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Development and Acceptability of Carrot Bamboo Shoot Loaf Bread

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ABSTRACT

This study developed a loaf bread using carrot and bamboo shoot to assess its acceptability to consumers in terms of color, aroma, taste, texture, general acceptability and to determine the product's proximate composition and nutritional analysis. The researchers provide valuable insights to industry stakeholders, including carrot and bamboo shoot Farmers, policy makers, enabling them to make informed decisions regarding the production and marketing of loaf bread in the market; and it contributes to the existing knowledge on carrot and bamboo shoot. Further, the results offer potential opportunities for Cagayan State University College of Industrial Technology on product diversification, meeting consumer preferences, and promoting sustainable agricultural practices. Proximate analysis of the best formulation revealed 5.86% crude protein, 1.40% crude fiber, 16.11% crude fat, 42.60% moisture, and 1.45% ash. Nutrition Facts showed a 100g per serving provides 304 kcal, 16g fat, 34g carbohydrates, and 6g protein, confirming as a nutrient-dense, moderate-energy snack suitable for functional food applications. Using experimental research, there were four (4) treatments; Treatment 1, Treatment 2, Treatment 3, and Control. Results of product acceptability revealed that Treatment 3, which had (288) grams of carrot bamboo shoot, is the most acceptable in terms of appearance, aroma, taste, texture, and general acceptability; it is also more acceptable than existing product. Overall, the study found that carrot and bamboo shoot can be successfully incorporated into loaf bread production to create a sensory-acceptable, nutritious, and cost-efficient product while supporting the sustainable use of agricultural by-products.

Keywords: *Carrot Bamboo Shoot*, *Sensory Evaluation, Proximate Analysis, Nutritional Composition*

INTRODUCTION

The purpose of this study is to develop a loaf bread incorporating bamboo shoots and carrots, and to evaluate its nutritional value, sensory qualities, and consumer acceptability. Rooted in local realities and community needs, this research not only seeks to create a healthful and marketable food product but also aims to inspire further exploration of underutilized agricultural materials in food technology and sustainable product development. (Pulwama2025). The Researchers are driven to introduce the Carrot Bamboo Shoot Loaf Bread in Tuguegarao City, Cagayan since the Loaf Bread on the market are a bit expensive for low-income consumers. This product offers year-round availability, not only for immediate consumption but also for extended storage. (Delos Santos, 2022). Carrot and bamboo shoot contains unique fibers that don't

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feed bacteria, which means they lower inflammation. They also bind to and eliminate unused hormones like estrogen, lower serotonin and histamine, which in turn lower the body's need to produce cortisol (catabolic stress hormone). Ultimately this increases the efficiency of progesterone and testosterone. (Adams, Che, Qin, Jiang, & Sello, 2018)

Integrating bamboo shoot and carrots not only enhances the nutritional profile of bread but also helps reduce food waste and supports the use of locally available agricultural resources. This approach offers a practical solution for improving food security and promoting healthier, more sustainable diets. (Frontiers in Nutrition, 2025). The overall market size is expected to grow by nearly 1.5 times during the same period, supported by increasing global demand for natural food ingredients, growing adoption of bamboo shoots in culinary applications, and rising health consciousness driving premium organic ingredients procurement across various food processing and preparations (Fact.MR, 2025).

Thus, this study strives to make a significant contribution to food science and technology by demonstrating a viable procedure for value-addition of local agricultural produce, including carrot and bamboo shoot. The study expects that by developing a new product, it will reduce food waste, create economic prospects for local banana growers, and provide a distinct, high-quality product to the bread industry. The outcomes will benefit food producers in need of creative product lines, the local community by encouraging sustainable farming techniques, and consumers by providing a delightful, relevant treat. (Betty S., Ivan O. 2024).

