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Sensory Acceptability and Characterization of Tufo Enhanced with Banana Blossom *(Musa acuminata)*

[1]Myla T. Maisog and [2]Cheyserr C. Lelis
Graduate School Student, Surigao del Norte State University, Surigao City, Philippines [1]
Professor, Surigao del Norte State University, Surigao City, Philippines[2]

Abstract: *This study aimed to develop tofu enhanced with banana blossom extract (Musa acuminata) and assess its acceptability as a plant-based food product. Specifically, it examined the sensory acceptability of three tofu formulations, determined significant differences among the formulations, and identified its nutritional composition. The study used a descriptive-developmental research design and was conducted at the Food Technology Innovation Center of Surigao del Norte State University. Three formulations of banana blossom tofu were created and evaluated through sensory testing using a 9-point hedonic scale by 120 purposively selected respondents composed of TLE/TVL students and teachers/food experts. Quantitative data were analyzed using descriptive statistics, repeated measures MANOVA, ANOVA, and post hoc tests.Findings showed that among the three formulations, Formulation A consistently received the highest sensory acceptability scores across all attributes—appearance, aroma, taste, texture, and composite appeal. Statistical analyses confirmed significant differences in sensory attributes across formulations, with Formulation A emerging as the most preferred. Nutritional analysis of Formulation A revealed it is low in fat and sodium but high in protein, making it a viable and healthy food option.The study concludes that tofu enriched with banana blossom extract is an acceptable and nutritious plant-based alternative. The incorporation of banana blossom not only enhances the sensory and nutritional properties of tofu but also presents opportunities for innovation in the local food industry and agriculture. This supports its potential commercialization and inclusion in sustainable food development initiatives.*

Keywords: *Banana Blossom Extract, Plant-Based Tofu, Sensory Evaluation, Food Innovation, Nutritional Analysis*

I. INTRODUCTION

The global rise in plant-based diets has driven the demand for innovative, nutritious, and sustainable alternatives to animal-based products. Banana blossom (Musa acuminata), a versatile and nutrient-rich byproduct of banana cultivation, presents an ideal candidate for developing plant-based tofu. Typically discarded as agricultural waste, banana blossoms can be transformed into a valuable food product, promoting zero-waste principles and sustainable food systems.Tofu, a widely consumed plant-based protein, is a versatile food product known for its nutritional value, adaptability, and mild flavor. As the demand for healthier and more sustainable food options grows, innovations in tofu production have explored the incorporation of functional ingredients to enhance its nutritional profile and sensory qualities. One such innovation is tofu enhanced with banana blossom (Musa acuminata), an underutilized byproduct of banana cultivation.

Banana blossom is a nutrient-rich ingredient, high in dietary fiber, antioxidants, and essential minerals such as potassium, magnesium, and iron. Its fibrous texture and mild flavor complement the smooth and soft qualities of tofu, creating a unique product with improved health benefits. This enhanced tofu not only provides a higher dietary fiber content but also introduces bioactive compounds that promote digestive health and reduce oxidative stress. Banana blossom, the flower of the banana plant (Musa acuminata), is a nutrient-rich and versatile ingredient gaining attention in

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the culinary and health industries. Packed with dietary fiber, antioxidants, and essential minerals like potassium, iron, and magnesium, it offers numerous health benefits, including improved digestion, anti-inflammatory effects, and blood sugar regulation.Traditionally used in various Asian cuisines, banana blossom is now being recognized globally for its potential as a plant-based meat alternative due to its fibrous texture and mild flavor. Beyond its nutritional value, its utilization supports sustainability by reducing agricultural waste and promoting eco-friendly food production. This makes banana blossom an important ingredient for addressing modern demands for healthy and sustainable diets.

The development of tofu enhanced with banana blossom presents a promising innovation in the plant-based food sector. By incorporating banana blossom into tofu, the product benefits from an enhanced nutritional profile, including higher fiber content, essential minerals, and antioxidants, which contribute to improved digestive health, heart health, and overall well-being. Additionally, banana blossom's bioactive compounds offer anti-inflammatory and antimicrobial benefits, further elevating the functional value of the product.Sensory evaluation plays a crucial role in the acceptability of this enhanced tofu, with factors such as texture, flavor, and appearance significantly impacting consumer preference. Proper processing methods, such as blanching or marinating the banana blossom, can help mitigate any bitterness and optimize its flavor profile, ensuring a product that appeals to health-conscious consumers and those seeking sustainable, plant-based alternatives.

