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Sensory Acceptability of Banana Blossom (Musa Acuminata) Burger Patty

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ABSTRACT

This study evaluated the sensory acceptability of Banana Blossom (Musa acuminata) Burger Patty formulated in three different treatments. Specifically, the study assessed the product's appearance, aroma, taste, texture, and general acceptability and determined whether significant differences existed among the treatments. A quasi-experimental research design was employed, involving 65 third-year Bachelor of Science in Hospitality Management students from the University of Antique–Tario-Lim Memorial Campus who participated in the sensory evaluation using a 9-point hedonic scale. Data were analyzed using mean, standard deviation, and one-way analysis of variance (ANOVA). Results revealed that all three treatments were rated positively across all sensory attributes, with mean scores ranging from 7.42 to 8.04, indicating a high level of acceptability. Treatment 2 obtained the highest overall acceptability rating (M = 7.98, SD = 0.97), particularly in texture and general acceptability. However, ANOVA results showed no significant differences among the three treatments in terms of appearance ($p = .135$), aroma ($p = .392$), taste ($p = .263$), texture ($p = .246$), and general acceptability ($p = .290$). The findings suggest that banana blossom can be successfully utilized as a primary ingredient in burger patty production and remains acceptable across varying treatment levels. Consequently, banana blossom burger patty demonstrates potential as a nutritious, sustainable, and innovative plant-based meat alternative.

INTRODUCTION

The growing demand for healthier and environmentally sustainable food products has increased interest in plant-based alternatives to conventional meat. Consumers are increasingly adopting plant-based diets due to concerns related to health, environmental sustainability, food security, and animal welfare (Fiorentini *et al.*, 2020). Consequently, researchers and food manufacturers continue to explore innovative ingredients that can provide desirable sensory qualities while promoting sustainable food production. Banana blossom (Musa acuminata), commonly known as banana heart, has emerged as a promising ingredient for plant-based food development because of its high dietary fiber content, antioxidant properties, and naturally fibrous texture that resembles meat when cooked (Devje, 2022; Tunma *et al.*, 2025). Recent studies have demonstrated the potential of banana-derived ingredients in various food applications, including plant-based burgers and other value-added products, with favorable nutritional and sensory outcomes (Asha *et al.*, 2025; Mercês *et al.*, 2025). Despite these developments, limited studies have specifically examined the sensory acceptability of burger patties formulated primarily from banana blossom, particularly within the Philippine context where the resource is abundant but underutilized. Addressing this gap, the present study evaluated the sensory acceptability of Banana Blossom (Musa acuminata) Burger Patty formulated in three treatment variations. Specifically, it assessed the products in terms of appearance, aroma, taste, texture, and general acceptability and determined whether significant differences existed among the formulations. The findings contribute to the growing body of knowledge on plant-based food innovation and provide empirical evidence supporting the utilization of banana blossom as a sustainable and consumer-acceptable alternative ingredient for burger patty production.

LITERATURE REVIEW

Plant-Based Food Alternatives and Sustainable Food Innovation

The increasing global demand for sustainable and health-conscious food products has accelerated the development of plant-based alternatives to conventional meat products. Plant-based foods are increasingly recognized for their potential to reduce environmental impacts associated with livestock production while promoting healthier dietary patterns (Fiorentini *et al.*, 2020). Consumer preferences have shifted toward products that combine nutritional value, environmental sustainability, and sensory appeal, prompting researchers and food manufacturers to explore alternative plant-derived ingredients for meat analog development. Recent studies have demonstrated that plant-based meat alternatives can achieve consumer acceptance when formulated to replicate the sensory characteristics of traditional meat products, particularly appearance, aroma, taste, and texture (Kyriakopoulou *et al.*, 2021). Consequently, identifying locally available and

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underutilized plant resources has become an important strategy for promoting sustainable food innovation and food security.

