

Consumer Acceptability of Bamboo Shoot-Based Burger Patty Enriched with Ground Glutinous Rice: A Sensory Evaluation Study

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ABSTRACT

The utilization of underexplored plant resources for sustainable food innovation has gained increasing attention. This study evaluated the sensory acceptability and consumer preference of bamboo shoot-based burger patties enriched with ground glutinous rice. An experimental descriptive-comparative design was employed involving four treatments: a commercial meat-based patty (control) and patties formulated with 40%, and 60%, and 100% bamboo shoot content. Fifty-six untrained consumer panelists assessed appearance, aroma, taste, and texture using a 9-point hedonic scale. Descriptive statistics and one-way ANOVA ($\alpha = 0.05$) were applied.

Results indicated high overall acceptability ($M=7.48$), with appearance receiving the highest mean rating ($M=7.71$). The 100% bamboo shoot formulation achieved the highest preference score ($M=8.30$). Significant differences were observed among treatments across all sensory attributes ($p < .05$). Findings demonstrate that full substitution of meat with bamboo shoots does not compromise sensory quality and may enhance consumer preference. The study provides empirical support for bamboo shoots as a viable primary ingredient in plant-based meat alternatives, contributing to sustainable food product development and local value-added innovation.

Keywords: *Bamboo Shoot, Plant-Based Burger Patty, Sensory Evaluation, Consumer Acceptability, Glutinous Rice, Food Innovation*

INTRODUCTION

The growing demand for plant-based and alternative foods has increased interest in locally available, sustainable, and underutilized raw materials. Bamboo shoots, the edible, young shoots of bamboo plant, are low in fat and calories while being rich in dietary fiber, minerals, and bioactive compounds (Nirmala, Bisht, & Laishram, 2018). Despite their nutritional value and wide availability in many Philippine communities, bamboo shoots remain underutilized and are typically incorporated only in traditional household dishes (Zhang et al., 2024).

In Antique Province, particularly in municipalities such as Sibalom, Tibiao, and Patnongon, bamboo grows abundantly along riverbanks, forest margins, and upland areas. Traditionally, bamboo has been used for construction, furniture, and handicrafts. In recent years, it has also received institutional support as a resource for economic and environmental development. The Provincial Government of Antique, in collaboration with the Department of Trade and Industry (DTI), has promoted bamboo cultivation and value addition through communal plantations and the establishment of the Bamboo Center Shared Service Facility (SSF) at the University of Antique. These initiatives provide access to improved processing technologies, skills development, and market support for local artisans and MSMEs (Petinglay, 2022).

Despite these initiatives, the utilization of bamboo in Sibalom remains largely confined to non-food applications such as skewers, utensils, plant holders, furniture, and handicrafts. Its potential as a food ingredient, particularly in convenience foods, remains largely unexplored. Meanwhile, convenience foods such as burger patties are typically made from ground beef or pork, which are high in saturated fat and have been associated with health risks including obesity, cardiovascular disease, and type 2 diabetes (Ishak & Habibah, 2020). This has increased interest in healthier and plant-based food alternatives.

Bamboo shoots, locally known as tambo, dabong, labong, or rakong, are traditionally used in Filipino cuisine and possess nutritional characteristics suitable for modern food applications (Nongdam & Tiendra, 2014). However, few studies have examined consumer acceptance of bamboo shoot-based convenience foods. The incorporation of ground glutinous rice flour as a binder may improve moisture retention, cohesiveness, and texture while providing a gluten-free option for dietary-sensitive consumers (Merrick, 2025). The local availability of both bamboo shoots and glutinous rice supports sustainable production and efficient resource utilization.

Aligned with DTI and LGU initiatives promoting food innovation, value addition, and MSME development, this study aims to determine the level of consumer acceptability of a bamboo shoot-based burger patty enriched with ground glutinous rice through sensory evaluation. Understanding consumer preferences may guide local food innovation, increase the utilization of bamboo shoots as a food resource, and contribute to livelihood opportunities within the community.

Objectives of the Study

This study aimed to determine the level of consumer acceptability and preference of bamboo shoot-based burger patty enriched with ground glutinous rice among consumers at the University of Antique, second semester 2024-2025.

Specifically, the study sought to:

1. Evaluate the level of acceptability of bamboo shoot-based burger patty in terms of appearance, aroma, taste, and texture among consumers when taken as an entire group and when classified according to treatments;
2. Evaluate the level of preference of bamboo shoot-based burger patty in terms of appearance, aroma, taste, and texture among consumers when taken as an entire group and when classified according to treatments; and
3. Determine significant differences among the level of acceptability of bamboo shoot-based burger patty in terms of appearance, aroma, taste, and texture among consumers when classified according to treatments.

Theoretical Framework

This study is grounded on Sensory Evaluation Theory, Consumer Preference Theory, and Product Development Theory, which collectively explain how consumers evaluate and choose food products.

The sensory evaluation theory posits that consumers' acceptance and preference for food products are influenced by sensory attributes perceived through the senses, such as appearance, aroma, taste, and texture (Stone & Sidel, 2012; Lawless and Heymann, 2010). These sensory attributes serve as key determinants of consumer judgment and product success.

Consumer preference theory explains that when presented with multiple options, consumers tend to select products they like most. Preferences are established through comparison and evaluation of product attributes, leading to the selection of the most favored option (Kotler & Keller, 2016). In food studies, this reflects the consumer's overall choice among different product treatments.

Product development theory emphasizes that food products are optimized through systematic formulation, testing, and evaluation to meet consumer needs and market expectations (Fuller, 2016). Sensory evaluation serves as a critical stage in this process, providing empirical evidence on product acceptability and quality

Guided by these theories, this study assumes that varying levels of bamboo shoot incorporation in burger patties influence sensory attributes, which in turn affect consumer preference. The most preferred

formulation can inform value-added food initiatives and support MSME development in line with DTI and LGU food innovation programs.

Conceptual Framework

The conceptual framework of the study is anchored on the Input-Process-Output (IPO) model (Figure 1).

Figure 1 illustrates the Input-Process-Output (IPO) framework guiding the study. The inputs consist of the product treatments, a commercial burger patty (control), 40%, 60%, and 100% bamboo shoot patties, along with other ingredients and ground glutinous rice as a binding agent. The process includes product preparation, cooking, sample presentation, and sensory evaluation using a 9-point Hedonic Scale, followed by data collection and statistical analysis. The outputs comprise the level of consumer acceptability and preference based on sensory attributes (appearance, aroma, taste, texture), the identification of the most preferred product treatment, and the determination of significant differences among treatments.

This model also clarifies the study variables: the independent variable consists of product treatments and ingredients; intervening variables involve product preparation and sensory evaluation; and dependent variables are consumer acceptability and preference.

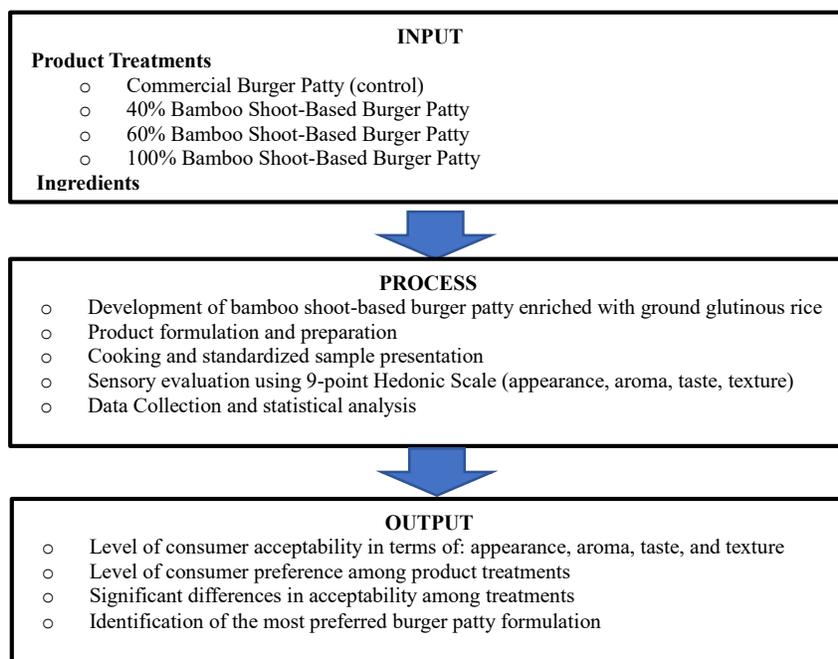


Figure 1.
IPO Model of Consumer Acceptability Bamboo Shoot-Based Burger Patty Enriched with Ground Rice

Hypothesis

Ho: There is no significant difference in the level of consumer acceptability of the bamboo shoot-based burger patty in terms of appearance, aroma, taste, and texture among consumers when classified according to treatments (commercial, 40%, 60%, and 100% bamboo shoot).