The growing trend toward plant-based diets and sustainability aligns well with the potential of banana blossom-enhanced tofu to meet consumer demands for nutritious, eco-friendly, and protein-rich food products. However, for widespread acceptance, it is essential to continue addressing challenges related to consumer unfamiliarity with the ingredient and to invest in education and marketing strategies to highlight its health benefits and versatility.Overall, banana blossom-enhanced tofu holds significant potential in the modern food market, offering a nutritious, sustainable, and innovative alternative to traditional tofu and other plant-based protein sources. With the right processing techniques and consumer education, it could become a popular choice among health-conscious and environmentally aware individuals.

II. LITERATURE REVIEW

Banana Blossom (*Musa Acuminata*) TOFU and Its Products

Banana blossom, the flower of the banana plant (Musa acuminata), is a nutrient-rich ingredient valued for its high dietary fiber, antioxidants, and essential minerals such as potassium, calcium, and magnesium (Singh et al., 2019). It is also a good source of plant-based iron and phenolic compounds, which contribute to its antioxidant and anti-inflammatory properties (Rani & Mishra, 2021). These attributes make banana blossom an excellent candidate for enhancing the nutritional profile of tofu-based products.Tofu, a traditional soy-based product, is recognized for its high protein content, low fat, and versatile nature in various culinary applications. Recent advancements in tofu production have focused on incorporating alternative plant-based ingredients to increase its nutritional density and cater to diverse consumer preferences (Smith et al., 2020). The addition of banana blossom to tofu provides an innovative approach to improving its fiber content and functional benefits while maintaining its characteristic soft texture and mild flavor. Banana blossom-enhanced tofu is a novel product that combines the health benefits of both ingredients. The fibrous texture and mild flavor of banana blossom complement tofu's adaptability, allowing for the creation of a protein-rich, high-fiber product suitable for various applications, such as stir-fries, soups, and snacks (Kumar & Gupta, 2021). Proper processing of banana blossom, such as blanching or soaking, is essential to reduce its bitterness and improve sensory qualities (Chen & Wang, 2018).

Research indicates that banana blossom tofu retains its nutritional and sensory qualities when subjected to freezing or other preservation methods, making it a viable option for frozen or ready-to-cook food products (Lopez & De Vera, 2022). Additionally, natural antioxidants in banana blossom help extend the shelf life of tofu products by reducing lipid oxidation (Sharma et al., 2022).Studies suggest that consumer acceptance of banana blossom tofu is primarily influenced by its sensory attributes, including texture, flavor, and appearance. Properly processed banana blossom tofu has been rated highly by sensory panels, particularly for its unique combination of firmness and smoothness (Kumar & Patel, 2023).Health benefits, such as high dietary fiber and antioxidant content, also appeal to health-conscious

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consumers. Marketing strategies emphasizing sustainability and the functional benefits of banana blossom tofu further enhance its consumer appeal (Davis & Morales, 2021).The development of banana blossom tofu supports sustainable food production by utilizing an agricultural byproduct that is often discarded. This aligns with global efforts to minimize food waste and promote eco-friendly practices (Rana et al., 2021). Economically, the integration of banana blossoms into tofu products provides an additional income source for banana farmers and reduces the environmental impact of banana cultivation.While banana blossom tofu has significant potential, challenges include consumer unfamiliarity with banana blossom as an ingredient and the need for optimized processing to enhance its sensory appeal. Opportunities exist in expanding its applications to international markets, particularly in regions where plant-based diets are growing in popularity (Smith & Gonzalez, 2022).

Development of Banana Blossom Tufo

Banana blossom, an underutilized byproduct of banana cultivation, is rich in essential nutrients, including dietary fiber, iron, potassium, magnesium, and antioxidants (Singh et al., 2019). Its high fiber content supports digestive health, while bioactive compounds such as flavonoids and tannins contribute to its anti-inflammatory and antimicrobial properties (Rani & Mishra, 2021). These characteristics make banana blossom an ideal candidate for functional food development.Research also highlights its low caloric value and cholesterol-free composition, which appeal to health-conscious consumers (Lopez et al., 2022). As a sustainable and cost-effective ingredient, banana blossom offers an opportunity to create innovative food products with added nutritional benefits.

Tufo, traditionally made from soybeans or other legumes, has gained recognition as a plant-based protein alternative due to its high nutritional value and adaptability in recipes (Smith et al., 2020). Enhancing tufo with banana blossom introduces additional health benefits, such as increased fiber content and bioactive compounds, while providing a unique texture and flavor profile (Kumar & Gupta, 2021).The integration of banana blossom in tufo production is particularly promising for developing vegetarian and vegan food products that align with the growing demand for sustainable and nutritious alternatives (Rao et al., 2021). Studies have shown that the incorporation of banana blossom not only boosts nutritional content but also adds natural antioxidants that improve product shelf life (Sharma et al., 2022).