METHODS

Research Design

This study used an experimental design of research. Experiment gives observation in the cause and effect by demonstrating one outcome results when a particular factor is manipulated (Serey Rath Em, 2024). The cause variable or the variable manipulated was the amount of carrot and bamboo shoot while the effect variables were the sensory characteristics such as appearance, aroma, taste, texture, and general acceptability of the different formulation of the carrot bamboo shoot loaf bread

Research Locale

The study was conducted at Cagayan State University Carig campus. The formulation of the various treatment in the Development of carrots bamboo shoot loaf bread was done at the Food Technology Laboratory in the College of Industrial Technology while the chemical analysis was conducted at the Regional Feed Chemical Analysis Laboratory of the Department of Agriculture Region II.

Sampling Technique

The study involved a total of Fifty (50) respondents in the sensory evaluation, consisting of CIT Food Technology Faculty, and Food Technology Students. A stratified random sampling technique was employed to gather data from respondents, ensuring a well-represented distribution across key roles in various group. This method allowed for the inclusion of various respondent's categories such as six (6) faculty major in Food Technology and Forty-Four (44) Food technology Students with each group being proportionately represented

Table 1. *Respondents of the Study*

Respondent	Number of Respondent	Percentage
CIT Student	44	88%
Faculty	6	12%
TOTAL	50	100%

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RESULTS AND DISCUSSION

Table 2. *Sensory Characteristics of Developed Banana Pith Muffin in terms of Color, Aroma, Taste, Texture and General Acceptability*

Sensory Characteristics	Treatment 1	Treatment 2	Treatment 3	Control
Color	7.00 Like Moderately	7.00 Like Moderately	7.40 Like Moderately	7.00 Like Moderately
Aroma	7.60 Like very much	7.80 Like very much	9.00 Like Extremely	7.20 Like Moderately
Taste	7.60 Like very much	7.20 Like Moderately	8.00 Like Extremely	7.00 Like Moderately
Texture	7.80 Like very much	7.40 Like Moderately	8.75 Like Extremely	7.20 Like Moderately
General Acceptability	7.40 Like Moderately	7.20 Like Moderately	8.50 Like Extremely	7.00 Like Moderately

Among the samples, Treatment 3 obtained the highest mean score across all sensory attributes, which indicated that the highest level of carrot bamboo shoot produced the most desirable product. In terms of Color Treatment 1and Treatment 2 has the same mean score of 7.00 described as “Moderately Liked”. Meanwhile Treatment 3 has the highest mean score of 7.40 describe as “Very Much Liked”, indicating that it that exhibit the most visually attractive and well developed. The results indicate that adding more carrots to the product had a beneficial color impact, perhaps as a result of the natural pigments found in carrots. Color plays a significant role in consumer acceptance because it gives them impression of the quality and freshness of the food. The improved rating of Treatment 3 indicates that respondents were more attracted to its appearance.

This suggests that the loaf bread's visual appeal and degree of browning were improved by adding more carrot. Loaf bread should have a deep, rich golden-brown color when you remove it from the oven, a slightly lighter in color, but they should still be browned, not pale. (Rossi Anastopoulo, 2020) The improved rating of Treatment 3 indicates that respondents are more attracted to its appearance.

In terms of Aroma Treatment 1 has a mean score of 7.60 described as “Liked Very Much”. Treatment 2 has the mean score of 7.80 described as “Liked Very Much”. Meanwhile Treatment 3 has highest mean score of 9.00 described as “Liked Extremely”. The results indicate that adding more carrots to the product had a desirable aromatic impact during baking, perhaps as a result of the natural pigments found in carrots. The aroma of loaf bread incorporating carrot and with a of bamboo shoot is a complex mix of sweet, earthy, and fermentation-derived compounds, driven primarily by Maillard reaction products and volatile terpenoids. The addition of fermented bamboo shoots adds significant sour and pungent notes. (Lasean & Dabaj, 2020) With regard to Taste, Treatment 1 achieved a mean rating of 7.60, described as “Like very much,” indicating an acceptable yet simple flavor profile. Treatment 2 scored slightly lower at 7.20, suggesting that its taste was “Like Moderately” but less preferred. The Control sample scored of 7.00, described as “Like Moderately” meaning it had a steady balance of sweetness. Treatment 3 achieved the highest score of 8.00, classified as “Like Extremely,” showing that it provided the best balance of sweetness and flavor among all the samples. Based on the result of the sensory evaluation, developed carrot (Daucus Carota) bamboo shoot (Phyllostachys Edulis) loaf bread exhibited a mildly sweet and pleasant flavor, primarily influenced by the natural sweetness of carrot. The incorporation of bamboo shoot contributed as subtle earthy and slightly vegetal undertone, which complimented the over taste without overpowering the breads characteristic flavor. (Ajmera 2021)