Significance of the Study

This study supports the programs and initiatives of the Department of Trade and Industry (DTI) and Local Government Units (LGUs) by demonstrating the potential of bamboo shoots as a value-added food product that contributes to food innovation, sustainable resource utilization, and the development of micro, small, and medium enterprises (MSMEs).

Department of Trade and Industry (DTI). The findings of this study may serve as a reference for the DTI in promoting food innovation, product diversification, and value-adding initiatives under programs such as Shared Service Facilities (SSF), One Town One Product (OTOP), and MSME development support. The developed bamboo shoot burger patty may be considered a viable product for incubation and potential commercialization.

Local Government Units (LGUs). This study provides LGUs with evidence on the feasibility of utilizing locally abundant bamboo shoots for food product development. The results may assist LGUs in designing livelihood, food processing, and enterprise development programs that promote sustainable agriculture and community-based entrepreneurship.

Entrepreneurship Students and Food Innovators. The study presents a practical model for developing marketable, plant-based food products using indigenous raw materials. It enhances competencies in innovation, product development, and consumer acceptability testing.

University of Antique. The study contributes to the University of Antique's mandate in instruction, research, and extension by supporting potential partnerships with DTI and LGUs in bamboo innovation, food processing, and MSME development initiatives within the province of Antique.

Consumers. The study offers consumers a nutritious, affordable, and plant-based alternative to conventional meat burger patties, contributing to healthier and more sustainable food choices.

Local Communities and MSMEs. The findings encourage the utilization of local agricultural resources, particularly bamboo shoots, as inputs for food enterprises. This supports livelihood generation and income diversification among micro-entrepreneurs and community-based enterprises.

Future Researchers. This study may serve as a reference for future research on food product development, sensory evaluation, and the utilization of underutilized agricultural resources.

Scope and Delimitation

This study focuses on the consumer acceptability and preference of a bamboo shoot-based burger patty enriched with ground glutinous rice, formulated with varying bamboo shoot content. Three (3) shoot concentrations such as 40%, 60%, and 100% were tested and compared with a commercially available meat-based burger patty, which served as the control.

The scope of the study includes:

1. Product formulation of three (3) bamboo shoot-based burger patty variants: B – 40% bamboo shoot content, C -60% bamboo shoot content, and D – 100% bamboo shoot content.
2. The sensory evaluation of four (4) burger patty samples (A – commercial control, B – 40%, C – 60%, and D – 100%) based on appearance, aroma, taste, and texture.
3. Consumer preference testing using a 9-point Hedonic Scale to determine the level of acceptability and preference for each treatment.

On the other hand, the study is subject to the following delimitations:

1. Respondents are limited to selected consumers, including students, faculty, staff, and community members within a specific locality, and may not represent the broader population.
2. Ingredients and preparation methods are confined to locally sourced bamboo shoots and basic cooking procedures, excluding advanced processing, preservation, or storage techniques.
3. The study does not include nutritional analysis, shelf-life evaluation, cost analysis, or profitability assessment, which may be considered in future research.
4. Evaluation focuses only on short-term consumer acceptability in a single-session sensory test and does not consider long-term consumption behavior, repeat purchase intent, or market feasibility.

These boundaries define the focus of the study and guide the interpretation of its findings within the context of sensory evaluation and preliminary product testing.

Definition of Terms

Bamboo shoot. This refers to the young, edible sprouts of bamboo plants commonly consumed as vegetables and recognized for their high dietary fiber, mineral content, and bioactive compounds (Nirmala et al., 2018)

In this study, bamboo shoot refers to the primary plant-based ingredient used in the formulation of the burger patty after cleaning, boiling, and finely chopping.

Bamboo Shoot-Based Burger Patty. This refers to a plant-based food product developed by combining bamboo shoots with other ingredients to form a meat alternative suitable for sandwich or burger preparation (Tziva et al., 2020).

In this study, bamboo shoot-based burger patty refers to the developed composed of bamboo shoots and ground glutinous rice, shaped into patties, cooked, and subjected to sensory evaluation.

Consumer Acceptability. This refers to the degree to which a product is liked or accepted by consumers based on sensory perception and preference (Fiorentini et al., 2020).

In this study, consumer acceptability refers to the level of liking of the bamboo shoot-based burger patty as measured using a 9-point Hedonic Scale.

Ground Glutinous Rice. This refers to a flour produced from glutinous (sticky) rice, characterized by its high amylopectin content, which provides binding and textural properties in food products (Juliano, 2019).

In this study, ground glutinous rice refers to the powdered glutinous rice incorporated into the bamboo shoot mixture to enhance binding, cohesiveness, and texture of the burger patty.

Sensory Evaluation. This refers to a scientific discipline used to measure, analyse, and interpret reactions to food characteristics as perceived by the senses of sight, smell, taste, touch, and hearing (Stone et al., 2020).

In this study, sensory evaluation refers to the systematic assessment of the bamboo shoot-based burger patty by respondents based on selected sensory attributes.

Sensory Attributes. This refers to the measurable characteristics of a food product perceived through the human senses and used to evaluate product quality and acceptability (Lawless & Heymann, 2010).

In this study, sensory attributes include appearance, aroma, taste, texture, and preference as rated by the respondents.

Appearance. It refers to the visual characteristics of a food product, including color and form, which influence consumer perception and initial acceptance (Lawless & Heymann, 2010).

In this study, appearance refers to the visual appeal of the bamboo shoot-based burger patty as rated by the respondents.

Aroma. This refers to the odor of a food product perceived through the olfactory senses and is a key determinant of food preference (Stone et al., 2020).

In this study, aroma refers to the perceived smell of the cooked bamboo shoot-based burger patty as evaluated by the respondents.

Taste. This refers to the basic flavour sensations perceived by the tongue, including sweetness, saltiness, sourness, bitterness, and umami (Lawless & Heymann, 2010).

In this study, taste refers to the flavour of the bamboo shoot-based burger patty as rated by the respondents during sensory evaluation.

Texture. This refers to the physical properties of food perceived by touch and mouthfeel, such as firmness and chewiness (Lawless & Heymann, 2010).

In this study, texture refers to the firmness, chewiness, and cohesiveness of the bamboo shoot-based burger patty as perceived by the respondents.

Preference. This refers to the degree of liking or choice of one product over others when consumers are presented with multiple alternatives, reflecting comparative evaluation based on sensory experience (Lawless & Heymann, 2010; Stone et al., 2020).

In this study, preference refers to the overall rating given by respondents to identify their most preferred burger patty treatment among the commercial product and the 40%, 60%, and 100% bamboo shoot-based formulations. Preference is determined based on the highest mean score obtained from respondents using a 9-point Hedonic Scale during sensory evaluation.

LITERATURE REVIEW

Bamboo Shoots as a Food Ingredient

Bamboo shoots are a versatile and nutritious food ingredient widely used in Asian cuisines. In India, they are commonly washed, soaked briefly, and cooked or fried, often combined with pork or vegetables (Patel et al., 2025). In the Philippines, fresh bamboo shoots are used in soups, stews, stir-fries, dinengdeng, pickles, and other braised or fried dishes. They are rich in dietary fiber, low in fat, and contain essential minerals such as potassium, calcium, and phosphorus (Nirmala et al., 2018; Nongdam & Tikendra, 2014).