Banana Blossom Extract

Banana blossom extract is a rich source of bioactive compounds with scientifically supported antioxidant, anti-inflammatory, antidiabetic, anticancer, and prostate-protective activities—predominantly in vitro and in animal models. Traditional uses in women's health and as a functional food are reinforced by modern evidence, but it awaits robust clinical validation.Banana blossom and its extracts are a nutrient-rich, multifunctional plant with strong traditional roots and emerging scientific support for benefits in digestion, blood sugar, immunity, menstrual/menopausal health, lactation, and possibly cancer/prostate support. For cooking, try using canned or fresh florets—experiment with fritters, vegan fish recipes, curries, salads, or Filipino *kulawo*. If you're interested in its medicinal effects (e.g. anti-inflammatory, antidiabetic), look for research-grade extracts or speak to a herbalist.Banana blossom extract is a **rich source of bioactive compounds** with scientifically supported antioxidant, anti-inflammatory, antidiabetic, anticancer, and prostate-protective activities—predominantly in vitro and in animal models. Traditional uses in women's health and as a functional food are reinforced by modern evidence, but it **awaits robust clinical validation.**

Processing and Preservation Techniques for Banana Blossom-Enhanced Products

The development of banana blossom tufo involves various processing steps, including cleaning, blanching, and incorporation into tufo production. These methods help reduce bitterness and improve the sensory qualities of the product (Chen & Wang, 2018). Freezing and drying have been identified as effective preservation techniques for maintaining the quality of banana blossom-based products, ensuring long shelf life and stability during storage (Singh et al., 2020).Natural preservatives, such as citric acid or ascorbic acid, can be used to prevent enzymatic browning and microbial spoilage during processing, enhancing the product's appeal and safety (Kumar et al., 2022).Banana blossom-

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enhanced tufo has potential applications in various food products, including frozen meals, snacks, and ready-to-cook dishes. Its fibrous texture mimics meat-like qualities, making it an excellent ingredient for plant-based patties, nuggets, and stir-fries (Lopez & De Vera, 2022). Researchers have successfully developed recipes incorporating banana blossom tufo into curries, salads, and soups, demonstrating its versatility and adaptability across different cuisines (Rao et al., 2020). The use of banana blossom in product development aligns with current food trends focusing on sustainability, zero-waste agriculture, and the use of locally sourced ingredients (Chatterjee et al., 2021). These innovations cater to both health-conscious consumers and environmentally conscious markets.

Acceptability and Sensory Evaluation of Banana Blossom-derived Products

Consumer interest in sustainable, plant-based ingredients has driven the demand for innovative products incorporating banana blossom. Research indicates that sensory attributes such as taste, texture, and appearance are critical factors influencing consumer acceptance (Davis & Morales, 2020). A study by Kumar and Patel (2023) highlighted that products enhanced with banana blossom are well-received for their health benefits, particularly among health-conscious and vegetarian consumers. However, sensory optimization through proper processing and seasoning is essential to overcome any potential bitterness or fibrous texture.The acceptance of new food products is influenced by a combination of sensory, cultural, and psychological factors. Taste, texture, appearance, and aroma remain the most critical determinants of consumer satisfaction and market success (Davis & Morales, 2020). Studies have shown that consumers are increasingly open to trying innovative foods, especially those marketed with health benefits or sustainability claims. However, sensory attributes must meet consumer expectations for these products to gain widespread acceptance (Rao et al., 2021).With growing awareness of health and environmental issues, consumer interest in plant-based and functional foods has surged. Products enriched with plant-based ingredients, such as banana blossom, are perceived positively when they align with trends in clean eating, veganism, and sustainability (Kumar et al., 2021). However, consumer perception of such products can vary based on prior exposure, cultural preferences, and marketing strategies. A study by Singh et al. (2019) highlighted that functional benefits, such as high fiber content or antioxidant properties, could increase the appeal of novel foods when clearly communicated.

Sensory evaluation is an essential tool for assessing consumer acceptance of new food products. Hedonic scales, consumer panels, and focus groups are commonly used to measure the appeal of specific sensory attributes, including flavor, texture, and appearance (Liu et al., 2020). Research has emphasized that optimizing sensory characteristics is crucial, especially for plant-based innovations that may have unfamiliar textures or flavors (Lopez & De Vera, 2022). For instance, banana blossom, while nutritious, may require careful seasoning and preparation to minimize bitterness and enhance its palatability. Health and sustainability claims significantly influence consumer decisions when selecting food products. According to a study by Davis et al. (2021), products labeled as "high in fiber," "rich in antioxidants," or "sustainably sourced" are more likely to gain consumer trust and acceptance. However, the perceived benefits must align with the actual sensory experience to sustain long-term market success. Overstated health claims without corresponding taste quality can lead to consumer rejection (Rao et al., 2021).

