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Innovative Use of Passion Fruit Byproducts in Tiramisu-Style Dessert for Waste Minimization

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ABSTRACT: Growing interest in sustainability within the culinary field has encouraged the use of fruit byproducts to reduce waste and enhance product value. A tiramisu-style dessert was formulated using passion fruit pulp, peel, and seeds to demonstrate their functional potential across multiple preparation forms, including jam, syrup, gel, and seed-based textural elements. Two stages of sensory evaluation were conducted, beginning with expert validation followed by hedonic testing with untrained panelists, revealing notable improvements in flavor intensity, aroma, and overall acceptability after formulation adjustments. The dessert achieved favorable responses for its distinctive tropical profile, creamy structure, and balanced sweetness, suggesting strong potential for consumer acceptance. Findings indicate that passion fruit byproducts can be effectively integrated into dessert formulations while supporting zero-waste culinary practices and offering opportunities for sustainable product innovation.

KEYWORDS: Culinary Innovation, Dessert, Food Waste, Passion Fruit, Tiramisu

I. INTRODUCTION

Desserts have undergone significant cultural and gastronomic transformation, shifting from simple sweet dishes into expressive elements of culinary identity. Historically, desserts were composed primarily of basic ingredients such as fruits and sugar (Tebben, 2015). Today, however, contemporary dessert practices display a diverse assortment of flavors, textures, and visual forms that reflect creativity, lifestyle shifts, and broader cultural influences. In many culinary contexts, desserts are valued not merely for their sweetness but for their ability to evoke memory, emotion, and sensory pleasure (Sthapit, 2017). In Indonesia, particularly in urban culinary hubs such as Jakarta, desserts have developed into products that merge novelty and aesthetic appeal, influenced by social media visibility and shifting consumer preferences. The popularity of visually engaging and "viral" dessert products demonstrates how digital consumption shapes contemporary food trends (Yuha, Suhud, & Rahmi, 2024). This consumer landscape has also been affected by evolving dietary considerations, including interest in plant-based, low-sugar, and gluten-free alternatives, enabling a wider group of consumers to enjoy dessert products while accommodating health-related concerns. At the same time, desserts play a psychological role linked to comfort, reward, and emotional gratification. Sweet flavors activate neurological reward mechanisms, which partly explains cravings and the emotional satisfaction associated with dessert consumption (Core, Price, Alquist, Baumeister, & Tice, 2018). Moreover, dessert preferences are often shaped by social influences, food trends, and personal emotional states, indicating that indulgent eating is connected not only to taste but also to lifestyle and identity (Pilska & Nesterowicz, 2016). Moreover, Innova Market Insights (2024), reported that 19% of Indonesian consumers increased their sweet food consumption over the past year, in line with the rising popularity of modern desserts. Within this broader landscape, sustainability has become an increasingly important dimension of culinary innovation. Food waste reduction and the valorization of agricultural by-products have received growing academic and industry attention, leading to new practices that minimize waste and increase the functional use of raw materials. Fruits and vegetables contribute a significant share of global food waste with a total of more than 1.7 billion tonnes annually (Edwiges et al., 2018). Passion fruit, for instance, is typically utilized for its pulp or juice, while the peel and seeds are frequently discarded despite containing nutritional and functional components that could be incorporated into food products. Passion fruit byproducts such as peel and seeds represent roughly 50–55% of the fruit's total weight and are usually discarded, generating avoidable food waste (Liu et al., 2025). Underutilization of food byproducts adds to environmental problems including greenhouse gas emissions and landfill (Gómez-García, Campos, Aguilar, Madureira, & Pintado, 2021). Developing dessert preparations that apply a zero-waste approach contributes to culinary sustainability and generates added value for underutilized local produce. The formulation of a tiramisu-

style dessert that incorporates passion fruit peel, pulp, and seeds therefore aligns with current movements toward environmentally responsible food production, innovation in dessert design, and the enhancement of locally available fruit-based ingredients. By integrating by-products into a recognizable and popular dessert format, this study positions passion fruit as a multifunctional ingredient capable of enriching sensory quality while contributing to sustainable culinary practice.