The fiber content of bamboo shoots allows them to enhance the nutritional value of various foods, including bread, pasta, meat products, cheese, and yogurt, demonstrating functional versatility (Silva et al., 2020). Bamboo shoots also contain bioactive compounds, such as phytosterols and phenolics, which have antioxidant and anti-inflammatory effects (Bajwa et al., 2015). Despite their potential, bamboo shoots

remain underutilized in many Philippine regions, largely limited to traditional dishes and household-level preparations (Zhang et al., 2024). This underutilization highlights the need for innovative applications that enhance consumer acceptability and market potential.

Plant-Based and Alternative Meat Products

Global interest in plant-based foods is rising due to health concerns, environmental awareness, and ethical considerations related to meat consumption. Excessive intake of red and processed meat is associated with obesity, cardiovascular diseases, and metabolic disorders (Ishak & Habibah, 2020). Plant-based alternatives offer comparable sensory qualities while providing improved nutritional profiles.

Burger patties are a widely consumed convenience food and a suitable platform for plant-based innovations. Research has shown that vegetable-based patties made from legumes, mushrooms, soy, and starches can achieve moderate to high consumer acceptability when formulated with suitable binders and processing techniques (Mazumder et al., 2024; Petrat-Melin & Dam, 2023). Successful plant-based patties balance nutrition, sensory quality, and familiarity to meet consumer expectations (Santos et al., 2017; Elzerman et al., 2011).

Use of Bamboo Shoots in Processed Food Products

Several studies demonstrate the successful incorporation of bamboo shoots into processed food without compromising sensory quality. Barrera (2017) enriched embutido with bamboo shoots, achieving high acceptability in aroma, color, taste, and texture. Similarly, Leonor (2017) found that bamboo shoots containing 25% bamboo shoots and 75% pork was the most preferred formulation.

Other applications include bamboo shoot powder in polvoron (Elumbra, 2019) and bamboo shoot chips (Maroma, 2015), both receiving positive consumer responses. While these studies focus on traditional or snack-based products, research on Western-style convenience foods, such as burger patties, remains limited, highlighting the relevance of this study in advancing bamboo shoot utilization.

Glutinous Rice as a Binding Agent

Binding agents improve texture, cohesiveness, and overall acceptability of processed foods. Glutinous rice flour, with high amylopectin content, enhances moisture retention, binding capacity, and a smooth texture (Merrick, 2025). Being gluten-free, it is suitable for consumers with dietary sensitivities. Studies show that rice-based binders maintain structural integrity and desirable sensory qualities in plant-based patties (Zhang et al., 2021). Ground glutinous rice thus supports both functional and sensory objectives in bamboo shoot-based burger patties.

Sensory Evaluation and Consumer Acceptability

Sensory evaluation is essential for assessing consumer responses to new food products. Attributes such as appearance, aroma, taste, and texture strongly influence acceptability and preference (Lawless and Heymann, 2010). The 9-point hedonic scale is widely used to measure liking and allows meaningful comparisons across treatments.

Consumer acceptability is influenced by demographic, psychographic, behavioural, and environmental factors, including gender, age, dietary habits, and health consciousness (Rai et al., 2023). Sensory evaluation identifies formulations that meet consumer expectations and guides product refinement for potential market adoption (Ruiz-Capillas & Herranz, 2021).

Sensory Evaluation and Consumer Preference

Consumer preference reflects the overall choice among available product options. Plant-based meat alternatives, such as bamboo shoot-based patties, achieve higher acceptance when sensory attributes – appearance, aroma, taste, and texture are optimized using appropriate binders and processing techniques (Stone et al., 2020; McClements & Grossmann, 2021; Kyriakopoulou et al., 2023). Research highlights that consumers value products combining health benefits with familiar sensory characteristics, making bamboo shoot-based patties a promising option when sensory quality is carefully managed (Zhang et al., 2024; Merrick, 2025).

Food Innovation, MSME Development, and Local Resource Utilization

The development of value-added food products using local agricultural resources aligns with national and local initiatives promoting food innovation and MSME development. The Department of Trade and Industry (DTI) encourages the utilization of indigenous raw materials to support entrepreneurship, improve food security, and generate livelihood opportunities through product diversification and innovation (ASEAN Consumer, 2023; Bicama, 2025).

Local government units (LGUs), in partnership with academic institutions such as the University of Antique, play a critical role in promoting research-based product development that supports community enterprises. The use of bamboo shoots in food product innovation not only enhances resource utilization but also contributes to sustainable development goals by promoting environmentally friendly and locally sourced ingredients.

Synthesis of the Reviewed Literature

The reviewed literature highlights the nutritional value and functional potential of bamboo shoots, the rising interest in plant-based meat alternatives, and the importance of sensory evaluation in food product development. While previous studies have established the acceptability of various plant-based meat products, limited attention has been given to bamboo shoots as a primary ingredient and to the use of

glutinous rice as a natural binding agent. Most research has focused on soy or legume-based formulations, leaving bamboo-based patties underexplored. This study addresses this gap by developing a bamboo shoot-based burger patty and evaluating its consumer acceptability and preference through sensory evaluation within a local context.

METHODOLOGY

Research Design

This study employed an experimental research design using a quantitative descriptive-comparative approach to evaluate its consumer acceptability and preference of a bamboo shoot-based burger patty enriched with ground glutinous rice. The experimental design was appropriate as it allowed a systematic manipulation of product treatments based on varying levels of bamboo shoot incorporation and the assessment of their effects on consumer sensory responses (Stone et al., 2020).

The descriptive-comparative approach was used to describe consumers' levels of acceptability and preference for each product treatment and to determine significant differences among them based on sensory attributes such as appearance, aroma, taste, and texture.

Research Locale

This study was conducted at the University of Antique-Main Campus in Sibalom, Antique, during the second semester of the academic year 2024-2025. The sensory evaluation survey was conducted on April 25, 2025, on the fourth floor of the University of Antique Library.

The university was chosen as the research locale due to its diverse population of students, faculty, staff, and nearby community members who regularly consume convenient and ready-to-cook food products. As an institution engaged in research, innovation, and community extension, it provides a controlled and suitable environment for conducting sensory evaluation and consumer acceptability studies. Sensory testing within academic institutions is widely practiced because of respondents' accessibility, controlled settings, and relevance to early-stage product development (Stone et al., 2020; Lawless & Heyman, 2021).

Moreover, the research locale is strategically aligned with local and national initiatives promoting food innovation, value addition, and utilization of indigenous resources. The University of Antique plays an active role in supporting local development programs in partnership with the DTI and LGUs, particularly in areas related to entrepreneurship, food processing, and MSME development. Conducting the study within this locale supports the relevance and applicability of the findings to local food innovation and community-based enterprise initiatives (DTI, 2022).

Respondents

The respondents of the study consisted of selected consumers from the University of Antique, including students, faculty members, staff, and selected community members within the vicinity of the campus. These respondents were considered appropriate as they represent typical consumers of burger patties and other convenience food products.

The study employed untrained consumer panelists, which is recommended for consumer acceptability and preference testing, as it reflects actual consumer perceptions rather than expert judgment (Stone et al., 2020; Lawless & Heymann, 2021)

The respondents participated in the sensory evaluation of four (4) burger patty treatments: one (1) commercially available meat-based patty (control) and three (3) bamboo shoot-based burger patties with varying levels of bamboo shoot formulations. The samples were evaluated in terms of appearance, aroma, taste, and texture using a 9-point hedonic scale. The use of untrained consumer panelists is widely accepted in food sensory research, particularly when the objective is to assess overall liking and consumer preference among potential consumers (McClements & Grossman, 2021; Zhang et al., 2024).

Table 1 presents the distribution of respondents according to selected demographic and consumption-related characteristics. In terms of age group, 2 respondents (4%) belong to Generation X, 1 respondent (1%) to Millennials, 51 respondents (91%) to Generation Z, and 2 respondents (4%) to Generation Alpha.