Banana Blossom as a Functional Food Ingredient

Banana blossom (Musa acuminata), commonly referred to as banana heart, is an underutilized agricultural resource with considerable potential for food product development. It contains dietary fiber, essential minerals, antioxidants, and other bioactive compounds that contribute to its nutritional and functional properties (Tunma *et al.*, 2025). In addition, its naturally fibrous structure resembles the texture of cooked meat, making it suitable for incorporation into plant-based meat alternatives (Devje, 2022). Research has increasingly focused on the utilization of banana-derived ingredients in value-added food products. Mercês *et al.* (2025) reported that green banana biomass enhanced the nutritional profile and technological characteristics of plant-based burgers. Similarly, Asha *et al.* (2025) found that burger patties developed from banana by-products exhibited favorable physicochemical properties and sensory acceptance. These findings suggest that banana-based ingredients can serve as viable alternatives for formulating innovative and sustainable food products. Within the Philippine context, banana blossom has been successfully incorporated into various food products. Belgira *et al.* (2022) demonstrated the acceptability of banana blossom empanadas, while Dago *et al.* (2022) reported positive sensory evaluations of banana blossom cookies. Likewise, Maramag (2025) found favorable consumer acceptance of banana blossom as a sustainable taco filling. These studies collectively indicate the versatility of banana blossom as a food ingredient and its potential for broader commercial applications.

Sensory Acceptability in Food Product Development

Sensory acceptability is a critical factor influencing consumer preference and market success of food products. Sensory evaluation provides a systematic approach to measuring consumer responses to specific product attributes, including appearance, aroma, taste, texture, and overall acceptability (Stone & Sidel, 2020). These attributes collectively influence consumers' purchasing decisions and perceptions of product quality. Appearance serves as the initial basis for consumer judgment and influences expectations regarding product quality and flavor. Aroma contributes significantly to flavor perception and may affect the overall eating experience. Taste remains one of the most influential determinants of food preference, while texture affects mouthfeel and product satisfaction (Lawless & Heymann, 2010). General acceptability represents the overall evaluation of a product based on the combined effects of these sensory attributes. Previous studies have emphasized that maintaining desirable sensory characteristics is particularly important in plant-based food products because consumers often compare them with conventional meat products. Therefore, the successful development of plant-based alternatives depends not only on nutritional value but also on their ability to meet consumer sensory expectations (Kyriakopoulou *et al.*, 2021).

Research Gap

Although previous studies have demonstrated the successful incorporation of banana blossom into various food products, limited research has specifically investigated its application as the primary ingredient in burger patty formulations. Existing studies have largely focused on bakery products, snack foods, and other culinary applications, leaving insufficient evidence regarding the sensory acceptability of banana blossom burger patties. Furthermore, studies examining comparative differences among multiple banana blossom formulations remain scarce, particularly in the Philippine context. Therefore, the present study addresses this gap by evaluating the sensory acceptability of Banana Blossom (Musa acuminata) Burger Patty across three formulations in terms of appearance, aroma, taste, texture, and general acceptability.

MATERIALS AND METHODS

Research Design

This study employed a quasi-experimental research design to evaluate the sensory acceptability of Banana Blossom (Musa acuminata) Burger Patty formulated in three treatment variations. A quasi-experimental design is appropriate for examining treatment effects without random assignment of participants (White & Sabarwal, 2023). The independent variable was the proportion of banana blossom used in the formulations, while the dependent variables were appearance, aroma, taste, texture, and general acceptability. Sensory evaluation was conducted using a 9-point hedonic scale, a widely accepted instrument for measuring consumer preference and food acceptability (Stone & Sidel, 2020). A quantitative approach was employed, and the collected data were analyzed using descriptive and inferential statistics. Mean and standard deviation were used to determine the level of acceptability of each formulation, while one-way Analysis of Variance (ANOVA) was performed to identify significant differences among treatments at the 0.05 level of significance.

Locale of the Study

The study was conducted at the University of Antique – Tario-Lim Memorial Campus, located in Tibiao, Antique, Philippines. The institution served as the venue for the preparation of the Banana Blossom Burger Patty treatments and the conduct of the sensory evaluation. The campus was selected because it provided access to respondents with academic backgrounds relevant to food preparation and sensory assessment, thereby ensuring informed evaluation of the developed product. All product testing and data collection activities were carried out within the university following established research and ethical protocols.