II. METHOD

The study employed a product development approach consisting of formulation, sensory evaluation, and iterative improvement. Passion fruit components were processed through multiple trials in order to obtain a tiramisu-style dessert that incorporated each part of the fruit as a functional ingredient. The peel was processed into jam, the seeds were dried and incorporated to provide texture, and the pulp was concentrated into syrup and gel, forming the basis of each layer in the dessert construction. This procedure followed a zero-waste principle intended to optimize the utilization of locally sourced passion fruit while minimizing discarded by-products. The research consisted of two testing phases. The first involved hedonic quality test carried out by three culinary professionals with academic and industry backgrounds. Instead of focusing solely on overall liking or disliking, this approach highlights panelists' assessments of specific product attributes, such as color, flavor, sweetness, and other distinctive sensory qualities (Lestiarini & Rindiani, 2023). The experts evaluated appearance, aroma, texture, taste, and aftertaste using a hedonic quality scale and provided qualitative feedback regarding improvements in flavor concentration, aroma intensity, and structural balance. Recommendations from this stage informed adjustments to the formulation, particularly in increasing passion fruit concentration and adjusting the consistency of the syrup and jam to intensify flavor without compromising texture. Following expert validation, a second sensory evaluation was administered to twenty untrained panelists from the general public who voluntarily participated in tasting sessions. The aim of this stage was to explore consumer impressions regarding taste, aroma, overall appeal, and the product's distinctive passion fruit characteristics. Participants were asked to provide hedonic ratings as well as general observations about product acceptability. Research instruments consisted of questionnaires, documentation of processing stages, and sensory evaluation forms. Hedonic assessment items were adapted from existing sensory evaluation practices in food-related studies (Qamariah, Handayani, & Mahendra, 2022). Product development was documented through photographic evidence, ingredient records, and preparation procedures. Data were collected quantitatively using numerical scores derived from the hedonic scale and further supported by qualitative comments from validators and panelists. Quantitative results were processed descriptively to determine the frequency of responses and level of acceptance, while qualitative feedback was used to guide further formulation refinement. The integrated approach between sensory scoring and descriptive feedback enabled systematic evaluation of improvements across consecutive product trials and supported the assessment of consumer acceptance of a passion fruit–based dessert using a minimum-waste concept.

III. RESULT

This section explain several research results based on the research and development stages, including product planning, initial prototype development, sensory testing by experts, product revisions, and hedonic testing.

A. Product Preliminary Design

The product design emphasizes the utilization of the entire passion fruit to minimize food waste while maximizing its functional and sensory potential in dessert applications. The pulp and juice serve as the primary flavoring components, delivering a bright, sweet–tangy tropical profile, while the seeds provide a natural crunchy contrast to the creamy dessert base. The peel is processed into a jam or extract and used as a flavor enhancer, contributing subtle aromatic complexity. The dessert is formulated to achieve a smooth and creamy texture with soft, intact layers, complemented by the fruit's natural golden color, refreshing tropical aroma, and balanced sweet–acidic taste. Prior to dessert preparation, all parts of the passion fruit are processed accordingly. The processing stage produced three main components, namely a concentrated sweet syrup, a slightly watery jam, and passion fruit seeds with a desirable crunchy texture. The syrup was utilized to soak the ladyfingers, allowing it to absorb moisture while imparting a mild yet recognizable tropical sweetness throughout the base of the dessert. The jam was applied as an additional layer between components to further enhance the passion fruit flavor; however, its contribution to tropical intensity remained limited due to its relatively thin consistency. Meanwhile, the passion fruit seeds were incorporated into the ladyfinger batter, providing a natural crunchy element that created textural contrast against the soft cake and creamy layers. Once all passion fruit components were processed and prepared, the dessert assembly process was carried out using these elements. The dessert was assembled through a carefully structured layering process, resembling a Tiramisu. The base layer consisted of ladyfingers thoroughly soaked in passion fruit syrup, allowing the cake to absorb moisture and flavor evenly. This was followed by a layer of smooth mascarpone cream, which provided richness and structural stability, and a thin layer of passion fruit jam that added a subtle fruity accent. The layering sequence was then repeated with another layer of syrup-soaked ladyfingers and mascarpone cream to build depth in both texture and flavor. To complete the dessert, a light drizzle of passion fruit jam was applied on top, along with a garnish of dried passion fruit seeds, which enhanced the visual presentation while introducing a contrasting crunchy texture.

