Barongko Crèmeux Formulations in Choux au Craquelin

ABSTRACT

Barongko, a traditional banana-coconut preparation from South Sulawesi, provided the culinary basis for developing a crèmeux filling for choux au craquelin. Sequential product development involved two successive formulations, F1 and F2, evaluated in separate sessions by the same 15 untrained panellists. Colour, texture, taste, aroma, and visual presentation were assessed using a five-point quality scale and summarised through descriptive statistics. F2 incorporated fully ripe kepok banana, fresh first-press coconut milk, 20 g cornstarch, and 6 g gelatin. Taste showed the largest difference in mean quality rating, increasing from 3.93 (SD = 0.96) in F1 to 4.67 (SD = 0.49) in F2. Mean differences in the remaining attributes ranged from −0.07 to +0.20 points. During production transfer to Ocean Café, the F2 formulation was maintained while the baking schedule was adjusted to obtain the intended dry choux shell. The sensory findings describe two successive preparations assessed in separate sessions, while the café transfer documents an adjustment to baking conditions under the available equipment.

Keywords: *Barongko crèmeux; choux au craquelin; culinary product development; sequential panel evaluation; sensory quality ratings*

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INTRODUCTION

Choux au craquelin is a steam-leavened pastry in which expansion, cavity formation, and shell integrity depend on the interaction between formulation and baking conditions. Nurhayati et al. (2026) examined the effects of mung bean flour incorporation on choux pastry properties and consumer acceptance.

Barongko is a traditional banana-coconut preparation from South Sulawesi, steamed in banana leaves (Amiruddin et al., 2026). Changes to South Sulawesi foods have been documented in commercial contexts (Anas et al., 2023), while adaptations of traditional foods may influence perceived traditional character and consumer acceptance (Fibri & Frøst, 2019; Vanhonacker et al., 2013). In this study, Barongko crèmeux refers to a chilled pastry filling made with banana, coconut milk, heavy cream, egg yolk, sugar, cornstarch, butter, and gelatin.

Banana ripeness affects sugar–acid balance, firmness, and volatile composition (Suresh Kumar et al., 2023), while coconut-milk processing can alter aroma-active compounds (Deng et al., 2024). Starch concentration and heating influence the rheology of

custard-like systems (Nishida & Watanabe, 2024). For pastry creams and fillings, ingredient selection also requires attention to functional performance and production consistency (Zaenal et al., 2026). Together, these factors inform decisions about flavour, setting, handling, and compatibility with the choux shell.

Research on choux structure, traditional-food adaptation, and ingredient functionality establishes relevant technical considerations, but the studies reviewed here do not examine Barongko crèmeux as a filling for choux au craquelin. This study documented formulation changes from F1 to F2 and compared quality ratings from the same panellists across two successive sessions.

METHOD

The Barongko crèmeux formulations were developed sequentially at the Laboratory Kitchen of Politeknik Pariwisata Makassar in 2025. An earlier prototype used Barongko diplomat cream and deck-oven baking but was not included in the F1–F2 comparison. The same 15 untrained panellists evaluated F1 and F2 in separate sessions, with F2 formulated after the F1 evaluation. Formulation was therefore confounded with session. The F2 laboratory preparation took place on 7 May 2025, one day before the second sensory session. A limited production transfer followed at Ocean Café in Gowa, South Sulawesi, on 21 June 2025.

The choux formulation was adapted from Gisslen (2025) and kept constant for F1 and F2, using 100 g water, 50 g unsalted butter, 1 g salt, 75 g hard flour, and 125 g whole egg. The craquelin contained 36 g unsalted butter, 30 g sugar, 40 g hard flour, and 2 g pandan paste. To prepare the choux, water, butter, and salt were brought to a boil before the flour was added to form a panade. After cooling, beaten egg was incorporated gradually, and the dough was moulded and frozen. The craquelin was mixed, rolled to approximately 2 mm, chilled or frozen, cut, and placed on the frozen choux pieces before baking.

