increased fat content in food products is known to correlate with lower gumminess (Mabrouki et al., 2023).

Chewiness refers to the sensory perception of difficulty in chewing caused by sustained elastic resistance of the food. One-Way ANOVA revealed significant differences in chewiness among treatments ($p < 0.05$). The highest chewiness value was observed in A1 (0% meat) at 14.81 ± 3.48 kgf·mm, while the lowest was found in A5 (60% meat) at 5.69 ± 2.33 kgf·mm. This trend suggests that higher proportions of saline tilapia meat reduce chewiness. Drier products typically exhibit higher chewiness values than those with higher moisture content (Godschalk-Broers et al., 2022).

Cohesiveness is defined as the energy required to break down a food product until it becomes swallowable. According to the One-Way ANOVA results, differences in meat concentration did not significantly affect cohesiveness ($p > 0.05$). The highest mean cohesiveness was measured in treatment A3

(30% meat) at 0.42 ± 0.06, while the lowest was found in A1 (0% meat) at 0.29 ± 0.05. This indicates that variations in saline tilapia meat concentration did not influence dim sum cohesiveness. Cohesiveness reflects material integrity, where a value of 1 indicates a completely intact, purely elastic material, and a value of 0 indicates full disintegration (Dunne et al., 2025).

Adhesiveness in TPA refers to the force required to overcome adhesion between the sample and the probe during testing. One-Way ANOVA showed that differences in meat concentration had no significant effect on adhesiveness ($p > 0.05$). The highest adhesiveness was observed in A2 (15% meat) at 0.42 ± 0.58 kgf·mm, while the lowest was recorded in A3 (30% meat) at –0.05 ± 0.04 kgf·mm. Adhesiveness can be influenced by surface roughness. Hand-made dim sum may exhibit variable surface textures that are not necessarily affected by ingredient concentration. These findings differ from Ainsa et al. (2021), who reported that adding fish meat increased adhesiveness in two types of pasta.

Bite force

The non-parametric test indicated that variations in the concentration of saline tilapia meat had a significant effect on the bite force value of the Dim Sum samples ($p < 0.05$). The mean bite force values showed that the highest value was observed in treatment A1 (0% meat concentration), with an average of 7.80 ± 1.52, whereas the lowest bite force was recorded in treatment A5 (60% meat concentration), with a value of 5.33 ± 2.45. Dim Sum with lower fish-meat concentrations exhibited a firmer texture, which is attributed to the predominance of tapioca flour—known to produce a harder texture compared to fish meat. Tapioca flour has been reported to influence the firmness of fish-based products, as reflected in bite-force measurements (Mufarihat et al., 2019).

Tabel 3. Bite force saline tilapia Dim Sum

Sample	Bite force
A1	7.80 ± 1.52^{a}
A2	7.50 ± 1.38^{a}
A3	6.80 ± 1.37^{b}
A4	6.10 ± 1.84^{c}
A5	5.33 ± 2.45^{c}

Note:
Data followed by different lowercase letters in the same column indicate a significant difference at the 5% level ($p < 0.05$).

Colour analysis

Based on the One-Way ANOVA analysis, differences in saline tilapia meat concentration significantly affected the lightness, redness, yellowness, and ΔE values of the Dim Sum samples ($p < 0.05$). The highest lightness value was observed in treatment A5 (60% meat concentration), with a value of 47.00 ± 4.44, whereas the lowest lightness was found in treatment A1 (0% meat concentration), with a value of 36.30 ± 0.85. The highest redness value was recorded in treatment A4 (45% meat concentration) at 5.14 ± 0.66, while the lowest was found in treatment A1 at 1.60 ± 0.26. The highest yellowness value occurred in treatment A5 (60% meat concentration), with a value of 22.63 ± 1.55, and the lowest in treatment A1 at 7.77 ± 0.52.