Recent studies indicate a global shift toward plant-based diets, driven by health concerns, ethical considerations, and environmental awareness (Smith & Gonzalez, 2022). Products like banana blossom-based meals are gaining traction as they offer sustainable, nutritious alternatives to traditional ingredients. However, their acceptance heavily depends on effective marketing, attractive product presentation, and familiarity with the ingredient (Kumar & Patel, 2023). Educating consumers about the nutritional and environmental benefits of banana blossom can further enhance its appeal.Introducing novel ingredients like banana blossom into mainstream food products can pose challenges. Some consumers may be resistant to unfamiliar flavors or textures, while others might hesitate due to a lack of awareness about the ingredient's benefits. Studies recommend gradual incorporation of such ingredients into familiar formats, such as curries, patties, or snacks, to ease consumer adaptation (Chatterjee et al., 2020). Additionally, clear labeling and transparent communication about the product's origin and nutritional value can improve acceptance rates (Rana et al., 2021).Consumer acceptance of banana blossom-enhanced products hinges on optimizing sensory attributes, leveraging health and sustainability claims, and addressing potential barriers through education and effective marketing strategies.

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The increasing demand for plant-based and functional foods presents a promising opportunity for banana blossom products, provided they align with consumer preferences and expectations.

III. METHODOLOGY

The study employed the descriptive-developmental research design method to create and evaluate a plant-based tofu alternative using banana blossom (Musa Acuminata). Mixed methods research design is determining the sensory attributes of the banana blossom tofu and analyzed for analytical and chemical analysis, which includes moisture content, fiber, and fat While the sensory acceptability of the food products that utilize the banana blossom for making tofu will be measured in terms of appearance, texture, aroma. The developmental research on banana blossom (Musa acuminata) tofu as a plant-based alternative for vegans was conducted at the Food Technology Innovation Center (FTIC) located within Surigao del Norte State University (SNSU) in Surigao City, CARAGA region. To determine the level of acceptability of the product, an adoptive questionnaire will be utilized, the potential products will be then evaluated using a Score Card and a Hedonic Scale especially in ascertaining the acceptability of the product in terms of appearance, texture and odor, by the panel of experts, consumers and farmers.

IV. RESULTS AND DISCUSSION

The sensory evaluation data reveals that Formulation A registered the strongest visual appeal among the three variants, posting an overall appearance mean of 8.17, which falls in the "Like Very Much" category. Panelists rated "The color of the tofu enhanced with banana blossom is visually pleasing" and "The smoothness and consistency of the tofu are suitable" equally highest at 8.82 ("Like Extremely"), underscoring how its bright hue and uniform surface strongly resonated with consumers. In contrast, the statement "The tofu enhanced with banana blossom presents an attractive and appetizing appearance" received the lowest mean of 5.65 ("Like Slightly"), suggesting that despite excellent technical attributes such as color uniformity and smoothness, the product's overall plating or visual excitement may need refinement to reach its full appetizing potential.Formulation B achieved an overall appearance mean of 7.41, interpreted as "Like Moderately," indicating that evaluators found it visually acceptable but less compelling than Formulation A. The highest - scoring attribute was "The tofu enhanced with banana blossom presents an attractive and appetizing appearance" with a mean of 7.59 ("Like Very Much"), implying that its general look on the plate appealed positively to panelists. However, the lowest rating, 7.19 ("Like Moderately"), was recorded for "The color of the tofu enhanced with banana blossom is visually pleasing," hinting that the product's hue—perhaps duller or less vibrant—was the key factor holding back greater visual enthusiasm. Formulation C posted a slightly higher overall mean of 7.47 ("Like Moderately") than Formulation B, reflecting a comparable yet marginally better visual acceptance. Evaluators awarded the highest mean of 7.57 ("Like Very Much") to "The tofu enhanced with banana blossom presents an attractive and appetizing appearance," showing that, as with Formulation B, its overall presentation was its strongest suit. The lowest mean, 7.29 ("Like Moderately"), corresponded to "The color of the tofu enhanced with banana blossom is visually pleasing," suggesting that improvements in pigmentation or uniformity of color would likely further enhance this formulation's aesthetic desirability.