With respect to sex, 22 respondents (39%) were males and 34 respondents (61%) were females. When grouped according to frequency of bamboo shoot consumption, 9 respondents (16%) reported Never consuming bamboo shoot, 17 respondents (30%) consumed them Rarely, 27 respondents (48%) consumed them Sometimes, and 3 respondents (6%) consumed them Often.

In terms of dietary habits, 9 respondents (16%) identified as vegetarian, while 47 respondents (84%) were omnivores. Regarding prior experience with bamboo shoot-based burger patty, 9 respondents (16%) reported having prior experience, whereas 47 respondents (84%) had none.

With respect to healthy eating habits, 1 respondent (2%) rated it Slightly important, 2 respondents (4%) as Moderately important, 4 respondents (8%) as Very important, 13 respondents (22%) as Extremely important, and 36 respondents (64%) as Extremely important.

In terms of level of food adventurousness, 1 respondent (2%) indicated not being adventurous at all, 1 respondent (2%) somewhat adventurous, 2 respondents (4%) moderately adventurous, 1 respondent (2%) adventurous, 9 respondents (16%) very adventurous, 6 respondents (11%) extremely adventurous, and 36 respondents (63%) rated themselves as extremely adventurous.

Table 1
Distribution of Respondents

	f	%
A. Entire group	56	100
B. Age group		
Generation X (46-60 yrs old)	2	4
Millennials (31-45 yrs old)	1	1
Generation Z (13-30 yrs old)	51	91
Generation Alpha (0-12 yrs old)	2	4
C. Sex		
Male	22	39
Female	34	61
D. Frequency of Bamboo Shoot Consumption		
Never	9	16
Rarely	17	30
Sometime	27	48
Often	3	6
E. Dietary Habits		
Vegetarian	9	16
Omnivore	47	84
F. Prior Experience with bamboo shoot-based burgers		
Yes	9	16
No	47	84
G. Level of Importance of Healthy Eating Habits		
Slightly important	1	2
Moderately important	2	4
important	4	8
Very important	13	22
Extremely important	36	64
H. Level of Adventurousness when trying new foods		

Not at all adventurous	1	2
Somewhat adventurous	1	2
Moderately adventurous	2	4
Fairly adventurous	1	2
Adventurous	9	16
Very adventurous	6	11
Extremely adventurous	36	63

Sampling

The study employed purposive sampling to select respondents suitable for sensory evaluation of the bamboo shoot-based burger patties. The respondents consisted of students, faculty, staff, and selected community members of the University of Antique, as they were readily accessible and familiar with burger patty products. This sampling method was considered appropriate, since the study aimed to assess consumer acceptability and preference rather than to generalize findings to the entire population.

A total of 56 respondents participated in the study. This sample size was considered sufficient for sensory evaluation, as previous studies recommend 30 to 100 untrained panelists to obtain reliable and meaningful acceptability data (Lawless & Heymann, 2010). All respondents were untrained consumers, reflecting typical market consumers and enhancing the practical relevance of the findings.

Respondents were selected based on the following inclusion criteria: (1) willingness to participate voluntarily, (2) absence of known food allergies related to the ingredients used, and (3) availability during the scheduled sensory evaluation session. Exclusion criteria included individuals with food-related allergies or health conditions that could affect taste perception. Through this sampling approach, the study ensured that the respondents were appropriate for evaluating the sensory attributes of the bamboo shoot-based burger patties.

Research Instrument

The primary research instrument used in this study was a structured sensory evaluation questionnaire designed to assess the consumer acceptability and preference for bamboo shoot-based burger patties enriched with ground glutinous rice. The questionnaire was adapted from standard sensory evaluation instruments commonly used in food product development studies and was structured to capture respondents' perceptions of key sensory attributes, namely appearance, aroma, taste, and texture (Stone et al., 2020; Lawless & Heymann, 2021).

A 9-point hedonic scale, ranging from 1 (dislike extremely) to 9 (like extremely), was employed to measure the level of acceptability of each burger patty treatment. This scale is widely recognized for its

reliability, simplicity, and effectiveness in assessing consumer liking, particularly among untrained panellists (Lawless & Heymann, 2021; Zhang et al., 2024). Each respondent evaluated four (4) burger patty samples: a commercially available meat-based patty (control) and three (3) bamboo shoot-based patties formulated with 40%, 60%, and 100% bamboo shoot content.

The questionnaire consisted of two (2) main sections. The first section gathered consumer profile information, including demographics, behavioral, and psychographic variables. Demographic data, including age, and sex (male or female). Behavioral variables covered dietary habits (categorized as omnivore, pescatarian, vegetarian, vegan, or others), frequency of bamboo shoot consumption (never, rarely [less than once a month], sometimes [1-3 times a month], and often [more than three times a month], and prior experience with bamboo shoot burgers (yes or no).

Psychographic variables were included to capture attitudes and lifestyle factors related to food choices. These included the perceived importance of healthy eating habits rated on a 9-point Likert scale (1=not at all important; 9=extremely important) and adventurousness in trying new foods, also rated on a 9-point Likert scale (1=not at all adventurous; 9=extremely adventurous).

The second section of the questionnaire comprised sensory evaluation items used to assess each product sample based on appearance, aroma, taste, and texture. An additional item asked respondents to indicate their most preferred product treatment based on overall sensory experience. The evaluated sensory attributes were defined as follows:

- *Appearance* – visual appeal, including color and overall presentation;
- *Aroma* – smell and perceived freshness;
- *Taste* – flavor profile and overall taste; and
- *Texture* – mouthfeel and consistency, including tenderness, juiciness, firmness, and chewiness.

Before data collection, the instrument was reviewed for clarity and appropriateness to ensure that all items were understandable to untrained respondents. The structured format of the sensory evaluation questionnaire facilitated systematic data collection and generated quantifiable data suitable for statistical analysis of consumer acceptability and preference (McClements & Grossmann, 2021; Kyriakopoulou et al., 2023).

Materials and Methods

This study utilized food ingredients, kitchen equipment, packaging materials, and research instruments necessary for the development and evaluation of a bamboo shoot-based burger patty enriched with ground glutinous rice. The materials were carefully selected to ensure product safety, consistency, and suitability for sensory evaluation.

Raw Materials. Fresh bamboo shoots were used as the primary raw material for the experimental burger patties. The bamboo shoots were locally sourced from Sibalom Public Market, where they were already cleaned and shredded, ensuring freshness and relevance to local agricultural utilization.

Ground glutinous rice was incorporated as a natural binding agent to improve the cohesiveness, mouthfeel, and overall texture of the bamboo shoot-based patties. Its high amylopectin content is known to enhance texture stability in plant-based formulations. Along with bread crumbs and eggs, glutinous rice flour served as the primary binding agent. The rice was finely ground into flour at the Sibalom Public Market, allowing for the use of locally sourced ingredients that support sustainability while maintaining freshness and consistency in the patty mixture.

Other ingredients included onions, garlic, carrots, bell peppers, salt, ground pepper, turmeric powder, soy sauce, oyster sauce, fish sauce, paprika, cheese, cooking oil, pineapple juice, all-purpose cream, sugar, and seasoning granules to enhance flavor, aroma, and overall palatability. Burger buns, sliced cheese, and common burger dressing such as ketchup and mayonnaise were also used during product preparation and sensory evaluation.

Ground beef was incorporated into product Treatment B (40% bamboo shoot content) and C (60% bamboo shoot content) to achieve mixed formulations. A commercially available meat-based burger patty served as the control sample for comparison during sensory evaluation.

Kitchen Supplies, Tools, and Equipment. The preparation and cooking of the burger patties required basic kitchen supplies, tools and equipment, including paper towel, pot holder, knives, chopping boards, mixing bowls, strainer, measuring cups and spoons, a food processor or blender, frying pan or griddle, peeler, burger patty moulder or ring egg moulder, spatula, stove, weighing scale, and fridge. These tools ensured accurate measurement of ingredients, uniform mixing, and consistent cooking conditions across all treatments.