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PASTRY STANDARD RECIPE CARD

DATE	RECIPE NUMBER	RECIPE TITLE	PRESENTATION (Example)	PORTIONS / SERVINGS	DURATION
		PASSION FRUIT TIRAMISU		10 cups Lady Finger : 15 cups	Prep : 15' Cook : 40' Plating : 10'

QUANTITY	UNIT	INGREDIENTS	PREPARATION	FOOD COST	
				UNIT COST	TOTAL COST
Passion Fruit Syrup					
200	ml	Water			
150	gram	Granulated Sugar			
330	ml	Passion fruit juice			
Passion Fruit Jam					
15	Pcs	Passion fruit skin			
50	gram	Granulated Sugar			
150	gram	Water			
	as needed	Passion fruit syrup			
Passion Fruit Seed					
15	pcs	Passion fruit			

METHOD

Passion Fruit Syrup

1	Lightly chop passion fruit pulp in a chopper (including the seed), avoid crushing the seeds excessively
2	Strain the juice until the seeds are drained of moisture (set aside the seed)
3	Put the juice in a pan, add water and sugar
4	Boil until slightly reduce and thickens up

Passion Fruit Seeds

1	Squeeze away all moistyre from the seeds. Spread and dry the seeds in an oven or airfryer on 120º C for 30-60 minutes
2	Finely ground the dried seeds using a food chopper to produce a coarse powder

Passion Fruit Jam

1	Cut passion fruit in half then scrape out the pulp and seed
2	Boil the skin for 2 hours
3	Scrape the pith from the thin outer layer
4	Blend the pith in a blender until smooth
5	Put the blended pith into a pan with sugar and water
6	Simmer until the mixture thickens up
7	Once it cooled down, add some of the passion fruit syrup into the jam.

Figure 1. Passion Fruit Processing – First Trial

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DATE	RECIPE NUMBER	RECIPE TITLE	PRESENTATION (Example)	PORTIONS / SERVINGS	DURATION
		PASSION FRUIT TIRAMISU		10 cups Lady Finger : 15 cups	Prep : 15' Cook : 40' Plating : 10'

QUANTITY	UNIT	INGREDIENTS	PREPARATION	FOOD COST	
				UNIT COST	TOTAL COST
Mascarpone Cream					
2	pcs	Egg yolks			
250	gram	Cheese Mascarpone			
300	gram	Whipping Cream	Whipped (Stiff Peak)		
15	tbsp	Passion fruit syrup			
Lady Finger					
5	Pcs	Egg white			
120	gram	Granulated Sugar			
5	Pcs	Egg yolk			
110	gram	All-purpose flour			
20	gram	Cornstarch			
10	gram	Passion fruit seed	Dried and Grounded		
Garnish					
As needed		Passion fruit seed			
As needed		Passion fruit jam			

METHOD

Lady Finger

1	Separate the egg whites and the egg yolks, then place asside the egg yolk
2	Whisk egg whites until foamy along with adding the sugar gradually and beat until stiff peaks
3	Add the egg yolk then gently fold the yolk into the whites
4	Sift in flour and cornstarch, then fold until combined
5	Add the dried passion fruit seeds, then gently fold again
6	Put the batter into a piping bag then pipe the batter into fingers on a tray lined with baking paper
7	Bake at 170º C for 14 minutes until golden

Mascarpone Cream

1	Whisk egg yolk in a double boiler until pale and slightly thick
2	Add the mascarpone cheese and fold with the egg yolk until smooth and combined
3	Add passion fruit syrup, mix well
4	In another bowl, whip cream to stiff peaks
5	Gently fold the mascarpone mixture into whipped cream until smooth and airy

Assembly

1	Spread a thin layer of passion fruit jam at the bottom
2	Dip lady finger until soaked into passion fruit syrup, then arrange over the jam
3	Add a layer of mascarpone cream
4	Spread another thin layer of jam then repeat with second layer of dipped lady fingers
5	Top with mascarpone cream
6	Add a bit of the passion fruit jam and finish with passion fruit seeds on top.

Figure 2. Passion Fruit Tiramisu-Style Dessert Recipe – First Trial

The dessert formulation resulted in soft ladyfingers complemented by a distinctive crunch from passion fruit seeds, contributing positively to the overall texture. The mascarpone cream exhibited good smoothness and structural stability, meeting the intended textural quality of the product. However, the dessert displayed a relatively pale appearance and a limited flavor profile, as the mascarpone layer lacked sufficient sweetness and failed to express the strong tropical aroma and taste characteristic of passion fruit. Since the cream functioned as the dominant component of the dessert, it was expected to deliver the primary tropical flavor.