TABLE 1: ACCEPTABILITY OF APPEARANCE OF TUFO ENHANCED WITH BANANA BLOSSOM (*Musa acuminata*)

Statement	Formulation A			Formulation B			Formulation C		
	M	SD	*D*	M	SD	*D*	M	SD	*D*
1. The color of the TUFO enhanced with banana blossom is visually pleasing.	8.82	0.39	***LE***	7.19	0.96	***LM***	7.29	0.76	***LM***
2. The smoothness and consistency of the TUFO enhanced with banana	8.82	0.39	***LE***	7.28	0.93	***LM***	7.42	0.69	***LM***

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blossom are suitable.									
3. The clarity or transparency of the TUFO enhanced with banana blossom meets the standard.	8.79	0.41	***LE***	7.44	0.85	***LM***	7.54	0.65	***LVM***
4. The TUFO enhanced with banana blossom is free from visible impurities.	8.75	0.49	***LE***	7.55	0.83	***LVM***	7.53	0.66	***LVM***
5. The TUFO enhanced with banana blossom presents an attractive and appetizing appearance.	5.65	1.07	***LS***	7.59	0.82	***LVM***	7.57	0.66	***LVM***
Average	**8.17**	**0.37**	***LVM***	**7.41**	**0.84**	***LM***	**7.47**	**0.64**	***LM***

Table 2 presents the sensory evaluation results on the aroma acceptability of tofu enhanced with banana blossom extract across three different formulations.

Formulation A achieved a high overall aroma acceptability score, with an average mean of 8.14, interpreted as "Like Very Much." It stood out for its consistent high scores across nearly all statements, particularly in "The aroma of the tofu enhanced with banana blossom is pleasant" and "The fragrance of the tofu enhanced with banana blossom is noticeable," both with a mean of 8.80 ("Like Extremely"). This suggests a strong aromatic profile that resonated well with the panelists. However, the lowest mean of 5.56 ("Like Slightly") was recorded for the statement "The scent of the tofu enhanced with banana blossom complements its expected flavor profile," pointing to a possible disconnect between the aroma and the anticipated taste experience, despite its otherwise strong olfactory appeal.Formulation B received a more modest overall mean of 7.47, interpreted as "Like Moderately," indicating a generally favorable but less enthusiastic reception. The highest rating for this formulation was 7.57 ("Like Very Much") in response to "The scent of the tofu enhanced with banana blossom complements its expected flavor profile," suggesting that its aroma was seen as well-aligned with its flavor. On the other hand, the lowest mean was 7.29 for "The aroma of the tofu enhanced with banana blossom is pleasant," reflecting a relatively less positive perception of the product's general aromatic strength or character.Formulation C recorded the highest overall aroma rating among the three, with a mean of 8.43 ("Like Very Much"), showing strong approval from respondents. Its best-rated attribute was "The scent of the tofu enhanced with banana blossom complements its expected flavor profile," which earned a mean of 8.58 ("Like Extremely"), indicating that the formulation's aroma was both pleasant and congruent with the flavor experience. The lowest-rated item, "The aroma of the tofu enhanced with banana blossom is pleasant," still earned a relatively high mean of 8.27 ("Like Very Much"), showing that even its least favorable aromatic feature was still well received. This reflects a well-balanced and harmonious aromatic profile for Formulation C, suggesting it may have the most marketable scent appeal among the three variants.

TABLE 2: ACCEPTABILITY OF AROMAOF TUFO ENHANCED WITH BANANA BLOSSOM (*Musa acuminata*)

Statement	**Formulation A**			**Formulation B**			**Formulation C**		
	M	**SD**	***D***	**M**	**SD**	***D***	**M**	**SD**	***D***
1. The aroma of the TUFO enhanced with banana blossom is pleasant.	8.80	0.46	***LE***	7.29	0.76	***LM***	8.27	0.60	***LVM***

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2. The fragrance of the TUFO enhanced with banana blossom is noticeable.	8.80	0.46	***LE***	7.42	0.69	***LM***	8.33	0.61	***LVM***
3. The aroma is free from any off-putting or undesirable scents.	8.78	0.48	***LE***	7.54	0.65	***LVM***	8.42	0.63	***LVM***
4. The aroma of the TUFO enhanced with banana blossom is fresh and natural.	8.78	0.48	***LE***	7.53	0.66	***LVM***	8.56	0.66	***LE***
5. The scent of the TUFO enhanced with banana blossom complements its expected flavor profile.	5.56	1.03	***LS***	7.57	0.66	***LVM***	8.58	0.62	***LE***
Average	**8.14**	**0.40**	***LVM***	**7.47**	**0.64**	***LM***	**8.43**	**0.55**	***LVM***