Packaging and Serving Materials. Food-grade plates, aluminium foil, disposable gloves, sample containers, and coded labels were used for hygienic handling, serving, and identification of samples during the sensory evaluation. A bottle of mineral water was also provided to respondents for palate cleansing between samples.

Procedure/Preparation Steps:

Step 1. Preparation of Bamboo Shoots: Fresh bamboo shoots were purchased from the Sibalom Public Market due to their availability and the convenience of obtaining pre-cleaned and finely shredded samples. Upon procurement, the bamboo shoots were thoroughly washed under running water to remove residual impurities, then kneaded with salt.

The shredded bamboo shoots were subjected to a double-boiling process to reduce bitterness and ensure food safety. After boiling, the bamboo shoots were properly drained and allowed to cool at room temperature before formulation.

Bamboo shoots naturally contain cyanogenic glycosides, which can release hydrogen cyanide (HCN), a toxic compound, if inadequately processed. Thermal treatment, particularly repeated boiling followed by draining, has been shown to significantly reduce cyanide levels by promoting leaching into the cooking water and facilitating volatilization (Nongdam & Tidendra, 2014; Nirmala et al., 2018). Previous studies have reported that boiling bamboo shoots twice for 10-15 minutes effectively lowers cyanogenic content to safe levels while maintaining acceptable texture and flavor (Singhal et al., 2013). Thus, the double-boiling method was employed in this study to enhance the safety, palatability, and consumer acceptability of the bamboo shoot-based burger patties.

Step 2. Formulation of Bamboo Shoot-Based Burger Patty: The bamboo shoot-based burger patties were formulated using three (3) experimental treatments with varying proportions of bamboo shoots and ground meat, along with a commercial burger patty serving as the control. Each formulation was prepared using a standardized total mixture weight of 500 grams per treatment to ensure consistency across samples.

The formulations were as follows:

- *Treatment A (Control):* Commercially available meat-based burger patty
- *Treatment B (40% Bamboo Shoot Content):* Bamboo shoots – 200 grams (40%); Ground meat – 300 grams (60%)
- *Treatment C (60% Bamboo Shoot Content):* Bamboo shoots – 300 grams (60%); Ground meat – 200 grams (40%)
- *Treatment D (100% Bamboo Shoot Content):* Bamboo shoots – 500 grams (100%); Ground meat – 0 grams

For all experimental treatments, two (2) cups of ground glutinous rice flour, 1 cup of bread crumbs, and 2 eggs were added as binding agents, with additional amounts incorporated as necessary to achieve proper cohesiveness and moldability of the patty mixture. The use of ground glutinous rice flour enhanced binding properties, moisture retention, and texture consistency across all treatments.

All ingredients were thoroughly mixed until a uniform and cohesive mixture was achieved before proceeding to patty formation.

Step 3: Mixing Ingredients. Onions, garlic, and carrots were peeled and sliced. Bell peppers were cut, and the seeds were removed. The boiled bamboo shoots, sliced onions, garlic, carrots, bell peppers,

pineapple juice, all-purpose cream, salt, ground pepper, paprika, oyster sauce, soy sauce, fish sauce, turmeric powder, sugar, cheese, and other seasonings were combined in a blender or food processor. This mixture was pureed until smooth. The ground meat, glutinous rice flour, and eggs were added to the mixture. Adjust the mixture with additional binder if necessary to achieve a cohesive texture suitable for forming patties. The mixture was then transferred to a clean bowl and kneaded gently to ensure uniform distribution of ingredients.

Step 4: Forming Patties. Shape the mixture into uniform patties using a patty moulder to ensure consistency in size and thickness, for even cooking, and for fair sensory evaluation.

Step 5: Cooking. The frying pan or griddle was preheated over medium heat. A cooking oil was added to prevent sticking and to enhance texture. The patties were cooked for 3-5 minutes per side or until golden brown and firm. The patties were removed, and excess oil was drained on a clean paper towel.

Step 6: Presentation and Coding. Cooked patties were placed on food-grade plates and burger boxes. Samples were labelled using the coded identifiers: A = Commercial meat-based patty (control); B = 40% bamboo shoot-based patty; C = 60% bamboo shoot-based patty; and 100% bamboo shoot-based patty. The samples were served immediately to respondents for sensory evaluation.

Step 7: Sensory Evaluation. The respondents were provided with pre-coded patty samples, bottled water, and a sensory evaluation questionnaire. They were instructed to taste each sample and evaluate its appearance, aroma, taste, and texture using a 9-point hedonic scale. In addition, the respondents were asked to indicate which of the four (4) sample products they preferred most. To minimize sensory carryover, respondents were allowed to cleanse their palate with water between tasting sessions. After completing the evaluation, all questionnaires were collected for data analysis.

Data Analysis

This study employed appropriate statistical techniques to address each of the stated research objectives. Data obtained from the sensory evaluation and consumer preference questionnaires were coded, tabulated, and analysed using descriptive and inferential statistics.

Objective 1: To evaluate the level of acceptability of bamboo shoot-based burger patties in terms of appearance, aroma, taste, and texture when taken as an entire group and when classified according to treatments.

Descriptive statistics, specifically mean scores and standard deviations, were used to determine the level of acceptability of each sensory attribute based on responses measured using a 9-point hedonic scale. Mean scores were interpreted using a descriptive scale to classify the degree of acceptability for each attribute, both for the entire group of respondents and per treatment.

The 9-point hedonic scale responses were interpreted using the following descriptive rating:

<u>9-Point Hedonic Scale</u>	<u>Mean Score</u>	<u>Descriptive Interpretation</u>
9 - Like extremely 8 - Like very much 7 - Like moderately	7 - 9	High acceptability and strong liking. These patties are likely to be well-received by consumers.
6 - Like slightly 5 - Neither like nor dislike 4 - Dislike slightly 3 - Dislike moderately	5 - 6	Neutral or slightly positive acceptability. These patties maybe acceptable, to some but not necessarily preferred over other options.
2 - Dislike very much 1 - Dislike extremely	1 - 4	Low acceptability and strong dislike. These patties have significant flaws in taste, texture, aroma, or appearance that make them unappealing to consumers.

Objective 2: To evaluate the level of preference of bamboo shoot-based burger patties in terms of appearance, aroma, taste, and texture when taken as an entire group and when classified according to treatments.

Consumer preference was determined by identifying the treatment that obtained the highest mean rating across the sensory attributes. Frequency counts and mean ranking were used to establish the most preferred burger patty formulation among respondents.

Objective 3: To determine significant differences in the level of acceptability of bamboo shoot-based burger patty in terms of appearance, aroma, taste, and texture when classified according to treatments.

A one-way Analysis of Variance (ANOVA) was used for significant differences in sensory acceptability among the four (4) treatments: commercial burger patty (control), 40%, 60%, and 100% bamboo shoot-based patties. When significant differences were detected, post-hoc comparisons using Tukey's Honestly Significant Difference (HSD) test were conducted to identify which treatments differed significantly from one another. All inferential analyses were tested at a 0.05 level of significance.

The statistical analyses were designed to test the null hypotheses: There is no significant difference in the level of acceptability of bamboo shoot-based burger patty in terms of appearance, aroma, taste, and texture when classified according to treatments. The results of the ANOVA and post-hoc tests were used to either reject or fail to reject the null hypothesis, thereby providing empirical support for conclusions drawn from the study.

Application of Control and Randomization

To ensure the validity and reliability of the findings, control and randomization procedures were applied throughout the study.

A commercially available meat-based burger patty was used as the control treatment (Treatment A) to serve as a benchmark of comparison with the experimental bamboo shoot-based burger patties. All burger patty samples, including the control and experimental treatments (40%, 60%, and 100% bamboo shoot content), were prepared using standardized cooking procedures, including uniform patty size, thickness, and cooking time. The same ingredients, except for the proportion of bamboo shoots and ground meat, were used across experimental treatments to control extraneous variables that could influence sensory attributes such as appearance, aroma, taste, and texture.