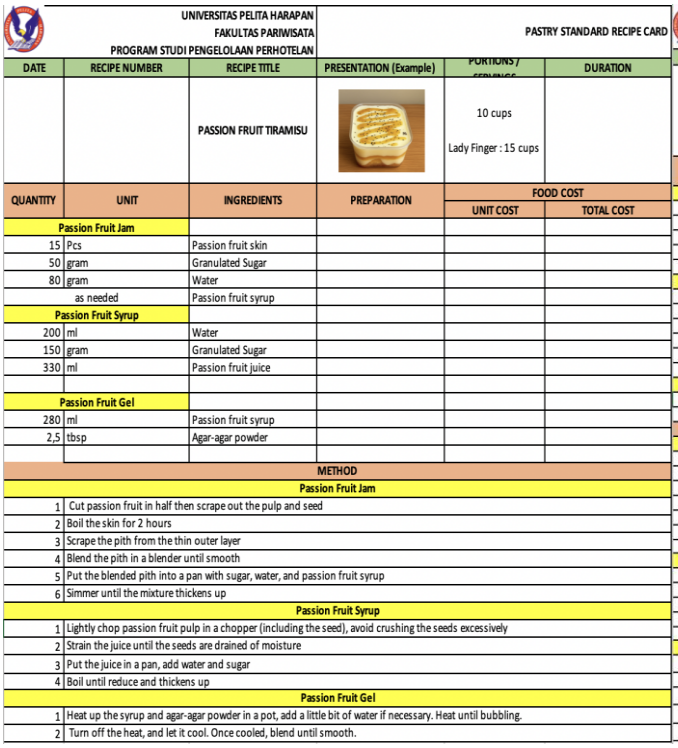
Figure 3. Passion Fruit Tiramisu-Style Dessert Result – First Trial

Nevertheless, the intensity remained subdued because only a small amount of syrup could be incorporated to maintain the desired cream consistency. Although increasing the syrup concentration could have improved flavor intensity, it would have compromised the cream's texture and stability due to the syrup's liquid nature. As a result, achieving an optimal balance between flavor intensity and structural quality emerged as a central challenge during the formulation process. To further validate the product's quality, the researchers invited two expert validators to do a hedonic quality test and assess the quality of the product.

B. Product Revision

Innovative Use of Passion Fruit Byproducts in Tiramisu-Style Dessert for Waste Minimization

Following the hedonic quality evaluation by two expert validators, several formulation adjustments were implemented to improve the dessert's overall flavor profile. These modifications primarily aimed to strengthen and balance the characteristic tropical flavor of passion fruit within the product.



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PASTRY STANDARD RECIPE CARD

DATE	RECIPE NUMBER	RECIPE TITLE	PRESENTATION (Example)	PORTIONS / SERVINGS	DURATION
		PASSION FRUIT TIRAMISU		10 cups Lady Finger : 15 cups	

QUANTITY	UNIT	INGREDIENTS	PREPARATION	FOOD COST	
				UNIT COST	TOTAL COST
Passion Fruit Jam					
15	Pcs	Passion fruit skin			
50	gram	Granulated Sugar			
80	gram	Water			
as needed		Passion fruit syrup			
Passion Fruit Syrup					
200	ml	Water			
150	gram	Granulated Sugar			
330	ml	Passion fruit juice			
Passion Fruit Gel					
280	ml	Passion fruit syrup			
2,5	tbsp	Agar-agar powder			

METHOD

Passion Fruit Jam

1. Cut passion fruit in half then scrape out the pulp and seed
2. Boil the skin for 2 hours
3. Scrape the pith from the thin outer layer
4. Blend the pith in a blender until smooth
5. Put the blended pith into a pan with sugar, water, and passion fruit syrup
6. Simmer until the mixture thickens up