The implies indicate that the integration of Carrot and Bamboo shoot did not negatively affect consumer preference. Instead, it improved the sensory appeal by adding depth of flavor while retaining a

soft, palatable, enjoyable taste. (Bjarnadottir 2024) For Texture, Treatment 1 obtained a mean of 7.80, described as "Like very much," indicating that it had an agreeable softness. Treatment 2 followed with a mean of 7.40, described as "Like Moderately" category but slightly firmer. The control sample scored 7.20, showing a softer and more desirable crumb compared to the first two treatments. Treatment 3 received the highest rating of 8.75, categorized as "Like Extremely," indicating that it achieved the most favorable texture profile.

Based on the result of the sensory evaluation, developed loaf bread exhibited a soft, moist, and cohesive texture, characteristic of well-structured vegetable-enriched breads. The incorporation of carrot contributed to the tender crumb due to its natural sugar and fiber content, which retain moisture during baking (Bjarnadottir 2021). It implies the soft and palatable texture aligns with sensory expectations for traditional bread products and support the feasibility of vegetable-enriched formulations in baked goods (Stone and Sidel 2012) In terms of General Acceptability, Treatment 1 received a mean score of 7.40, described as "Like Moderately," indicating a favorable overall impression. Treatment 2 scored slightly lower at 7.20, described as "Like Moderately" still considered acceptable but less preferred. The control sample also received 7.00, described as "Like Moderately". Treatment 3 recorded the highest mean of 8.75, categorized as "Like Extremely," identifying it as the most preferred formulation among all treatments.

Based on the sensory evaluation results, the developed loaf bread was well-received by respondents in terms of overall acceptability. Respondents reported that the product was pleasant in color, aroma, taste, and texture, which contributed to overall positive perception (Stone and Sidel 2012).

Overall, the study indicates the carrot and bamboo shoot loaf bread is both organoleptically acceptable and nutritionally beneficial, highlighting its sustainability for product diversification in the baking industry (Stone and Sidel 2012) The table has shown that the Carrot Bamboo Shoot loaf bread is composed of 5.86% crude protein, 1.40% crude fiber, 16.11% crude fat, 42.60%, moisture and 1.45% ash Presents the proximate composition of the developed carrot bamboo shoot loaf bread, which was conducted at the Food Laboratory and Innovation Center of the Department of Agriculture, Cagayan Valley Integrated Agricultural Laboratory, Tuguegarao City, Cagayan. The sample was kept for one month from the date it was received. The results of the analysis revealed that the Carrot Bamboo Shoot Loaf Bread contained 6.24% crude protein, 1.12% crude fiber, 10.48% crude fat, 29.67% moisture, and 2.58% ash. These findings provide a clear understanding of the proximate composition of the product and show how the inclusion of carrot and bamboo shoot flour influenced its overall nutrient content compared to regular loaf bread. The relatively high moisture content (29.67%) indicates that the product maintains a soft and moist texture, which is desirable in bakery products such as loaf bread.