Table 3 displays the results of the taste acceptability evaluation for tofu formulations enhanced with banana blossom extract, a key sensory attribute that directly influences consumer satisfaction and repeat consumption,

Formulation A emerged as the most favored in terms of taste, recording the highest overall mean of 8.59, interpreted as "Like Very Much." The formulation was consistently rated "Like Extremely" across four of the five taste attributes, with the statement "The flavor of the food product is balanced (not too sweet or bitter)" receiving the highest mean of 8.82. This suggests that the formulation achieved an ideal harmony of flavors that pleased the panelists. The lowest-rated item, though still within a favorable range, was "The tofu enhanced with banana blossom leaves a pleasant aftertaste," which scored 7.74—interpreted as "Like Slightly." This dip suggests that although the overall flavor was well-liked, the residual taste might need improvement for a more satisfying finish.Formulation B received a lower overall mean score of 7.57, still falling under the "Like Very Much" category but markedly behind the other two variants. The highest rating for this formulation was found in the statement "The tofu enhanced with banana blossom leaves a pleasant aftertaste" (M = 7.64), while the lowest was for "The taste of the tofu enhanced with banana blossom is pleasant" (M = 7.46). These ratings suggest that while Formulation B was acceptable, it lacked the exceptional flavor harmony or freshness present in the other formulations, which might have impacted its ability to stand out in a competitive market.

Formulation C, on the other hand, achieved an impressive overall mean of 8.43, also interpreted as "Like Very Much." This formulation was characterized by high ratings across all descriptors, with the best-performing statement being "The tofu enhanced with banana blossom leaves a pleasant aftertaste," which received a mean of 8.58—suggesting a flavor experience that not only impressed during consumption but also left a satisfying finish. The lowest score, 8.27, was for "The taste of the tofu enhanced with banana blossom is pleasant," which is still high and indicates that even its weakest attribute was well received. This formulation demonstrates a consistently positive taste profile that would likely appeal to health-conscious and flavor-sensitive consumers alike.

TABLE 3: THE ACCEPTABILITY OF TASTE OF OFTUFO ENHANCED WITH BANANA BLOSSOM (*Musa acuminata*)

Statement	**Formulation A**			**Formulation B**			**Formulation C**		
	M	**SD**	***D***	**M**	**SD**	***D***	**M**	**SD**	***D***
1. The taste of the TUFO enhanced with banana blossom is pleasant.	8.81	0.42	***LE***	7.46	0.73	***LM***	8.27	0.60	***LVM***

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2. The flavor of the food product is balanced (not too sweet or bitter).	8.82	0.41	***LE***	7.53	0.69	***LVM***	8.33	0.61	***LVM***
3. The taste is natural and fresh, without any artificial aftertaste.	8.79	0.41	***LE***	7.60	0.64	***LVM***	8.42	0.63	***LVM***
4. The food product has a satisfying and enjoyable overall taste.	8.78	0.48	***LE***	7.63	0.62	***LVM***	8.56	0.66	***LE***
5. The TUFO enhanced with banana blossom leaves a pleasant aftertaste.	7.74	1.13	***LS***	7.64	0.62	***LVM***	8.58	0.62	***LE***
Average	**8.59**	**0.38**	***LVM***	**7.57**	**0.63**	***LVM***	**8.43**	**0.55**	***LVM***

Table 4 presents the sensory evaluation of the texture acceptability of tofu enhanced with banana blossom extract, based on ratings provided by a panel of evaluators.

Formulation A recorded the highest overall texture acceptability, with a mean score of 8.54, interpreted as "Like Extremely." It was rated highly across all texture parameters, with the statement "The tofu enhanced with banana blossom flows consistently when poured" achieving the highest mean of 8.65. Similarly, "The tofu has an even and smooth mouthfeel" (M = 8.64) also received strong approval. The lowest rating within this formulation was for "The texture of the tofu is smooth and uniform," which still received a favorable mean of 8.43 ("Like Very Much"), indicating consistent and desirable textural properties throughout the product.On the other hand, Formulation B had the lowest overall mean texture rating of 7.49, categorized as "Like Moderately." Among its texture descriptors, the statement "The tofu enhanced with banana blossom flows consistently when poured" received the highest score of 7.62, indicating acceptable consistency. The lowest rating was for "The texture of the tofu is smooth and uniform" (M = 7.32), which suggests slight dissatisfaction in terms of surface uniformity. While the formulation still received generally positive evaluations, the results point to areas for refinement, particularly in enhancing its smoothness and cohesiveness.