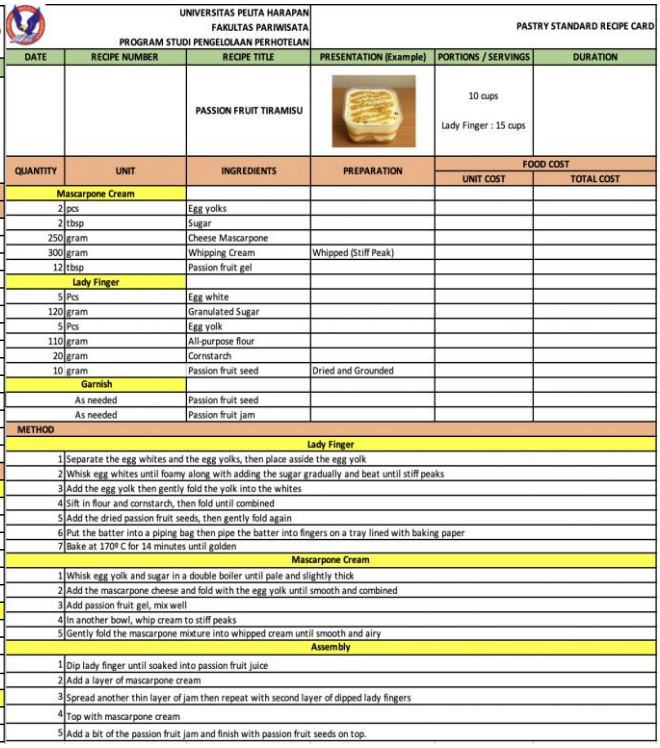
Passion Fruit Syrup

1. Lightly chop passion fruit pulp in a chopper (including the seed), avoid crushing the seeds excessively
2. Strain the juice until the seeds are drained of moisture
3. Put the juice in a pan, add water and sugar
4. Boil until reduce and thickens up

Passion Fruit Gel

1. Heat up the syrup and agar-agar powder in a pot, add a little bit of water if necessary. Heat until bubbling.
2. Turn off the heat, and let it cool. Once cooled, blend until smooth.

Figure 4. Passion Fruit Processing – Second Trial



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		PASSION FRUIT TIRAMISU		10 cups Lady Finger : 15 cups	

QUANTITY	UNIT	INGREDIENTS	PREPARATION	FOOD COST	
				UNIT COST	TOTAL COST
Mascarpone Cream					
2	pcs	Egg yolks			
2	tbsp	Sugar			
250	gram	Cheese Mascarpone			
300	gram	Whipping Cream	Whipped (Stiff Peak)		
12	tbsp	Passion fruit gel			
Lady Finger					
5	Pcs	Egg white			
120	gram	Granulated Sugar			
5	Pcs	Egg yolk			
110	gram	All-purpose flour			
20	gram	Cornstarch			
10	gram	Passion fruit seed	Dried and Grounded		
Garnish					
As needed		Passion fruit seed			
As needed		Passion fruit jam			

METHOD

Lady Finger

1. Separate the egg whites and the egg yolks, then place aside the egg yolk
2. Whisk egg whites until foamy along with adding the sugar gradually and beat until stiff peaks
3. Add the egg yolk then gently fold the yolk into the whites
4. Sift in flour and cornstarch, then fold until combined
5. Add the dried passion fruit seeds, then gently fold again
6. Put the batter into a piping bag then pipe the batter into fingers on a tray lined with baking paper
7. Bake at 170º C for 14 minutes until golden

Mascarpone Cream

1. Whisk egg yolk and sugar in a double boiler until pale and slightly thick
2. Add the mascarpone cheese and fold with the egg yolk until smooth and combined
3. Add passion fruit gel, mix well
4. In another bowl, whip cream to stiff peaks
5. Gently fold the mascarpone mixture into whipped cream until smooth and airy

Assembly

1. Dip lady finger until soaked into passion fruit juice
2. Add a layer of mascarpone cream
3. Spread another thin layer of jam then repeat with second layer of dipped lady fingers
4. Top with mascarpone cream
5. Add a bit of the passion fruit jam and finish with passion fruit seeds on top.

Figure 5. Passion Fruit Tiramisu-Style Dessert Recipe – Second Trial

The majority of the formulation revisions were concentrated on improving the processing of the passion fruit components. The water content used during jam preparation was reduced to achieve a thicker consistency and a more stable texture that better suited its role as a dessert layer. The syrup formulation itself remained consistent with the first stage, as it had already met the researcher's expectations in terms of sweetness and flavor. However, to improve its functional application, a portion of the syrup was converted into a gel by incorporating agar-agar powder. This modification allowed the passion fruit flavor to be integrated into the mascarpone cream more effectively without compromising the cream's stability or consistency. Meanwhile, the processing of the passion fruit seeds was left unchanged from the first trial, as their texture, crunchiness, and overall quality were already considered appropriate and satisfactory.Only minor modifications were applied during the dessert assembly stage, mainly related to the preparation of the mascarpone mixture. In the initial formulation, egg yolks were heated using a double-boiler method without added ingredients, resulting in a mixture with limited stability and a tendency to curdle. In the revised formulation, two tablespoons of sugar were added during the double-boiling process to enhance stability while also contributing mild sweetness. In addition, the infusion of passion fruit flavor into the mascarpone was achieved using syrup in gel form rather than liquid syrup, allowing a higher flavor concentration to be incorporated without compromising the mixture's consistency. The layering procedure remained unchanged from the first stage. Collectively, these adjustments resulted in a more pronounced and well-balanced passion fruit flavor in the final dessert.