F1 contained 200 g of kepok banana purée with maturity unspecified, 150 g of instant coconut milk, and 10 g of cornstarch. F2 used 200 g of fully ripe kepok banana, described as very soft and sweet, 150 g of fresh first-press coconut milk, and 20 g of cornstarch. The fresh coconut milk was the thick fraction obtained from the first pressing of mature grated coconut. F2 also contained two Gelita gelatin sheets (6 g total). Although the development notes describe an increase in gelatin, the F1 ingredient list does not specify its quantity, so the initial amount cannot be established. Heavy cream, egg-yolk count, sugar, butter, vanilla essence, and salt remained unchanged, as detailed in Table 1.

Table 1

Comparison of Barongko Crèmeux Formulations F1 and F2

Ingredient or condition	F1	F2	Status in comparison
Kepok banana	200 g purée; maturity not recorded	200 g; fully ripe, very soft	Changed specification
Coconut milk	150 g instant coconut milk	150 g fresh first-press coconut milk	Changed specification
Heavy cream	50 g	50 g	Fixed
Egg yolk	3 yolks; mass not retained	3 yolks; mass not retained	Fixed
Sugar	60 g	60 g	Fixed

Ingredient or condition	F1	F2	Status in comparison
Cornstarch	10 g	20 g	Changed quantity
Unsalted butter	30 g cold	30 g cold	Fixed
Vanilla essence	0.5 g	0.5 g	Fixed
Salt	0.25 g	0.25 g	Fixed
Gelatin sheet	Quantity not specified in the F1 ingredient list	6 g (2 Gelita sheets), bloomed	F1 quantity undetermined

Note. The F2 gelatin quantity was obtained from the ingredient-costing record.

Barongko crèmeux preparation and laboratory baking

Banana was processed into a coarse purée for both formulations, then heated with coconut milk, heavy cream, sugar, salt, and cornstarch to approximately 70°C under continuous stirring. A portion of the hot mixture was used to temper the egg yolks. The combined mixture was then stirred over low heat for approximately 15 min until visibly thickened, and cold unsalted butter was incorporated after heating. Pre-bloomed gelatin was included in F2. The crèmeux was cooled and chilled before filling. For the laboratory sensory preparations, choux shells were baked at 180°C for approximately 25 min using convection heat, with steam release or ventilation open to support surface drying, then cooled before filling.

Panel and rating procedure

Panel assessments covered colour, texture, taste, aroma, and visual presentation using a five-point quality scale anchored at 1 = Buruk, 2 = Kurang, 3 = Cukup, 4 = Baik, and 5 = Sangat Baik. The fifth item, labelled estetika in the original questionnaire, was reported as visual presentation based on the study notes referring to shape, garnish, and overall composition. The scale assessed perceived product quality rather than liking, so responses were treated as quality ratings rather than hedonic or descriptive sensory measurements. The Culinary Arts Study Program's Form 05 specified participant health eligibility, standardised instructions, random sample coding, uniform portions, and a controlled testing environment. The available session records establish the assessment sequence but do not verify implementation of these controls or document recruitment, serving conditions, and response independence.

Data analysis

Quality ratings for colour, texture, taste, aroma, and visual presentation were summarised using means and sample standard deviations (SD) for each formulation. Sample SD values were derived from the recorded descriptive statistics using 15 observations per formulation. Differences in mean ratings were calculated as F2 − F1 before rounding. Taste-score frequencies were tabulated to describe the distribution of responses across the five-point quality scale.

Replication and participant protection

The F2 sensory preparation was linked to one documented laboratory production event. Repeated panel ratings were treated as observations on the preparations rather than independent production-batch replicates. Sensory evaluation followed the Culinary Arts Study Program's Form 05 procedure for Project-Based Learning, which specifies participant

eligibility, assessment instructions, and a consent/signature section (*Tanda Tangan dan Persetujuan*) (Culinary Arts Study Program, Politeknik Pariwisata Makassar, 2025). The Head of the Culinary Arts Study Program and the Head of the Practice Kitchen Laboratory confirmed that Form 05 applied to this activity in 2025, that separate formal research-ethics approval was not required under the procedure, and that participant agreement was administered through the form. They also confirmed that anonymised sensory data could be used for scholarly publication. Completed signed forms were unavailable for retrospective individual verification. The findings are reported without participant identifiers.