However, higher moisture levels may also reduce the shelf life due to a greater tendency for microbial growth if not properly packaged or stored. The crude fat content (10.48%) reflects the presence of energy-rich ingredients that contribute to the loaf's rich flavor, tenderness, and smooth crumb structure. This fat level aligns with standard formulations for bread-type products that aim to balance palatability and nutritional value. Meanwhile, the crude protein content (6.24%) represents a moderate level of nutritional value, likely derived from the combination of bamboo shoot flour, carrot puree, and wheat flour. Although not high, this protein content contributes to dietary intake and enhances the product's nutritional quality as a healthy snack or light meal option. The crude fiber content (1.12%) signifies an improvement compared to regular loaf bread, which typically contains less fiber. The inclusion of bamboo shoot flour, known for its fiber-rich composition, adds functional health benefits related to digestion and satiety. The ash content (2.58%) denotes the mineral component of the product, indicating the presence of essential micro nutrients derived from the carrot and bamboo shoot ingredients. These minerals contribute to the overall nutritional profile of the developed loaf bread. According to AOAC (2019) and FDA Circular No. 2023-009, proximate analyses such as these are crucial for determining product composition, labeling accuracy, and compliance with food quality standards. The results confirm that the Carrot Bamboo Shoot Loaf Bread meets the acceptable parameters for bakery products and demonstrates a nutritionally balanced composition. Overall,

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the findings indicate that the developed loaf bread provides a good energy source with adequate fat and moisture levels that enhance its sensory appeal. With proper packaging and storage, the Carrot Bamboo Shoot Loaf Bread shows a great potential for consumer acceptability as a nutritious, flavorful, and locally developed bakery product enriched with vegetable-based ingredients.

Table3: Proximate analysis of the developed Carrot Bamboo shoot Loaf Bread

Table 3. *Proximate Analysis of the Developed Carrot bamboo shoot loaf bread*

Lab no.	Sample description	Crude protein	Crude fiber	Crude fat	Moisture	Ash
		%	%	%	%	%
FT-25-609	Carrot bamboo shoot loaf bread	5.86	1.40	16.11	42.60	1.45

Source: Regional Feed Chemical Analysis Laboratory Department of Agriculture, R02

Proximate composition of carrot bamboo shoot loaf bread tested using the Semi-Automatic Kjeldahl Method, ANKOM Filter Bag Technique, and Gravimetric Method at the Department of Agriculture Region 2 (DA RO2). The proximate composition analysis of the carrot bamboo shoot loaf bread revealed important nutritional properties, providing insight into its overall quality and potential health benefits. The crude protein at 5.86%, crude fiber at 1.40%, crude fat at 16. 11%, moisture at 42.60%, and ash at 1.45%. These values indicated a nutritional profile characterized by moderate protein and high fat and moisture contents, with notably low fiber and ash levels. The protein content of 5.86 % reflected contributions from the base ingredients, while the low fiber (1.4%) suggested effective processing of the banana pith to reduce indigestible components. The elevated fat (16. 11%) and moisture (42.60%) levels contributed to a soft, palatable texture, and the minimal ash (1.45%) aligned with the organic composition of the loaf bread.

Nutritional Analysis of the developed Carrot Bamboo shoot Load Bread

The carrot bamboo shoot loaf bread (250 g) showed that it contains 304 kcal of energy, with 145 kcal derived from fat, 16 g total fat, 34 g carbohydrates, 1 g crude fiber, and 6 g protein. The product is moderately energy-dense, with nearly half of its calories coming from fat, indicating a rich formulation that enhances flavor and texture. Carbohydrates serve as the main energy source, while protein and fiber levels are modest, typical of refined bread products. Overall, carrot bamboo shoot Loaf Bread offers a balanced nutrient profile suitable as an energy-dense food, though future formulations could be improved by increasing fiber and protein content for better nutritional value (FAO, 2019; USDA, 2020).

Table 4. *Test Significant Difference among the three (3) treatments in terms of color, aroma, taste, texture, and general acceptability*

Attributes	Treatment	Mean	Sd	t-value	P	Decision
Color	Treatment 3	7.96	0.82	0.36	.722	Do not Reject Ho
	Control	7.89	1.03			
	Treatment 3	7.98	0.87	0.75	.459	Do not Reject Ho
	Control	7.84	0.95			
Aroma	Treatment 3	8.36	0.77	1.87	.068	Do not Reject Ho

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	Control	8.07	0.96			
Texture	Treatment 3	7.84	0.93	0.45	.656	Do not Reject Ho
	Control	7.76	0.91			
General Acceptability	Treatment 3	8.11	0.86	0.00	1.000	Do not Reject Ho

Mean rank values with different superscripts in each attribute are significantly different ($p<0.05$).