C. Product Testing

The sensory quality of the passion fruit tiramisu-style dessert was evaluated using a hedonic quality test conducted in two validation stages. Product assessment involved expert validators who evaluated five sensory attributes: appearance, aroma, texture, taste, and aftertaste. Each attribute was rated using a six-point Likert hedonic scale, ranging from 1 (strongly dislike) to 6 (strongly like). In this study, a minimum mean score of 4.5 was established as the acceptability standard. Scores equal to or above this value indicate that the product meets the required sensory quality standard and is considered acceptable for further development or consumer testing. Sensory evaluation standards were defined prior to testing to guide assessment consistency. Appearance was expected to show clear layering and a vibrant yellow tone characteristic of passion fruit. Aroma was expected to express a distinct and refreshing tropical passion fruit scent. Texture was assessed based on a creamy and smooth mouthfeel combined with a subtle crunch from passion fruit seeds. Taste was evaluated based on a balanced profile of sweetness, acidity, and creaminess, with a clearly identifiable tropical flavor. Aftertaste was expected to leave a pleasant, lingering passion fruit freshness without bitterness or off-flavors. The validation process involved three expert validators with professional and academic

backgrounds in the culinary and pastry field. Two validators are professional chefs and lecturers from the Faculty of Hospitality and Tourism in Universitas Pelita Harapan, while one additional validator is a pastry professional and cake shop owner with approximately five years of industry experience. Their expertise ensured that the product evaluation was conducted based on established culinary quality standards and practical industry perspectives.

Table 1. Hedonic Quality Test – First Trial

No.	Validator's Name	Aspects				
		Appearance	Aroma	Texture	Taste	Aftertaste
1.	Jeremia Devananda Anca Putra S.Tr.Par.	6	1	6	2	2
2.	Vriandi Hapsara, S.Tr.Par., M.Par.	6	3	6	3	3
Total		12	4	12	5	5
Mean Score		6	2	6	2.5	2.5

The results of the first validation stage, as presented in Table 1, show that the initial formulation achieved high scores for appearance and texture, indicating that the visual presentation and structural characteristics of the tiramisu-style dessert were well received by the expert validators. The clear layering, creamy consistency, and inclusion of passion fruit seeds contributed positively to these attributes. However, aroma, taste, and aftertaste received comparatively low scores, resulting in mean values that fell far below the established minimum acceptability benchmark of 4.5. This outcome suggests that, despite satisfactory physical qualities, the sensory expression of passion fruit was insufficient. In particular, the dominant mascarpone component appeared to dilute the characteristic tropical aroma and flavor of passion fruit, leading to a less pronounced sensory profile. The low aftertaste scores further prove that the flavor did not persist adequately after consumption. This indicates the need of formulation revision.

Table 2. Hedonic Quality Test – Second Trial

No.	Validator's Name	Aspects				
		Appearance	Aroma	Texture	Taste	Aftertaste
1.	Jeremia Devananda Anca Putra S.Tr.Par.	6	5	6	6	6
2.	Vriandi Hapsara, S.Tr.Par., M.Par.	6	6	6	6	6
3.	Arum Amelia	5	6	5	5	5
Total		17	17	17	17	17
Mean Score		5.6	5.6	5.6	5.6	5.6

After formulation revisions, the second validation stage, as presented in Table 2, showed a substantial improvement in sensory performance across all evaluated attributes. All validators provided consistently high scores for appearance, aroma, texture, taste, and aftertaste, resulting in mean values that exceeded the minimum acceptability threshold of 4.5. The enhancement in appearance can be attributed to the passion fruit syrup being cooked for a longer duration, producing a brighter orange color that improved visual appeal and product vibrancy. Improvements in aroma, taste, and aftertaste were primarily achieved by thickening the syrup into a gel using agar-agar powder, which allowed for better flavor retention and a more concentrated passion fruit profile. In addition, increasing the amount of passion fruit gel further intensified the tropical aroma and flavor, resulting in a more pronounced and lingering sensory experience. Texture remained highly rated, indicating that these revisions did not compromise the product's creamy consistency or the desired crunchy element contributed by passion fruit seeds. Overall, the results confirm that the targeted formulation revisions effectively addressed the sensory limitations identified in the first trial and significantly improved alignment with the predefined sensory quality standards.