Participants of the Study

A total of 65 third-year Bachelor of Science in Hospitality Management students from the University of Antique – Tario-Lim Memorial Campus participated in the study. Respondents were selected through purposive sampling due to their familiarity with food preparation and sensory evaluation. The participants served as consumer panelists and evaluated the Banana Blossom Burger Patty treatments using a 9-point hedonic scale based on appearance, aroma, taste, texture, and general acceptability. Participation was voluntary, and informed consent was obtained prior to the conduct of the sensory evaluation.

Research Instrument

Data were collected using a researcher-developed sensory evaluation questionnaire designed to assess the acceptability of Banana Blossom Burger Patty. The instrument was based on established sensory evaluation principles and was structured to measure five sensory attributes: appearance, aroma, taste, texture, and general acceptability. The questionnaire utilized a 9-point hedonic scale, a widely recognized method for assessing consumer preference and food acceptability (Stone & Sidel, 2020). The scale ranged from 1 ("Highly Unacceptable") to 9 ("Highly Acceptable"), allowing respondents to indicate their degree of liking for each sensory attribute. For general acceptability, respondents provided an overall evaluation of the product based on their cumulative sensory experience. To ensure content validity, the instrument underwent expert evaluation by a panel of five specialists in food preparation, research, and sensory assessment. Their recommendations regarding content relevance, clarity, and appropriateness were incorporated into the final version of the questionnaire. The instrument was further reviewed using the Good and Scates criteria for instrument validation. Prior to the conduct of the main study, a pilot test was administered to 30 respondents who were not included in the final sample. Reliability analysis using Cronbach's alpha yielded a coefficient of 0.952, indicating excellent internal consistency and confirming the suitability of the instrument for measuring the sensory acceptability of food products. The high reliability coefficient demonstrated that the instrument could consistently evaluate respondents' perceptions across the assessed sensory attributes.

Data Gathering Procedure

Prior to data collection, approval to conduct the study was secured from the appropriate university authorities. After obtaining the necessary permissions, the researchers prepared the Banana Blossom Burger Patty treatments following standardized procedures and ingredient proportions for each treatment. Three burger patty treatments were developed using varying proportions of banana blossom. The preparation process involved cleaning and boiling the banana blossom, mincing the cooked material, mixing it with the required ingredients, shaping the mixture into patties, and cooking the products under controlled conditions. To ensure consistency, all treatments were prepared using the same processing and cooking procedures. The sensory evaluation was conducted at the University of Antique – Tario-Lim Memorial Campus. Prior to the evaluation, the participants were informed about the purpose of the study and provided instructions on how to complete the sensory assessment. Each treatment was coded and presented to the respondents in a randomized manner to minimize bias. Drinking water was provided to allow participants to cleanse their palate between sample evaluations. Participants evaluated each treatment using a validated sensory evaluation questionnaire based on a 9-point hedonic scale. The products were assessed in terms of appearance, aroma, taste, texture, and general acceptability. Upon completion of the evaluation, the questionnaires were collected, checked for completeness, and organized for data processing and statistical analysis. All gathered data were encoded, tabulated, and analyzed using appropriate statistical tools to determine the level of sensory acceptability of the different Banana Blossom Burger Patty treatments and to identify any significant differences among treatments.

Data Analysis

The data gathered from the sensory evaluation were encoded, tabulated, and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive and inferential statistical techniques were employed to interpret the respondents' evaluations of the Banana Blossom Burger Patty treatments. Descriptive statistics, specifically the mean and standard deviation, were used to determine the level of acceptability of each treatment in terms of appearance, aroma, taste, texture, and general acceptability. The mean provided a measure of the respondents' overall ratings, while the standard deviation described the variability of responses. To determine whether significant differences existed among the three burger patty treatments across the evaluated sensory attributes, one-way Analysis of Variance (ANOVA) was employed. ANOVA is an appropriate statistical method for comparing the mean ratings of more than two independent groups and identifying variations in sensory acceptability among treatments. All statistical tests were conducted at a 0.05 level of significance. The null hypothesis was rejected when the computed p-value was less than 0.05 and accepted when the p-value was greater than or equal to 0.05.