Color

Treatment 3 obtained a mean of 7.96 (SD = 0.82), while the control recorded a mean of 7.89 (SD = 1.03). The computed t-value of 0.36 with a corresponding p-value of .722 indicates that the difference was not statistically significant. Although Treatment 3 had a slightly higher rating, the similarity in scores suggests that the addition of bamboo shoot and carrot did not significantly alter the visual appeal of the product. In terms of taste, Treatment 3 obtained a mean of 7.98 (SD = 0.87), compared to the control with a mean of 7.84 (SD = 0.95). The computed t-value of 0.75 and p-value of .459 show that there was no significant difference between treatments. This implies that the incorporation of bamboo shoot and carrot maintained acceptable flavor characteristics

Taste

Treatment 3 obtained a mean of 7.98 (SD = 0.87), compared to the control with a mean of 7.84 (SD = 0.95). The computed t-value of 0.75 and p-value of .459 show that there was no significant difference between treatments. This implies that the incorporation of bamboo shoot and carrot maintained acceptable flavor characteristics.

Aroma

Treatment 3 recorded a mean of 8.36 (SD = 0.77), while the control had a mean of 8.07 (SD = 0.96). The computed t-value of 1.87 with a p-value of .068 indicates that the difference was not statistically significant at the 0.05 level. Despite Treatment 3 receiving a slightly higher rating, the aroma was considered comparably acceptable across treatments.

Texture

Treatment 3 had a mean of 7.84 (SD = 0.93), while the control obtained 7.76 (SD = 0.91). The computed t-value of 0.45 and p-value of .656 confirm that there was no significant difference. This suggests that the fiber content of bamboo shoot and carrot did not negatively affect the softness and consistency of the product.

General acceptability

Treatment 3 recorded a mean of 8.11 (SD = 0.86). The computed t-value of 0.00 with a p-value of 1.000 clearly indicates no significant difference between treatments. This demonstrates that all formulations were equally acceptable to the panelists. Overall, although Treatment 3 consistently showed slightly higher mean scores across most sensory attributes, statistical analysis confirmed that these differences were not significant at the 0.05 level.

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Volume 2 Issue 3 (March 2026)

CONCLUSION

The findings of this study conclude that incorporating bamboo shoot (Phyllostachys edulis) into Carrot Bamboo Shoot Loaf Bread significantly enhances its sensory characteristics, nutritional value, and consumer acceptability. Among the four formulations, Treatment 3, containing 36g of bamboo shoot, emerged as the most preferred, achieving the highest ratings for color, texture, aroma, taste, and overall acceptability. The proximate composition analysis confirmed the nutritional quality of the loaf bread, with high protein content (5.86%) and moderate levels of fat and moisture, offering a balanced and healthful option for consumers. Furthermore, the microbial composition analysis showed that the product is safe for consumption, with microbial levels well within acceptable limits. Statistical analysis using ANOVA indicated no significant differences between Treatment 3 and the control, highlighting the successful integration of bamboo shoot without negatively impacting sensory attributes. These results affirm the potential of Carrot Bamboo shoot Loaf Bread as an innovative, nutritious, and appealing food product that meets both safety and quality standards

Recommendations

1. Future researchers are encouraged to modify the proportion of carrot and bamboo shoot to further enhance the loaf bread's sensory characteristics such as taste, aroma, and texture.
2. It is recommended to conduct microbial and shelf-life analyses to ensure the product's safety and quality during storage.
3. Nutritional evaluation should be expanded to include vitamin, mineral, and fiber content for a more detailed nutritional profile.
4. The product may be promoted to local bakeries or livelihood programs as a nutritious and affordable alternative to commercial loaf bread.
5. Future studies may also assess the market potential and consumer preference of the developed product in different areas.

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