Randomization was applied during the sensory evaluation process to minimize bias. The order in which the burger patty samples were presented to respondents was randomly assigned using coded labels (A, B, C, and D) to prevent identification of treatments. Respondents were not informed of the formulation details of each sample. Additionally, the sequence of sample tasting varied among respondents to control for order effects and sensory fatigue. These procedures helped ensure that consumer responses reflected genuine sensory perception rather than prior expectations or presentation order.

Through the application of both control and randomization, the study minimized potential sources of bias and enhanced the internal validity of the sensory evaluation results.

Ethical Considerations

Ethical principles were carefully observed throughout this study to ensure the protection, safety, and rights of all respondents. Before participation, respondents were informed of the purpose of the study, the procedures involved in the sensory evaluation, and the voluntary nature of their participation. Informed consent was obtained from all respondents, and they were assured that they could withdraw from the study at any time without any penalty.

The study ensured the confidentiality and anonymity of respondents by not collecting personally identifiable information. Data gathered from the sensory evaluation questionnaires were used solely for academic and research purposes. All responses were kept confidential and were reported only in aggregated form.

Food safety and hygiene were strictly observed during the preparation and serving of the burger patty samples. All ingredients were handled according to proper food safety standards, and samples were prepared and served fresh to minimize health risks. Respondents were informed of the ingredients used in the burger patties prior to tasting to prevent potential allergic reactions. Overall, the study adhered to ethical guidelines for research involving human participants and ensured that the welfare of respondents was not compromised at any stage of the research process.

RESULTS AND DISCUSSION

Descriptive Data Analysis

Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Appearance, Aroma, Taste, and Texture When Taken as an Entire Group

Table 2 presents the level of acceptability of bamboo shoot-based burger in terms of appearance, aroma, taste, and texture classified according to treatments using mean and standard deviation.

Entire group. The level of acceptability of burger when taken as an entire group (M = 7.48, SD = 1.07) was rated as “High”.

Similarly, the level of acceptability of the burger in terms of appearance (M = 7.71, SD = 0.94), aroma (M = 7.54, SD = 1.28), texture (M = 7.36, SD = 1.22), and taste (M = 7.31, SD = 1.20) was likewise rated as “High”. This suggests that consumers tended to value the visual appeal and aroma of the bamboo shoot-based burger slightly more than its taste and texture, indicating that these sensory attributes play an important role in overall product acceptability.

Table 2
Mean and Standard Deviation Results in the Level of Acceptability of Burger in Terms of Appearance, Aroma, Taste, and Texture Classified According to Treatments

	M	SD	Description	Rank
A. Entire Group	7.48	1.07	High	
Appearance	7.71	0.94	High	1
Aroma	7.54	1.28	High	2
Taste	7.31	1.20	High	4
Texture	7.36	1.22	High	3

Legend: 7 – 9 (High); 5 -6 (Neutral/slightly positive); 1 -4 (Low)

This indicates that increasing the proportion of bamboo shoots in the formulation did not adversely affect consumer perceptions of appearance, aroma, taste, and texture.

Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Appearance, Aroma, Taste, and Texture Classified According to Treatments

Table 3 presents the level of acceptability of the bamboo shoot-based burger in terms of appearance, aroma, taste, and texture classified according to treatments using mean and standard deviation.

Appearance. When classified according to appearance, all treatments obtained a “High” level of acceptability. Treatment A (commercial burger patty) recorded a mean score of $M = 7.20$ ($SD = 0.85$), while Treatment B (40% Bamboo shoot content) obtained $M = 7.72$ ($SD = 0.83$). Treatment C (60% Bamboo shoot content) yielded a mean of $M = 7.69$ ($SD = 1.03$), and Treatment D (100% Bamboo shoot content) achieved the highest mean score at $M = 8.25$ ($SD = 0.76$).

Aroma. For aroma, all treatments were likewise rated at a “High” level of acceptability. Treatment A (Commercial burger patty) recorded $M = 7.16$ ($SD = 1.28$), Treatment B (40% Bamboo shoot content) $M = 7.45$ ($SD = 1.39$), Treatment C (60% Bamboo shoot content) $M = 7.57$ ($SD = 1.29$), and Treatment D (100% Bamboo shoot content) $M = 8.00$ ($SD = 1.04$).

Taste. With respect to taste, Treatments B, C, and D were all rated “High” in acceptability, with mean scores of $M = 7.38$ ($SD = 1.16$), $M = 7.25$ ($SD = 1.30$), and $M = 7.93$ ($SD = 0.83$), respectively. On the other hand, Treatment A (commercial burger patty) obtained a lower mean score of $M = 6.68$ ($SD = 1.16$), corresponding to a “Neutral/Slightly Positive” level of acceptability.

Texture. In terms of texture, Treatment B, C, and D likewise achieved a “High” level of acceptability, with mean scores of $M = 7.61$ ($SD = 0.89$), $M = 7.50$ ($SD = 1.12$), and $M = 8.10$ ($SD = 0.74$), respectively. Treatment A recorded a lower mean score of $M = 6.25$ ($SD = 1.24$), interpreted as “Neutral/Slightly Positive”.

Overall, the results indicate that the 100% bamboo shoot-based burger patty (Treatment D) consistently obtained the highest acceptability ratings across all sensory attributes, demonstrating strong consumer acceptance of a fully plant-based formulation.

Table 3
Mean and Standard Deviation Results in the Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Appearance, Aroma, Taste, and Texture Classified According to Treatments

		Mean	SD	Description	Rank
A. Appearance					
Treatment (Commercial)	A	7.20	0.85	High	4
Treatment B (40%)		7.72	0.83	High	2
Treatment C (60%)		7.69	1.03	High	3
Treatment D (100%)		8.25	0.76	High	1
B. Aroma					
Treatment (Commercial)	A	7.16	1.28	High	4

Treatment B (40%)		7.45	1.39	High	3
Treatment C (60%)		7.57	1.29	High	2
Treatment D (100%)		8.00	1.04	High	1
C. Taste					
Treatment (Commercial)	A	6.68	1.16	Neutral/Slightly Positive	4
Treatment B (40%)		7.38	1.16	High	2
Treatment C (60%)		7.25	1.30	High	3
Treatment D (100%)		7.93	0.83	High	1
D. Texture					
Treatment (Commercial)	A	6.25	1.24	Neutral/Slightly Positive	4
Treatment B (40%)		7.61	0.89	High	2
Treatment C (60%)		7.50	1.12	High	3
Treatment D (100%)		8.10	0.74	High	1

Legend: 7 – 9 (High); 5 -6 (Neutral/slightly positive; 1 -4 (Low)

The findings suggest that increasing the proportion of bamboo shoots in the burger patty did not negatively affect consumer perceptions of appearance, aroma, taste, and texture, but instead may have enhanced overall sensory acceptability.

Level of Preference of Bamboo Shoot-Based Burger Patty in Terms of Appearance, Aroma, Taste, and Texture When Taken as an Entire Group and Classified According to Treatments

Table 4 presents the level of preference of bamboo shoot-based burger patty in terms of appearance, aroma, taste, and texture when taken as an entire group and classified according to treatments, using mean and standard deviation.

Entire group. The level of preference of bamboo shoot-based burger patty of consumers when considered as an entire group ($M = 7.69$, $SD = .099$), was “High”. This indicates that consumers generally favored the burger formulations evaluated in the study.

Treatment. When classified according to treatments, consumers’ preference for Treatment A (commercial burger) was rated “Neutral or Slightly Positive”. In contrast, Treatments B, C, and D demonstrated a “High” level of preference. Specifically, Treatment B (40% bamboo shoot content) obtained a mean score of $M = 7.91$ ($SD = 0.67$), Treatment C (60% bamboo shoot content) recorded $M = 7.75$ (SD

= 1.01), and Treatment D (100% bamboo shoot content) achieved the highest mean score of $M = 8.30$ ($SD = 0.63$).