Ethical Considerations

The study was conducted in accordance with established ethical principles governing research involving human participants. Prior to data collection, approval to conduct the study was obtained from the appropriate university authorities. The researchers ensured that all procedures complied with institutional ethical standards and protected the rights, welfare, and dignity of the

participants. Participation in the study was entirely voluntary. Before the sensory evaluation, respondents were informed of the purpose, procedures, and nature of the study and were provided with sufficient information to make an informed decision regarding their participation. Informed consent was obtained from all participants prior to their involvement in the study. The respondents were assured that their identities and responses would remain confidential and would be used solely for research purposes. No personally identifiable information was collected, thereby ensuring participant anonymity. Respondents were also informed of their right to decline participation or withdraw from the study at any stage without penalty or disadvantage. To minimize potential risks, the food products used in the sensory evaluation were prepared under appropriate food safety and sanitation practices. The researchers maintained the integrity of the data throughout the study and reported the findings accurately and objectively. All collected data were securely stored and accessed only by the researchers for the purpose of analysis and reporting.

RESULTS AND DISCUSSION

Sensory Acceptability of Banana Blossom Burger Patty

Table 1 showed that all three treatments of Banana Blossom Burger Patty were favorably evaluated by the respondents across the sensory attributes of appearance, aroma, taste, texture, and general acceptability. Mean ratings ranged from 7.42 to 8.04 on the 9-point hedonic scale, indicating that the products were generally perceived as very acceptable. Among the three treatments, Treatment 2 obtained the highest overall acceptability rating (M = 7.98, SD = 0.97), followed by Treatment 1 (M = 7.72) and Treatment 3 (M = 7.62). The superior performance of Treatment 2 may be attributed to its balanced proportion of banana blossom and complementary ingredients, which contributed to desirable sensory characteristics. Texture received the highest mean rating (M = 8.04), suggesting that respondents appreciated the product's mouthfeel and consistency. Previous studies have emphasized that texture is a critical determinant of consumer acceptance of plant-based meat alternatives because it closely influences perceptions of product quality and resemblance to conventional meat products (van den Bedem *et al.*, 2026). The fibrous structure of banana blossom may have contributed to the favorable texture ratings by providing a meat-like consistency that consumers find appealing. Similarly, aroma emerged as one of the highest-rated attributes across the treatments, particularly in Treatments 1 and 3. The favorable aroma ratings may be associated with the ability of banana blossom to absorb seasonings and flavoring ingredients during preparation. This observation supports the findings of Silva *et al.* (2025), who reported satisfactory sensory evaluations for banana blossom-based food products, particularly in attributes related to flavor and overall consumer liking. The positive ratings for appearance and taste further suggest that banana blossom can be effectively incorporated into burger patty treatments without compromising consumer expectations. These findings are consistent with previous studies on banana blossom cookies, empanadas, cupcakes, and taco fillings, which reported favorable sensory evaluations and high levels of consumer acceptance (Belgira *et al.*, 2022; Dago *et al.*, 2022; Maramag, 2025). Likewise, Asha *et al.* (2025) found that banana-derived ingredients can be successfully utilized in burger patty development while maintaining desirable sensory qualities. The results demonstrate the potential of banana blossom as a viable ingredient in plant-based burger products. The consistently high ratings across all sensory attributes indicate that banana blossom possesses desirable functional and sensory properties that can support the development of nutritious, sustainable, and consumer-acceptable meat alternatives. Given the abundance and affordability of banana blossom in the Philippines, its utilization in food product innovation may contribute to the promotion of sustainable food systems while providing consumers with alternative protein-rich food options.

Table 1: Acceptability of Treatment 1, Treatment 2, and Treatment 3 Across Sensory Attributes

Attributes	Treatment 1			Treatment 2			Treatment 3		
	Mean	SD	Interpretation	Mean	SD	Interpretation	Mean	SD	Interpretation
Appearance	7.78	1.21	Very Acceptable	7.90	1.29	Very Acceptable	7.42	1.46	Very Acceptable
Aroma	7.95	1.03	Very Acceptable	8.02	0.97	Very Acceptable	7.71	1.61	Very Acceptable
Taste	7.47	1.72	Very Acceptable	7.95	1.28	Very Acceptable	7.67	1.52	Very Acceptable
Texture	7.71	1.33	Very Acceptable	8.04	1.17	Very Acceptable	7.64	1.47	Very Acceptable
General Acceptability	7.69	1.10	Very Acceptable	8.00	1.19	Very Acceptable	7.67	1.36	Very Acceptable