Table 4. Colour of saline tilapia Dim Sum

Sample	L*	a*	b*	ΔE*
A1	36.30 ± 0.85^{a}	1.60 ± 0.26^{a}	7.77 ± 0.52^{a}	58.64 ± 0.82^{b}
A2	37.46 ± 0.83^{b}	2.64 ± 0.39^{a}	11.09 ± 0.90^{b}	58.06 ± 0.78^{b}
A3	40.54 ± 2.14^{c}	3.20 ± 0.40^{b}	14.94 ± 1.59^{b}	55.98 ± 1.71^{b}
A4	44.32 ± 3.56^{c}	5.14 ± 0.66^{c}	19.73 ± 2.47^{c}	54.10 ± 2.38^{b}
A5	47.00 ± 4.44^{c}	4.96 ± 1.32^{c}	22.63 ± 1.55^{c}	52.77 ± 3.47^{a}

Note:
Data followed by different lowercase letters in the same column indicate a significant difference at the 5% level ($p < 0.05$).

The highest ΔE value was obtained in treatment A1 (0% meat concentration) at 58.64 ± 0.82, whereas the lowest ΔE value was observed in treatment A5 (60% meat concentration) at 52.77 ± 3.47. Dim Sum samples with higher meat concentrations exhibited higher yellowness values compared to those with lower meat content. These findings align with Febiwina et al. (2024), who reported that increasing fish meat content leads to an increase in the yellowness (b*) of fish balls, resulting in a more yellow appearance.

Proximate Analysis

Protein content represents the amount of protein present in a food material or product and is commonly used to determine its nutritional value and overall quality. The One-Way ANOVA test indicated that variations in saline tilapia meat concentration significantly affected the protein content of the dim sum samples ($p < 0.05$). According to SNI 7756:2020 for fish dim sum, the minimum required protein content is 5%. Based on this standard, treatments A1, A2, and A3 did not meet the SNI requirement, whereas treatments A4 and A5 complied. The highest protein content was observed in treatment A5 (60% meat concentration), with an average of 8.82 ± 1.62%, while the lowest was found in treatment A1 (0% meat), averaging 2.11 ± 0.91%. Higher protein content corresponds to a greater proportion of meat and a lower proportion of tapioca flour, as reported by Nuriyansyah et al. (2024).

Table 5. Proximate of saline tilapia Dim Sum

Sample	Proximate (%)				
	Protein	Fat	Moisture	ash	Carbohydrate
A1	$2.11±0.91^{a}$	$0.24±0.13^{a}$	$54.13±2.43^{a}$	$0.81±0.11^{a}$	$42.71±1.49^{b}$
A2	$3.38±1.32^{b}$	$0.42±0.09^{a}$	$52.30±0.66^{a}$	$1.18±0.12^{b}$	$42.72±0.59^{b}$
A3	$4.17±1.60^{b}$	$0.57±0.04^{a}$	$50.53±0.84^{a}$	$1.24±0.16^{b}$	$43.50±2.22^{b}$
A4	$6.65±1.06^{c}$	$0.64±0.07^{b}$	$56.65±4.39^{a}$	$1.44±0.32^{b}$	$34.62±5.06^{a}$
A5	$8.82±1.62^{c}$	$1.27±0.50^{b}$	$58.74±4.39^{b}$	$1.67±0.19^{b}$	$29.50±5.32^{a}$

Note:

Data followed by different lowercase letters in the same column indicate a significant difference at the 5% level ($p < 0.05$).

Lipid analysis is important for determining the caloric value of food and assessing product quality. Differences in saline tilapia meat concentration significantly influenced the lipid content of the dim sum ($p < 0.05$). Based on SNI 7756:2020, the maximum allowable fat content for fish dim sum is 12%. All treatments in this study met the SNI fat-content requirement. The highest lipid content was recorded in treatment A5 (60% meat) at 1.27 ± 0.50%, while the lowest was in treatment A1 (0% meat) at 0.24 ± 0.13%. This difference is attributed to the higher moisture content in treatment A5, which hinders lipid extraction with non-polar solvents. High water content reduces solvent penetration into tissue and causes solvent saturation, leading to lower extraction efficiency (Harmayani & Fajri, 2021).

Moisture content represents the percentage of water in a food product. One-Way ANOVA results showed that variations in saline tilapia meat concentration significantly affected the moisture content of the dim sum ($p < 0.05$). According to SNI 7756:2020, the maximum allowable moisture content for fish dim sum is 60%. All treatments remained within this limit. The highest moisture content was found in treatment A5 (60% meat), averaging 58.74 ± 4.39%, whereas the lowest was observed in treatment A3 (30% meat) at 50.53 ± 0.84%. The decrease in moisture content is related to the binding ability of flour; as a binder, flour absorbs water within the meat matrix, thereby reducing overall moisture levels (Rokhayati et al., 2025).