Based on the mean preference scores, Treatment D (100% bamboo shoot content) ranked first, followed by Treatment B (40% bamboo shoot content) in second place, Treatment C (60% bamboo shoot content) in third, and Treatment A (commercial burger patty) in fourth. This shows that consumers preferred the fully bamboo shoot-based burger patty the most, and that increasing the bamboo shoot content did not reduce its overall acceptability.

Table 4
Level of Preference of Burger When Taken as an Entire Group and Classified According to Treatments

	Mean	SD	Description	Rank
A. Entire Group	7.69	0.99	High	
B. Treatment				
Treatment A (Commercial)	6.79	0.93	Neutral/Slightly Positive	4
Treatment B (40%)	7.91	0.67	High	2
Treatment C (60%)	7.75	1.01	High	3
Treatment D (100%)	8.30	0.63	High	1

Inferential Data Analysis

Differences in the Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Appearance, Aroma, Taste, and Texture Classified According to Treatments

Table 5 presents the differences in the level of acceptability of bamboo shoot-based burger patty in terms of appearance, aroma, taste, and texture, classified according to treatments, using One-Way ANOVA.

The results revealed significant differences in the acceptability of the burger patty across all treatments for all sensory attributes, with F-values 13.624 (appearance), 4.320 (aroma), 11.763 (taste), and 33.793 (texture), all at $p < .05$. These findings indicate that consumer acceptability differs depending on the treatment, suggesting that the proportion of bamboo shoot in the formulation influences how the product is perceived in terms of its appearance, aroma, taste, and texture.

Table 5
One-Way ANOVA Results in the Differences in the Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Appearance, Aroma, Taste, and Texture Classified According to Treatments

	Sum of Squares	df	Mean Square	F	Sig.
Appearance					
Between groups	31.134	3	10.378	13.624**	.000
Within groups	167.580	220	.762		
Total	198.714	223			
Aroma					
Between groups	20.446	3	6.815	4.320**	.006
Within groups	347.107	220	1.578		
Total	367.554	223			
Taste					
Between groups	44.658	3	14.886	11.763**	.000
Within groups	278.415	220	1.266		
Total	323.073	223			
Texture					
Between groups	104.520	3	34.840	33.793**	.000
Within groups	226.815	220	1.031		
Total	331.335	223			

Post Hoc Scheffe Results in the Differences in the Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Appearance Classified According to Treatments

Table 6 shows the Post Hoc results of the multiple comparisons of mean differences in the acceptability of the bamboo shoot-based burger patty in terms of appearance classified according to treatments using Scheffe.

Significant mean differences were observed between the commercial burger and 40% bamboo shoot-based burger; between commercial burger and 60% bamboo shoot-based burger; between commercial and 100% bamboo shoot-based burger, Mean differences = $-.52679^*$, $-.49107^*$, -1.05357^* , all at $p < .05$.

Likewise, significant mean differences were found among 40% bamboo shoot-based burger and 60% bamboo shoot-based burger, between 40% bamboo shoot-based burger and 100% bamboo shoot-based burger, and between 60% bamboo shoot-based burger and 100% bamboo shoot-based burger, Mean differences = $-.03571$, $.52179$, and $.56250$, respectively, all at $p < .05$.

These results show that consumers rated the appearance of the burger higher as the bamboo shoot content increased, indicating that a greater bamboo shoot proportion improved visual acceptability.

Table 6
Post Hoc Scheffe Results in the Differences in the Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Appearance Classified According to Treatments

Dependent Variable	(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.	95%		
						Lower Bound	Upper Bound	
Appearance	Commercial Burger	40% Bamboo Shoot Content	$-.52679^*$	.16494	.019	.9915	-.0621	
		60% Bamboo Shoot Content	$-.49107^*$	.16494	.033	-.9557	-0.264	
		100% Bamboo Shoot Content	-1.05357^*	.16494	.000	-1.5182	-.5889	
	40% Bamboo Shoot Content	Commercial Burger	Commercial Burger	$-.52679^*$	.16494	.019	.0621	-.9915
			60% Bamboo Shoot Content	$.03571^*$	.16494	.033	-.4290	-.5004
			100% Bamboo Shoot Content	$-.52679^*$	.16494	.000	-.9915	-.0621
	60% Bamboo Shoot Content	Commercial Burger	Commercial Burger	$.49107^*$	.16494	.033	.0264	.9957
			40% Bamboo Shoot Content	$.03571$	.16494	.997	-.5004	.4290
			100% Bamboo	$.56250^*$	.16494	.010	-1.0272	-.0978

		Shoot Content					
	100% Bamboo Shoot Content	Commercial Burger	1.05357*	.16494	.000	.5889	1.5182
		40% Bamboo Shoot Content	-.52679*	.16494	.019	.0621	.9915
		60% Bamboo Shoot Content	.56250*	.16494	.010	.0978	1.0272

Post Hoc Scheffe Results in the Differences in the Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Aroma Classified According to Treatments

Table 7 shows the Post Hoc results of the multiple comparisons of mean differences in the level of acceptability of bamboo shoot-based burger patty in terms of aroma classified according to treatments using Scheffe.

In terms of appearance, a significant difference was observed between the commercial burger and the 100% bamboo shoot-based burger, with a mean difference = $-.83929$ ($p < .05$).

This shows that consumers liked the aroma of the 100% bamboo shoot-based burger more than the commercial burger, suggesting that higher bamboo shoot content improves aroma acceptability.

Table 7
Post Hoc Scheffe Results in the Differences in the Level of Acceptability of Burger in Terms of Aroma Classified According to Treatments

						95%	
Dependent Variable	(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Aroma	Commercial Burger	40% Bamboo Shoot Content	-.28671	.23738	.695	.3830	.3830
		60% Bamboo Shoot Content	-.41071	.23738	.395	.2580	.2580
		100% Bamboo Shoot Content	-.83929*	.23738	.007	-.1705	-.1705
	40% Bamboo Shoot Content	Commercial Burger	.28571	.23738	.695	.9545	.9545

		60% Bamboo Shoot Content	-.12500	.23738	.964	.5438	.5438
		100% Bamboo Shoot Content	-.55357	.23738	.146	.1152	.1152
	60% Bamboo Shoot Content	Commercial Burger	.41071	.23738	.395	1.0795	1.0795
		40% Bamboo Shoot	.12500	.23738	.964	.7938	.7938
		100% Bamboo Shoot	-.42857	.23738	.356	.2402	.2402
	100% Bamboo Shoot Content	Commercial Burger	.83929*	.23738	.007	1.5080	1.5080
		40% Bamboo Shoot	.55357	.23738	.146	1.2223	1.2223
		60% Bamboo Shoot	.42857	.23738	.356	1.0973	1.0973

Post Hoc Scheffe Results in the Differences in the Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Taste Classified According to Treatments

Table 8 presents the Post Hoc Scheffe results of the multiple comparisons of mean differences in the level of acceptability of bamboo shoot-based burger patty in terms of taste classified according to treatments.

In terms of appearance, significant mean differences existed between commercial burger and 40% bamboo shoot-based burger between commercial and 100% bamboo shoot-based burger, and between 60% and 100% bamboo shoot-based burger, with mean differences of -.69732, -1.25661, and -.68500, respectively ($p < .05$).

This shows that consumers preferred the taste of the higher bamboo shoot-based burgers, particularly the 100% bamboo shoot patty, over the commercial burger and the lower bamboo shoot formulations.