Differences in Sensory Acceptability Among Treatments

Table 2 presents the results of the one-way Analysis of Variance (ANOVA) conducted to determine whether significant differences existed among the three formulations of Banana Blossom (Musa acuminata) Burger Patty in terms of appearance, aroma, taste, texture, and general acceptability. The findings revealed

that no statistically significant differences were observed across all evaluated sensory attributes. Specifically, appearance yielded a p-value of 0.13507, aroma obtained a p-value of 0.39218, taste recorded a p-value of 0.26309, texture generated a p-value of 0.24606, and general acceptability resulted in a p-value of 0.29031. Since all p-values exceeded the established significance level of 0.05, the null hypothesis was accepted for all attributes. The absence of significant differences indicates that variations in the proportion of banana blossom used in the three formulations did not substantially influence respondents' sensory perceptions of the products. Although Treatment 2 obtained slightly higher mean ratings across most sensory attributes, these differences were not sufficient to produce statistically distinguishable levels of acceptability. This finding suggests that the sensory qualities of the burger patties were maintained despite modifications in formulation, demonstrating the versatility of banana blossom as a primary ingredient in plant-based burger production. The results further imply that banana blossom possesses favorable functional properties that contribute consistently to product quality. Its naturally fibrous texture, flavor-absorbing capacity, and compatibility with other ingredients may have enabled the formulations to maintain similar sensory profiles. Previous studies have reported that banana blossom and other banana-derived ingredients can be successfully incorporated into food products without negatively affecting consumer acceptance (Asha *et al.*, 2025; Silva *et al.*, 2025). Likewise, studies on banana blossom-based empanadas, cookies, cupcakes, and taco fillings consistently demonstrated favorable sensory evaluations regardless of formulation variations (Belgira *et al.*, 2022; Dago *et al.*, 2022; Maramag, 2025). From a product development perspective, the findings are encouraging because they indicate formulation flexibility. Food manufacturers and entrepreneurs may adjust the proportion of banana blossom according to availability, nutritional targets, production costs, or desired product characteristics without significantly affecting consumer acceptability. This flexibility enhances the commercial viability of banana blossom burger patties and supports their potential as sustainable and affordable plant-based food alternatives. The results demonstrate that all three treatments were similarly acceptable to the respondents. The consistent sensory ratings across appearance, aroma, taste, texture, and general acceptability highlight the potential of banana blossom as a stable and consumer-acceptable ingredient for the development of innovative plant-based burger products.

Table 2: Comparative Differences Across Appearance, Aroma, Taste, Texture, and General Acceptability

Attributes	Computed - f	p - value	Decision
Appearance	2.02689	0.13507	Not Significant
Aroma	0.94144	0.39218	Not Significant
Taste	1.34631	0.26309	Not Significant
Texture	1.41436	0.24606	Not Significant
General Acceptability	1.24627	0.29031	Not Significant

CONCLUSION

This study demonstrated that Banana Blossom Burger Patty is a very acceptable plant-based food product based on respondents' evaluations of appearance, aroma, taste, texture, and general acceptability. All three treatments received favorable sensory ratings, indicating positive consumer perception of the developed product. Among the treatments, Treatment 2 obtained the highest mean ratings across most sensory attributes, suggesting that its ingredient composition provided the most desirable sensory characteristics. However, statistical analysis revealed no significant differences among the three treatments, indicating that variations in the proportion of banana blossom did not substantially affect consumer acceptability. The findings highlight the potential of banana blossom as a viable ingredient for the development of innovative burger patties and other plant-based food products. Its ability to maintain desirable sensory qualities across different formulations demonstrates its versatility and suitability as a sustainable alternative to conventional meat-based products. Furthermore, the study contributes to the growing body of literature on plant-based food innovation by providing empirical evidence on the sensory acceptability of banana blossom burger patties within the Philippine context. Banana Blossom Burger Patty shows promise as a nutritious, affordable, and environmentally sustainable food product that can support the diversification of plant-based food options and promote the utilization of locally available agricultural resources.

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