Table 3. Hedonic Test Mean Score Summary

No.	Aspects	Trial 1	Trial 2
1.	Appearance	4.9	5.3
2.	Aroma	3.6	5.4
3.	Texture	3.95	5.45
4.	Taste	4.15	5.85
5.	Aftertaste	4.1	5.75

Once the product is validated by experts. Both versions are tasted by twenty untrained panelists to learn the overall likeability. Table 3 presents the mean score summary of the hedonic test for the passion fruit tiramisu-style dessert across twenty untrained panelists. The mean scores were calculated using the same six-point Likert hedonic scale applied in the hedonic quality evaluation, with a minimum acceptability threshold set at 4.5. In Trial 1, only the appearance attribute exceeded the acceptability standard with a mean score of 4.9 while aroma (3.6), texture (3.95), taste (4.15), and aftertaste (4.1) fell below the required minimum mean score. These results indicate that the initial formulation did not fully meet the predefined sensory quality standards, particularly in terms of flavor intensity and aroma expression. Following formulation revisions, Trial 2 demonstrated a substantial improvement across all evaluated aspects. All sensory attributes achieved mean scores well above the acceptability threshold, with taste (5.85) and aftertaste (5.75) receiving the highest ratings, followed by texture (5.45), aroma (5.4), and appearance (5.3). This improvement confirms that the revised formulation successfully enhanced the sensory quality of the product and met the hedonic quality standards established for this study.

D. Discussion

The hedonic evaluation results confirm that passion fruit byproducts can be effectively incorporated into a tiramisu-style dessert while maintaining high sensory acceptability. The first trial revealed that although the product met structural and visual expectations, the passion fruit aroma and taste were insufficiently pronounced. This outcome highlights the challenge of incorporating aqueous fruit components into dairy-based desserts without compromising texture or flavor clarity. To address this limitation, the formulation was revised by increasing flavor concentration through the use of passion fruit gel rather than liquid syrup. This modification allowed stronger tropical flavor delivery without destabilizing the mascarpone cream. As reflected in Table 3, the revised product achieved high mean scores for aroma, taste, and aftertaste, indicating that the sensory standard of a strong yet balanced tropical profile was successfully achieved.

Texture consistently received favorable evaluations in both trials, confirming that the combination of creamy mascarpone and crunchy passion fruit seeds met the intended textural standard. This finding supports the functional value of passion fruit seeds as a natural textural enhancer rather than a waste component. Similarly, the use of peel-based jam contributed to flavor depth while supporting the study's waste-minimization objective. Overall, the improvement in hedonic scores between trials demonstrates that sensory quality can be enhanced through targeted processing adjustments. The results support the hypothesis that sustainable dessert innovation using fruit byproducts can align with established sensory quality standards. This study further demonstrates that waste-minimization strategies in dessert development do not inherently compromise consumer acceptance when supported by appropriate formulation and processing techniques.

IV. CONCLUSION

The results show that all components of passion fruit including pulp, peel, and seeds can be incorporated into a tiramisu-style dessert and still produce an acceptable sensory profile. Processing the peel into jam, the pulp into syrup and gel, and the seeds into a crunchy element allowed each part of the fruit to contribute sensorially without reducing product quality. The comparison between trials confirmed that, once the formulation was adjusted, the distinctive tropical flavour and aroma became more pronounced, indicating that passion fruit byproducts are suitable as functional ingredients in a dessert application. These findings directly address the research question and support the potential of a zero-waste approach in dessert development. Further refinement and wider testing are recommended in order to evaluate consistency, market acceptance, and possible commercial adaptation. Future studies may also investigate other dessert formats and explore variations in processing to optimise flavour intensity, stability, and sustainability outcomes.

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participation of the 20 untrained panelists, consisting of acquaintances, whose willingness to take part in the hedonic testing played an essential role in the successful completion of this study.

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