Table 8
Post Hoc Scheffe Results in the Differences in the Level of Acceptability of Burger in Terms of Taste Classified According to Treatments

Dependent Variable	(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.	95%	
						Lower Bound	Upper Bound
Taste	Commercial Burger	40% Bamboo Shoot content	-.69732*	.21260	.015	-1.2963	-.0984
		60% Bamboo Shoot content	-.57161	.21260	.068	-1.1705	.0273
		100% Bamboo Shoot content	-1.25661*	.21260	.000	-1.8555	-.6577
	40% Bamboo Shoot Content	Commercial Burger	-.69732*	.21260	.015	.0984	1.2963
		60% Bamboo Shoot content	-.12571	.21260	.950	-.4732	.7247
		100% Bamboo Shoot content	-.55929	.21260	.078	-1.1582	.0397
	60% Bamboo Shoot Content	Commercial Burger	-.57161	.21260	.068	-.0273	1.1705
		40% Bamboo Shoot content	.12571	.21260	.950	-.7247	.4732
		100% Bamboo Shoot content	-.68500*	.21260	.017	-1.2839	-.0861
	100% Bamboo Shoot Content	Commercial Burger	-1.25661*	.21260	.000	.6577	1.8555
		40% Bamboo	.55929	.21260	.078	-.0397	1.1582

		Shoot content					
		60% Bamboo Shoot content	.68500*	.21260	.017	.0861	1.2839

Post Hoc Scheffe Results in the Differences in the Level of Acceptability of Bamboo Shoot-Based Burger Patty in Texture of Appearance Classified According to Treatments

Table 9 shows the Post Hoc results of the multiple comparisons of mean differences in the level of acceptability of bamboo shoot-based burger patty in terms of texture classified according to treatments using Scheffe.

In terms of texture, significant mean differences were observed between commercial burger and 40% bamboo shoot-based burger; between commercial burger and 60% bamboo shoot-based burger; between commercial and 100% bamboo shoot-based burger, and between 60% bamboo shoot-based burger and 100% bamboo shoot-based burger, with mean differences of -1.36161, -1.25000, -1.85268, and -.60268, respectively ($p < .05$).

This indicates that consumers rated the texture of the higher bamboo shoot-based burgers more favorably than they did on the commercial burger, with the 100% bamboo shoot-based patty receiving the highest texture acceptability.

Table 9
Post Hoc Scheffe Results in the Differences in the Level of Acceptability of Bamboo Shoot-Based Burger Patty in Terms of Texture Classified According to Treatments

Dependent Variable	(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.	95%	
						Lower Bound	Upper Bound
Texture Burger	Commercial	40% Bamboo Shoot content	-1.36161*	.19189	.000	-1.9022	-.8210
		60% Bamboo Shoot content	-1.25000*	.19189	.000	-1.7906	-.7094
		100% Bamboo Shoot content	-1.85268*	.19189	.000	-2.3933	-.13121

	40% Bamboo Shoot content	Commercial Burger	1.36161*	.19189	.000	.8210	1.9022
		60% Bamboo Shoot content	.11161	.19189	.953	-.4290	.6522
		100% Bamboo Shoot content	-.49107	.19189	.091	-1.0317	.0495
	60% Bamboo Shoot content	Commercial Burger	1.25000*	.19189	.000	.7094	1.7906
		40% Bamboo Shoot content	.11161	.19189	.953	-.6522	.4290
		100% Bamboo Shoot content	-.60268*	.19189	.022	-1.1433	-.0621
	100% Bamboo Shoot content	Commercial Burger	1.85268*	.19189	.000	1.3121	2.3933
		40% Bamboo Shoot content	.49107	.19189	.091	-.0495	1.0317
		60% Bamboo Shoot content	.60268*	.19189	.022	.0621	1.1433

SUMMARY

This study determined the level of consumer acceptability and preference for a bamboo shoot-based burger patty enriched with ground glutinous rice using four (4) product treatments: a commercial meat-based burger patty (control), and 40%, 60%, and 100% bamboo shoot-based burger patties. Sensory evaluation was conducted among 56 untrained consumer panelists from the University of Antique – Main Campus using a 9-point hedonic scale.

Based on the sensory evaluation of bamboo shoot-based burger patties enriched with ground glutinous rice, the study yielded the following findings:

1. **Respondents Profile.** The respondents' profiles revealed that the majority of the 56 untrained consumer panelists were Generation Z and predominantly omnivores, with limited prior exposure to bamboo shoot-based burger products. Despite this, respondents demonstrated openness toward plant-based food innovations.
2. **Overall Consumer Acceptability.** When considered as an entire group, the bamboo shoot-based burger patties received a high level of acceptability ($M=7.48$), indicating that consumers generally liked the product.
3. **Acceptability by Sensory Attributes.** All sensory attributes (appearance, aroma, taste, and texture) were rated highly acceptable. Among these, appearance received the highest mean score ($M= 7.71$), followed by aroma, texture, and taste. This suggests that visual appeal plays a key role in initial consumer acceptance.
4. **Acceptability According to Treatments.** All product treatments, including the 100% bamboo shoot-based burger patty, were rated as highly acceptable across all sensory attributes (appearance, aroma, taste, and texture). Notably, higher bamboo shoot incorporation did not result in product rejection, demonstrating consumer openness to plant-based alternatives.
 - *Appearance Rankings:* Treatment D (100% bamboo shoot) ranked first, Treatment B (40%) third, and Treatment A (commercial burger) fourth.
 - *Aroma Rankings:* Treatment D (100%) ranked first, Treatment C (60%) second, Treatment B (40%) third, and Treatment A (commercial burger) fourth.
 - *Taste and Texture Rankings:* Treatments B (40%), C (60%), and D (100%) were highly acceptable, while Treatment A (commercial burger) received a neutral or slightly positive rating for taste.
5. **Consumer Preference.** Consumers showed a clear preference for bamboo shoot-based formulations, with Treatment D (100% bamboo shoot) ranked highest, followed by Treatments B (40%) and C (60%). Treatment A (commercial burger) received the lowest preference, with a neutral or slightly positive response.
6. **Significant Differences Among Treatments.** Statistical analysis revealed significant differences in acceptability across treatments for sensory attributes, confirming that varying the level of bamboo shoot incorporation influenced consumer sensory perception.

Overall, the findings indicate that bamboo shoots can be successfully used as a primary ingredient in burger patties without compromising consumer acceptability. Respondents reacted positively to taste, texture, aroma, and visual appeal, showing openness to plant-based alternatives.

This study was limited to a single institution and relied on untrained consumers, which may limit generalizability. Additionally, the study focused exclusively on sensory acceptability and did not include nutritional content, shelf-life, or cost analysis. Despite these limitations, the findings provide baseline evidence for the feasibility of bamboo shoot-based burger patties as a consumer-acceptable, plant-based product.

CONCLUSION

Based on the findings, the study concludes that bamboo shoots can be successfully utilized as a primary ingredient in plant-based burger patties without negatively affecting sensory quality. Increasing the proportion of bamboo shoots, including full substitution, did not diminish consumer acceptability and improved preference ratings.

The results demonstrate that locally available bamboo shoots, when properly processed and enriched with ground glutinous rice, can serve as a viable and competitive plant-based alternative to conventional meat patties. The positive consumer response suggests readiness for product commercialization and supports the potential for sustainable, value-added food innovation in local communities.

RECOMMENDATION

In light of the findings and conclusions, the following recommendations are offered:

1. For Food Product Innovators and MSMEs

- Consider adopting higher bamboo shoot content formulations, particularly the most preferred treatment, for pilot production and commercialization.
- Collaborate with DTI Shared Service Facilities (SSF) for product refinement, packaging, and market testing.

2. For the Department of Trade and Industry (DTI) and LGUs

- Include bamboo shoot-based food products in food innovation, livelihood, and MSME incubation programs, such as OTOP and SSF initiatives.
- Promote bamboo shoots not only for non-food applications but also as a sustainable food ingredient.

- Pilot testing and small-scale commercialization of the most preferred formulation may be conducted in partnership with DTI Shared Service Facilities to assess market viability.
3. ***For the University of Antique***
- Utilize the study as a basis for extension activities, product demonstrations, and entrepreneurship training focused on bamboo-based food innovation.
 - Encourage interdisciplinary research linking agriculture, food technology, and entrepreneurship.
4. ***For Consumers***
- Increase awareness and acceptance of plant-based and locally sourced food alternatives as healthier and more sustainable options.
5. ***For Future Researchers***
- Conduct further studies on nutritional analysis, shelf-life evaluation, cost analysis, and market feasibility of bamboo shoot-based burger patties.
 - Explore other food applications of bamboo shoots and test the product among a larger and more diverse consumer population.

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