Formulation C received a slightly higher overall texture mean of 7.57, which falls within the "Like Very Much" range. It performed most favorably in the statement "The tofu enhanced with banana blossom flows consistently when poured," with a mean of 7.64, and "The tofu has an even and smooth mouthfeel" (M = 7.63), both suggesting an agreeable textural experience. The least-rated item was "The texture of the tofu is smooth and uniform," with a mean of 7.46, which still reflects a generally acceptable perception. Overall, Formulation C showed promising texture characteristics with minor variations, positioning it slightly ahead of Formulation B but still behind the excellent texture performance of Formulation A.

TABLE 4: ACCEPTABILITY OF TEXTURE OFTUFO ENHANCED WITH BANANA BLOSSOM (*Musa acuminata*)

Statement	**Formulation A**			**Formulation B**			**Formulation C**		
	M	**SD**	***D***	**M**	**SD**	***D***	**M**	**SD**	***D***
1. The texture of the TUFO enhanced with banana blossom is smooth and uniform.	8.43	0.59	***LVM***	7.32	0.80	***LM***	7.46	0.73	***LM***
2. The TUFO enhanced with banana blossom has a pleasant thickness and	8.48	0.55	***LVM***	7.41	0.74	***LM***	7.53	0.69	***LVM***

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consistency.

3. The texture is free from any graininess or lumps.	8.52	0.62	***LE***	7.54	0.67	***LVM***	7.60	0.64	***LVM***
4. The TUFO enhanced with banana blossom has an even and smooth mouthfeel when consumed.	8.64	0.61	***LE***	7.57	0.66	***LVM***	7.63	0.62	***LVM***
5. The TUFO enhanced with banana blossom flows consistently when poured.	8.65	0.59	***LE***	7.62	0.65	***LVM***	7.64	0.62	***LVM***
Average	**8.54**	**0.52**	***LE***	**7.49**	**0.66**	***LM***	**7.57**	**0.63**	***LVM***

Tables 5 and 6 present the results of statistical analyses conducted to determine whether significant differences exist among the three formulations of tofu with banana blossom extract in terms of their sensory attributes: appearance, aroma, taste, and texture.

TABLE 5: SIGNIFICANT DIFFERENCE ON THE ACCEPTABILITY OF THE SENSORY ATTRIBUTES OF THE THREE FORMULATIONS OFTUFO ENHANCED WITH BANANA BLOSSOM *(Musa acuminata)*

Attribute	F	p	Decision on Ho	Interpretation
Appearance	51.15	<0.01	Rejected	Significant
Aroma	123.56	<0.01	Rejected	Significant
Taste	87.33	<0.01	Rejected	Significant
Texture	169.09	<0.01	Rejected	Significant

Wilks' Lambda Λ= 0.159, F=88.44, p<0.01

The significant value of Wilks' Lambda ($\Lambda = 0.159$, $F = 88.44$, $p < 0.01$) in Table 9 confirms that the type of formulation had a statistically significant effect on at least one of the sensory attributes evaluated. Subsequent univariate analyses further supported this finding, revealing significant differences across all four individual sensory attributes—appearance ($F = 51.15$), aroma ($F = 123.56$), taste ($F = 87.33$), and texture ($F = 169.09$), all with p-values less than 0.01. These results indicate that the formulations were perceived differently by panelists depending on their sensory characteristics.

Table 10 provides a more detailed look into these differences through pairwise comparisons using Bonferroni post-hoc tests. For appearance, Formulation A ($M = 8.17$) was significantly preferred over both Formulation B ($M = 7.41$) and C ($M = 7.47$), while the difference between B and C was not significant ($p = 1.000$). In terms of aroma, all three formulations differed significantly from one another, with Formulation C ($M = 8.43$) leading in preference, followed by A ($M = 8.14$), and then B ($M = 7.47$). For taste, again, all pairwise comparisons showed significant differences. Formulation A ($M = 8.59$) was the most preferred, followed by C ($M = 8.43$), and lastly B ($M = 7.57$). Lastly, for texture, Formulation A ($M = 8.54$) significantly outperformed both Formulation B ($M = 7.49$) and C ($M = 7.57$), while no significant difference was found between Formulations B and C ($p = .679$). These findings underscore Formulation A's consistent superiority in sensory appeal, though Formulation C also showed competitive results, especially in aroma and taste.