Ash content represents the inorganic mineral components present in a food product. One-Way ANOVA demonstrated that different concentrations of saline tilapia meat significantly influenced the ash content of dim sum ($p < 0.05$). According to SNI 7756:2020, the maximum permissible ash content for fish dim sum is 2.5%. All treatments in this study complied with this standard. The highest ash content was recorded in treatment A5 (60% meat), with an average of 1.67 ± 0.19%, while the lowest was in treatment A1 (0% meat), averaging 0.81 ± 0.11%. The increase in ash content is associated with moisture evaporation during processing, which reduces water content while increasing the relative concentration of mineral components (Verawati et al., 2025).

Carbohydrate content is an essential component of food products and serves as a primary energy source. Variations in saline tilapia meat concentration significantly affected carbohydrate levels in the dim sum ($p < 0.05$). The highest carbohydrate content was observed in treatment A3 (30% meat), averaging 43.50 ± 2.22%, while the lowest was found in treatment A5 (60% meat), averaging 29.50 ± 5.32%. The reduction in carbohydrate content is influenced by shifts in other nutrient components; lower levels of protein, fat, or moisture correspond to higher carbohydrate percentages, and vice versa (Gaspersz et al., 2022).

Sensory analysis

Table 6. Sensory analysis of saline tilapia Dim Sum

Treatments	**Sensory**				
	Appearance	**Aroma**	**Taste**	**Texture**	**Slime**
A1	$\mathbf{7.00±1.66^{a}}$	$\mathbf{7.53±1.04^{a}}$	$\mathbf{7.20±0.81^{a}}$	$\mathbf{6.93±1.62^{a}}$	$\mathbf{9.00±0.00^{a}}$
A2	$\mathbf{6.93±1.44^{a}}$	$\mathbf{7.53±0.90^{a}}$	$\mathbf{7.40±0.97^{a}}$	$\mathbf{7.40±1.52^{ab}}$	$\mathbf{9.00±0.00^{a}}$
A3	$\mathbf{7.33±0.92^{a}}$	$\mathbf{7.87±1.01^{a}}$	$\mathbf{8.00±1.02^{b}}$	$\mathbf{7.87±1.25^{b}}$	$\mathbf{9.00±0.00^{a}}$
A4	$\mathbf{8.00±1.30^{b}}$	$\mathbf{8.60±0.81^{b}}$	$\mathbf{8.67±0.76^{c}}$	$\mathbf{8.47±1.04^{c}}$	$\mathbf{9.00±0.00^{a}}$

Treatments	Sensory				
	Appearance	Aroma	Taste	Texture	Slime
A5	**8.27±1.44^{b}**	**8.73±0.69^{b}**	**8.80±0.61^{c}**	**8.60±0.97^{c}**	**9.00±0.00^{a}**

Note:

Data followed by different lowercase letters in the same column indicate a significant difference at the 5% level ($p < 0.05$).

Appearance is one of the organoleptic parameters assessed using visual perception. The non-parametric Kruskal–Wallis test showed that the different concentrations of saline tilapia meat significantly affected the appearance of the fish Dim Sum ($p < 0.05$). The highest appearance score was observed in treatment A5 (60% meat concentration), with an average score of 8.27 ± 1.44, while the lowest score was found in treatment A2 (15% meat concentration), with an average of 6.93 ± 1.44.

The Kruskal–Wallis analysis also indicated that variations in saline tilapia meat concentration significantly affected the aroma of the Dim Sum ($p < 0.05$). The highest aroma score was recorded in treatment A5 (60% meat) with an average of 8.73 ± 0.69, whereas the lowest aroma score occurred in treatment A2 (15% meat) with an average of 7.53 ± 0.90. Increasing the proportion of fish meat tends to enhance the fish aroma, which may positively influence panelist acceptance (Bataweya et al., 2022).

Similarly, the Kruskal–Wallis test revealed that meat concentration significantly influenced the taste of the fish Dim Sum ($p < 0.05$). Treatment A5 (60% meat) yielded the highest taste score (8.8 ± 0.61), while treatment A1 (0% meat) resulted in the lowest score (7.2 ± 0.81). Higher meat concentrations generally enhance umami perception, thereby improving taste quality (Amalia et al., 2023).