RESULTS

The initial product-development stage identified two production issues concerning the Barongko-based filling and choux baking conditions. The earlier prototype used Barongko diplomat cream as the filling and a deck oven for baking. Before sensory evaluation, the filling was changed to Barongko crèmeux, and laboratory baking shifted to convection heat at 180°C for approximately 25 min. These adjustments established the production conditions used for F1. The choux and craquelin formulations, together with the laboratory baking conditions, were subsequently maintained for F2, with further refinement concentrated on the crèmeux filling. The formulation changes between F1 and F2 are presented in Table 1.

Both crèmeux formulations contained 200 g of kepok banana and 150 g of coconut milk, although the ingredient specifications differed. F1 used kepok banana purée and instant coconut milk, while F2 incorporated fully ripe kepok banana, described as very soft and sweet, and fresh first-press coconut milk. Cornstarch increased from 10 g in F1 to 20 g in F2, and the F2 formulation specified two pre-bloomed gelatin sheets (6 g total). The quantities of heavy cream, egg yolks, sugar, unsalted butter, vanilla essence, and salt remained unchanged between the two preparations (Table 1).

Among the five assessed attributes, taste showed the largest difference in mean quality rating, increasing from 3.93 (SD = 0.96) in F1 to 4.67 (SD = 0.49) in F2, a difference of 0.73 points (Table 2). F1 ratings were distributed across four categories, comprising five scores of 5, five of 4, four of 3, and one of 2. In F2, ten panellists assigned a score of 5 and five assigned a score of 4, placing all responses within the two highest categories. The distribution of F2 taste ratings was consequently more concentrated, consistent with its lower standard deviation.

Mean quality ratings for colour, texture, aroma, and visual presentation ranged from 4.33 to 4.67 in F1 and from 4.53 to 4.67 in F2. Aroma showed the largest mean difference outside taste, increasing from 4.33 to 4.53. Colour increased by 0.07 points, while texture was 0.07 points lower in F2. Visual presentation maintained the same mean rating of 4.67 across both sessions. Differences in the distribution of responses were most evident for colour, with the standard deviation decreasing from 0.99 in F1 to 0.52 in F2, whereas texture ratings showed comparable dispersion, with standard deviations of 0.49 and 0.51, respectively (Table 2).

Table 2

Descriptive Quality Ratings of Barongko Crèmeux Formulations F1 and F2

Attribute	F1 Mean ± SD	F2 Mean ± SD	Δ
Colour	4.47 ± 0.99	4.53 ± 0.52	+0.07
Texture	4.67 ± 0.49	4.60 ± 0.51	−0.07
Taste	3.93 ± 0.96	4.67 ± 0.49	+0.73
Aroma	4.33 ± 0.62	4.53 ± 0.52	+0.20
Visual presentation	4.67 ± 0.62	4.67 ± 0.49	0.00

Note. The same 15 panellists evaluated each formulation using a five-point quality scale. Values are presented as mean ± sample SD. Δ = F2 − F1, calculated before rounding.

The F2 formulation was prepared with Ocean Café staff on 21 June 2025, following the recipe and production sequence established in the laboratory. During the café production transfer, the choux required approximately 35 min at 180°C, followed by a further 10 min at 150°C, to achieve the intended dry outer shell. By comparison, laboratory convection baking required approximately 25 min at 180°C. The café preparation therefore involved a longer baking period and a lower temperature finishing stage under the available oven conditions. One staff-training session followed the production transfer.

DISCUSSION

Taste showed the largest shift in perceived quality between the F1 and F2 preparations. The remaining attributes began at mean ratings above 4 in F1, leaving comparatively little scope for higher scores within the five-point scale. Their smaller mean differences describe the pattern of panel assessments rather than establishing equivalent colour, texture, aroma, or visual presentation across the two preparations. The instrument recorded quality judgements of the finished choux au craquelin rather than analytical sensory intensity or consumer liking. Because F2 followed F1 in a separate evaluation session, the higher taste rating reflects the second preparation as assessed, with formulation and session conditions considered together.