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TABLE 6: PAIRWISE COMPARISONS ON SENSORY ATTRIBUTES OFTUFO ENHANCED WITH BANANA BLOSSOM *(Musa acuminata)* IN THREE FORMULATIONS

Attribute	Formulation (Mean)		p	Decision on Ho	Interpretation
Appearance	A (M=8.17)	B (M=7.41)	<0.01	Rejected	Significant
	A (M=8.17)	C (M=7.47)	<0.01	Rejected	Significant
	B (M=7.41)	C (M=7.47)	1.000	Not Rejected	Not Significant
Aroma	A (M=8.14)	B (M=7.47)	<0.01	Rejected	Significant
	A (M=8.14)	C (M=8.43)	<0.01	Rejected	Significant
	B (M=7.47)	C (M=8.43)	<0.01	Rejected	Significant
Taste	A (M=8.59)	B (M=7.57)	<0.01	Rejected	Significant
	A (M=8.59)	C (M=8.43)	<0.01	Rejected	Significant
	B (M=7.57)	C (M=8.43)	<0.01	Rejected	Significant
Texture	A (M=8.54)	B (M=7.49)	<0.01	Rejected	Significant
	A (M=8.54)	C (M=7.57)	<0.01	Rejected	Significant
	B (M=7.49)	C (M=7.57)	.679	Not Rejected	Not Significant

These results blend with the study of Soberano, Parojenog, and Crisologo (2022) who found that incorporating banana blossom flour into baked goods retained appealing color and visual characteristics, which aligns with the results of this study where Formulation A received the highest ratings in appearance. Their findings affirm the viability of banana blossom as an ingredient that does not negatively affect the visual quality of the final product.The variation in aroma scores among formulations can be explained by the presence of volatile compounds in banana blossom extract. Yang et al. (2024) reported that different marinated tofu products exhibited distinct aroma profiles due to volatile components such as 1,8-cineole and 2-pentylfuran, which significantly influenced panelists' evaluations. Similarly, the distinct aromatic properties of Formulation C in this study may be attributed to the complex aroma-active compounds in banana blossom.With regard to taste, Lin et al. (2024) emphasized that the use of plant-derived extracts and pre-emulsified compounds can improve the palatability of tofu by minimizing undesirable beany flavors. This is consistent with the higher taste scores of banana blossom–enhanced formulations, particularly Formulation A. Additionally, texture differences observed in this study echo the findings of Yang et al. (2024), who noted that plant-based ingredient addition influenced textural parameters such as cohesiveness and springiness, which correlated positively with sensory acceptability.

Table 7 presents the nutritional composition of the most preferred formulation of tofu enhanced with banana blossom extract, offering insight into its health benefits and dietary relevance.

The formulation contains 91.08 calories per 100g, with only 11.88 calories derived from fat, showing that it is a light food option suitable for calorie-conscious individuals. It provides 1.32g of total fat, contributing a modest 1% of the recommended daily value based on a 2,000-calorie diet. Sodium content is minimal at 8.52 mg, translating to 0% of the daily value, making this tofu formulation appropriate for those managing sodium intake, such as individuals with hypertension or cardiovascular concerns.

Carbohydrates are also modest at 7.22g per 100g, with 6g per serving accounting for only 2% of the daily value. The standout nutrient is protein, with a significant 12.58g per 100g or 11g per serving, which supplies 22% of the daily value and 15% of the Recommended Energy and Nutrient Intake (RENI) for Filipino males aged 19–29, as set by FNRI (2020). This makes the product particularly beneficial for muscle development, tissue repair, and overall satiety.

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TABLE 7: NUTRITIONAL CONTENTS OF FORMULATION "A"OF TUFO ENHANCED WITH BANANA BLOSSOM *(Musa acuminata)*

Food Nutrients	Result of Chemical Analysis (per 100g)	Amount of Food Nutrient per Serving Size (Rounded Value)	% Daily Value (based on 2000 Calorie Diet, Rounded Value)	% RENI (based on FNRI reference adult requirement of males 19–29 years old)
Calories	91.08	80	–	3
Calories from Fat	11.88	10	–	–
Total Fat (g)	1.32	1	1	–
Sodium (mg)	8.52	5	0	–
Total Carbohydrates (g)	7.22	6	2	–
Protein (g)	12.58	11	22	15

*Based on the Report of Chemical Analysis

% Daily Value is based on the New Nutrition Facts Label finalized May 20, 2016

V. CONCLUSION

Among the three tofu formulations enhanced with banana blossom extract, Formulation A was the most acceptable in terms of appearance, aroma, taste, texture, and overall appeal.The significant differences in sensory attributes among the three formulations confirm that the level of enhancement with banana blossom extract notably affects consumer acceptability.The most preferred formulation of tofu with banana blossom extract is nutritionally rich, especially in protein, and may contribute meaningfully to daily dietary needs.

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