The textural evaluation demonstrated that saline tilapia meat concentration also had a significant effect on Dim Sum texture ($p < 0.05$). The highest texture score was obtained in treatment A5 (60% meat) with an average of 8.6 ± 0.97, whereas the lowest score occurred in treatment A1 (0% meat) with an average of 6.93 ± 1.62. Increased fish meat concentration has been associated with improved texture characteristics in similar products (Mukminah et al., 2019).

Conversely, the concentration of saline tilapia meat did not significantly influence the sliminess parameter of the Dim Sum ($p > 0.05$). All treatments received a score of 9, indicating the absence of surface slime. Sliminess is one of the indicators of food spoilage, often associated with microbial growth on the product surface (Qotimah et al., 2022). The formation of a slimy layer denotes quality deterioration due to bacterial activity, rendering the product unsuitable for consumption (Alamsyah et al., 2021).

Conclusion

The results of the study indicate that variations in saline tilapia meat concentration significantly affected the parameters of hardness, springiness, gumminess, and chewiness, but had no significant effect on cohesiveness or adhesiveness. Differences in meat concentration also influenced protein content, fat content, moisture content, ash content, appearance, odor, taste, texture, bite strength, and color, while having no effect on slime formation. The best treatment was obtained in treatment A5 (60% meat concentration), as it met all quality standards for organoleptic attributes, protein content, fat content, moisture content, ash content, and Dim Sum bite strength.

References

Alamsyah, F. H., Irfan, & D. Yunita. (2021). The use of liquid smoke as a natural preservative for yellowfin tuna (Thunnus albacares) meatballs. *Food Technology: Information and Scientific Communication Media for Agricultural Technology*, 12(1): 103–109.

Anwar, K., & T. Khoirunnisaa. (2024). Evaluation of color intensity, pH, and preference of functional beverages made from butterfly pea flower tea and dates. *Pontianak Nutrition Journal (PNJ)*, 7(1): 509–515.

Apriansyah, E., F. M. Jaya, & H. Haris. (2021). The effect of varying compositions of African catfish (Clarias gariepinus) meat on the characteristics of instant noodles. *Journal of Fisheries Science and Aquaculture*, 16(1): 59–71.

Bakhsh, A., S. J. Lee, E. Y. Lee, Y. H. Hwang, & S. T. Joo. (2021). Evaluation of rheological and sensory characteristics of plant-based meat analogues compared to beef and pork. *Food Science of Animal Resources*, 41(6): 983–996.

Bataweya, I., R. S. Sulistijowaty, & N. Yusuf. (2022). Formulation and quality characteristics of squid sausage. *The NIKé Journal*, 10(4): 171–176.

Dunne, R. A., E. C. Darwin, V. A. P. Medina, M. E. Levenston, S. R. S. Pierre, & E. Kuhl. 2025. Texture profile analysis and rheology of plant-based and animal meats. *Food Research International*, 205: 1–10.

Falah, S., Aryani, & I. Ratnasari. (2023). The effect of adding green spinach (Amaranthus tricolor L.) on the nutritional quality of patin fish (Pangasius sp.) Dim Sum. *Juvenil: Scientific Journal of Marine and Fisheries*, 4(1): 51–56.

Febiwina, S., Diachanty, Irawan, I., B. F. Pamungkas, & I. Zuraida. (2024). Physicochemical characteristics and consumer acceptance of surimi-based meatballs from Sangkuriang catfish (*Clarias gariepinus* var. sangkuriang). *Media Teknologi Hasil Perikanan*, 12(3): 172–183.

Firmansyah, I., S. Suharto, & A. S. Fahmi. (2024). Addition of seaweed flour (Eucheuma cottonii) in stuffed milkfish prepared with white sweet potato flour (Ipomoea batatas L.). *Journal of Fisheries Science and Technology*, 6(2): 9–16.

Gasperzs, F. F., R. B. Sormin, & N. Salatin. (2022). The effect of flour ratio on proximate composition of scad fish (Decapterus sp.) meatballs. *INASUA: Journal of Fisheries Product Technology*, 2(2): 54–60.

Godschalk-Broers, L., G. Salad, & E. Scholten. (2022). Meat analogues: Relating structure to texture and sensory perception. *Foods*, 11(15): 1–31.