Banana ripening changes sugar–acid balance, firmness, and volatile composition (Suresh Kumar et al., 2023), making fruit maturity relevant to the kepok banana specified for F2. Deng et al. (2024) documented changes in coconut-milk aroma-active compounds during thermal processing, indicating that processing conditions can influence its aromatic characteristics. These findings provide a scientific basis for considering banana maturity and coconut-milk processing when developing the filling. Starch concentration and heating influence the rheological behaviour of custard-like systems (Nishida & Watanabe, 2024), supporting the consideration of thickening and handling properties during crèmeux refinement. The observed taste ratings describe the finished preparations, in which the ingredient adjustments were evaluated together.

Zaenal et al. (2026) discuss ingredient qualification in pastry and bakery production in terms of functional performance and repeatability, including applications involving creams and fillings. In choux au craquelin, the Barongko crèmeux functions as part of the assembled pastry, where the filling and shell jointly contribute to the characteristics assessed by panellists. Texture ratings therefore represent perceived quality of the filled pastry, while

visual-presentation ratings encompass shape, garnish, and overall composition, consistent with the interpretation of *estetika* in the assessment notes.

Barongko crèmeux retained the banana–coconut basis of Barongko while adopting a different preparation method and product structure. Traditional Barongko is steamed in banana leaves (Amiruddin et al., 2026), whereas the developed crèmeux was cooked, chilled, and incorporated into a baked choux au craquelin shell. Samson et al. (2025) examine the diversification of traditional fermented foods through changes in ingredients, processing methods, and sensory characteristics, offering a conceptual basis for distinguishing culinary adaptation from reproduction of an original product. In the present application, the Barongko reference was expressed through ingredient selection and filling composition within an established pastry format. Fibri and Frøst (2019) examined consumer perceptions of original and modernised Indonesian traditional foods, establishing perceived traditional character as a separate consideration in evaluating culinary adaptations. The quality ratings reported here describe the assembled pastry, with cultural recognition remaining a distinct question from its assessed sensory attributes.

Trifosa et al. (2026) developed Job's Tears tempeh through successive preparation trials before sensory evaluation. Ilham et al. (2026) examined tamarind vinegar in a standardised pickled-fruit preparation, assessing its culinary application within a finished product. In developing Barongko crèmeux, feedback from the F1 evaluation informed the formulation of F2, while both preparations were assessed within choux au craquelin. This sequence combines iterative formulation refinement with evaluation in the intended culinary application.

The narrower distribution of F2 taste ratings indicates less variation in responses among panellists during the second evaluation. Production repeatability concerns a different source of variation: whether independently prepared batches of the same formulation produce comparable filling characteristics under defined conditions. Assessing repeatability would require separate production batches prepared with consistent ingredient specifications, heating and chilling procedures, and evaluation criteria. This would allow the performance of Barongko crèmeux to be examined across production runs, extending the assessment from panel responses to consistency in culinary preparation.

The production transfer to Ocean Café retained the F2 formulation and laboratory preparation sequence, while a longer, two-stage baking schedule was used to obtain the intended dry outer shell. This adjustment distinguishes the formulation, which remained unchanged, from the baking conditions applied under the café's equipment configuration. The observed shell condition provides a practical reference for assessing the baking endpoint alongside time and temperature settings. Recording oven temperature, product loading, and shell condition during subsequent café production would provide a basis for evaluating the consistency of the baking schedule under the same operating conditions.

Conclusion

The sequential development of Barongko crèmeux resulted in an F2 preparation that received a higher mean taste-quality rating than F1 among the same 15 panellists (4.67 versus 3.93). Mean differences in colour, texture, aroma, and visual presentation were smaller, with the ratings describing the complete choux au craquelin preparations evaluated in their respective sessions. The F2 formulation incorporated adjustments to banana specification, coconut-milk type, and thickening ingredients, providing a basis for further evaluation of the filling within the established pastry formulation. During production transfer to Ocean Café, the F2 recipe was maintained while the baking schedule was adapted to obtain the intended dry choux shell. Subsequent production trials can examine filling consistency across independently prepared batches and establish baking conditions suited to the café equipment.

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