Guo, K., N. Zhang, J. Zhang, M. Zhang, M. Zhou, Y. Zhang, & G. Ma. 2023. Cantonese morning tea (Yum Cha): A bite of Cantonese culture. *Journal of Ethnic Foods*, 10(12): 1–12.

Haddad, S., H. Prasetiyo, & M. Rudi. (2024). Organoleptic and nutritional values of nuggets made from mixed fusilier and grouper surimi. *EDUFORTECH*, 9(1): 66–77.

Harmayani, R., & N. A. Fajri. (2021). Effect of adding oyster mushrooms (Pleurotus sp.) on chemical composition and organoleptic values of broiler chicken meatballs. *Journal of Science, Technology, and Environment*, 7(1): 78–90.

insa, A., A. Honrado, P. L. Marquina, P. Roncalés, J. A. Beltrán, & M. J. B. Calanche. (2021). Innovative development of pasta with the addition of fish by-products from two species. *Foods*, 10(8): 1–15.

Laksono, U. T., Suprihatin, T. Nurhayati, & M. Romli. (2019). Improving the texture quality of moray eel surimi using sodium tripolyphosphate and transglutaminase activator. *Indonesian Journal of Fishery Product Processing*, 22(2): 198–208.

Li, M., J. Huang, Y. Chen, X. Zu, G. Xiong, & H. Li. (2022). Correlations between texture profile analysis and sensory evaluation of cured largemouth bass meat (Micropterus salmoides). *Journal of Food Quality*, 2022: 1–7.

Mabrouki, S., A. Brugiapaglia, S. G. Patrucco, S. Tassone, & S. Barbera. (2023). Texture profile analysis of homogenized meat and plant-based patties. *International Journal of Food Properties*, 26(2): 2757–2771.

Mufarihat, I. K., S. Haryati, & A. Munandar. (2019). Characteristics of "bontot" made from a combination of Hawaiian ladyfish (Elops hawaiiensis) and tarpon (Megalops cyprinoides) meats. *Indonesian Journal of Fishery Product Processing*, 22(3): 476–482.

Mukminah, N., C. Lestari, & M. Agustiana. (2019). Effects of adding catfish (Clarias sp.) meat on protein content and organoleptic properties of fish chips. *Scientific Journal of Engineering Science and Technology*, 2(1): 45–52.

Nuraeni, N., E. T. W. Utami, E. Priyono, & W. M. Mustofa. (2023). Physical and organoleptic properties of nuggets made with different rabbit meat compositions. *Nusantara Journal of Animal Science*, 3(1): 21–28.

Nurchayati, S., Haeruddin, F. Basuki, & Sarjito. (2021). Suitability analysis for saline tilapia (Oreochromis niloticus) aquaculture ponds in Tayu Subdistrict. *Saintek Perikanan: Indonesian Journal of Fisheries Science and Technology*, 17(4): 224–233.

Nuriyansyah, H., Pramono, A. N. Annisa, & D. F. R. Purnama. (2024). Effects of meat and tapioca composition on cooking loss and physicochemical properties of chicken meatballs. *Journal of Food and Agricultural Technology*, 2(1): 34–40.

Qotimah, K., E. N. Dewi, & S. Suharto. (2022). Effects of gelatin–alginate edible coating on quality deterioration of catfish (Clarias sp.) meatballs during room temperature storage. *Journal of Fisheries Science and Technology*, 4(2): 93–99.

Rokhayati, U. A., S. I. Gubali, T. A. E. Nugroho, & Syahruddin. (2025). pH value and moisture content of broiler chicken meatballs formulated with purple sweet potato flour. *Journal of Agricultural Extension Development*, 22(1): 1–7.

Thenu, J. L., & L. H. Tinglioy. (2021). Growth rate, survival, and chemical composition of Nile tilapia (Oreochromis niloticus) engineered from freshwater to seawater environments. *INASUA: Fisheries Product Technology*, 1(1): 40–50.

Verawati, N., N. Aida, and M. Y. Osaka. (2025). Innovation of patin fish nuggets with the addition of spinach, bamboo shoots, and wader fish (Rasbora jacobsoni). *Sains & Food Technology Journal*, 10(1): 8077–8086.