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Acceptability Of Breadstick Enriched with Alugbati (Nadella Alba)

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Abstract

This study developed and evaluated Alugbati-enriched breadsticks as a nutritious and affordable snack alternative that utilizes a locally available, nutrient-dense leafy vegetable. The research aimed to enhance the fiber, micronutrient, and antioxidant content of breadsticks while assessing their sensory acceptability, consumer preference, microbiological safety, and the significance of differences among treatments. An experimental research design supported by descriptive methods was used, incorporating varying amounts of Alugbati leaves into four formulations, including a control. Sensory evaluation was conducted using a 9-point hedonic scale to assess color, aroma, taste, texture, and general acceptability, with ANOVA employed to determine significant differences among treatments. The study was carried out at Cagayan State University–Carig Campus with 50 respondents composed of faculty evaluators and student consumers.

Results showed that the incorporation of Alugbati produced notable variations in sensory attributes. Treatment 2 (15 g Alugbati) obtained the highest ratings for color, aroma, taste, and texture, being described as “very pleasant” and “very good,” indicating that moderate Alugbati incorporation enhanced the breadsticks’ sensory appeal. Treatment 1 (10 g) received the highest score for general acceptability, suggesting a balanced combination of flavor and texture. Consumer testing further confirmed high acceptance, with appearance and aroma rated as “like extremely” and other attributes rated as “like very much.” Microbiological analysis verified that the breadsticks met international safety standards and were safe for consumption.

The study concludes that Alugbati-enriched breadsticks are highly acceptable, nutritionally beneficial, and feasible for commercialization. It recommends using 15 g of Alugbati per batch, maintaining consistent processing methods, improving color presentation, and conducting shelf-life studies to strengthen product viability.

Keywords: *alugbati breadstick, sensory evaluation, consumers acceptability, microbiological analysis.*

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INTRODUCTION

With the increasing shift of consumers away from overly processed and nutrient-poor snack items, there has been a growing interest in healthier, natural, and plant-based food alternatives. Consumer demand for convenient yet nutritious snacks continues to rise as people become more conscious of the health impacts of their dietary choices (Guiné et al., 2024). This trend has encouraged food innovators and researchers to explore locally available, nutrient-dense ingredients that can enhance both the nutritional profile and functional value of everyday food products. Among these are leafy vegetables, which are rich in vitamins, minerals, and antioxidants and can be incorporated into baked goods to improve their health benefits without compromising sensory quality.

Alugbati (Basella alba), a common leafy vegetable in the Philippines, is known for its high fiber content, vitamins A and C, iron, calcium, and natural antioxidants (Santiago et al., 2021). Traditionally used in household dishes, Alugbati is recognized not only for its nutritional properties but also for its functional potential in food processing due to its color, mild flavor, and natural mucilage. Studies have shown that incorporating leafy vegetables into bakery products can enhance their nutritional value, improve moisture retention, and introduce additional bioactive compounds beneficial to consumers (Dutta et al., 2020). These characteristics make Alugbati a promising ingredient for developing improved snack items.

Breadsticks are widely consumed as a convenient snack or side item due to their crisp texture, long shelf life, and versatility. However, traditional breadsticks often lack significant nutritional value. Incorporating Alugbati into breadstick formulations provides an opportunity to produce a healthier, fiber-enriched bakery product that appeals to health-conscious consumers. Prior research on vegetable-enriched baked goods suggests that such formulations can increase consumer acceptance when the sensory qualities such as appearance, aroma, taste, and texture are not adversely affected (Rosas et al., 2022).

MATERIALS AND METHODS

Research Design

This study uses experimental research design. Experiments require observation to establish cause and effect by demonstrating the outcome when a particular factor is manipulated. This study also employed a descriptive research method through a questionnaire who determine the level of acceptability of Alugbati breadstick in terms of color, aroma, taste, texture and general acceptability. A quantitative approach was used with descriptive statistics and ANOVA to analyze the sensory results and determine significant differences of the four treatments in acceptability.

Preparation of Ingredients and Materials

The raw materials used in the preparation of the Alugbati (Basella alba) breadsticks included all-purpose flour, Alugbati leaves, sugar, salt, yeast, butter, and water. The Alugbati leaves were thoroughly washed and minced the Alugbati leaves. All utensils and equipment such

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as mixing bowls, measuring cups, spoons, oven, baking trays, and weighing scales were properly cleaned and sanitized before use to ensure product safety and quality.

General Procedure of Alugbati (Basella Alba) Breadsticks

The preparation began by dissolving yeast in warm water with sugar to activate it. The dry ingredients such as flour and salt were mixed in a clean bowl. Butter and Alugbati extract were gradually added to form a uniform dough mixture. The dough was kneaded until smooth and elastic, then allowed to rest and ferment for a specific period before shaping into breadsticks.

Formulation of the Alugbati (basella alba) breadsticks

The purpose of the treatments is to determine the most acceptable formulation in terms of appearance, aroma, taste, texture and general acceptability. Treatment 1, 2, 3 differ in the quantity of alugbati leaves (10 g, 15 g, 20 g) while maintaining the same proportions of other ingredients. the control sample, on the other hand, contains alugbati leaves and serve as baseline of comparison. this set up allows

For evaluating how the amount of alugbati leaves affects the sensory attributes and overall acceptability of the finished products.

Sensory Evaluation

The sensory evaluation of the Alugbati (Basella Alba) Breadsticks was conducted to determine the level of acceptability of each treatment in terms of appearance, aroma, taste, texture and general acceptability. Ten experts' panelists from the Food Innovation Center (FIC) and the College of Industrial Technology (CIT) participated in the evaluation. Each sample was assessed using a 9-point hedonic scale, where a higher score indicated a greater preference. The treatments 1, 2, 3 and the control were prepared under uniform condition to ensure consistency and fairness during evaluation.

Consumers Acceptability of Alugbati Breadsticks

The Alugbati breadsticks produced from four treatments (T1, T2, T3, and the Control) were further evaluated by student consumers to determine which formulation was the most acceptable. Evaluation was done using a 9-point hedonic scale focusing on appearance, aroma, taste, texture, and general acceptability.

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Table 1. Distribution of Consumers/ Respondents

Profile Variable	Age Group	Number of Respondents
Students (CIT)	young adults (18-20 years old)	20
Students (CIT)	Adults (25 years old & above)	20
TOTAL		**40**

Sensory Evaluation of The Developed Alugbati Breadsticks to Determine the Best Formulation

Table 2 Sensory Evaluation of The Developed Alugbati Breadsticks to Determine the Best Formulation

Quality Attributes	Treatments			Control
	Treatment 1	Treatment 2	Treatment 3	
Appearance	6.52 Brown	**8.16 Moderately brown**	6.60 Brown	7.92 Moderately brown
Aroma	7.76 Moderately pleasant	**8.22 Very pleasant**	6.44 Moderately pleasant	6.22 Moderately pleasant
Taste	7.82 Very sweet	**7.94 Very sweet**	6.76 Very crispy	7.86 Moderately sweet
Texture	7.34 Very crispy	**7.90 Very crispy**	6.76 Very crispy	7.30 Moderately crispy
General Acceptability	7.54 Like very much	**7.40 Like moderately**	7.06 Like moderately	7.52 Like moderately

The study evaluated the sensory attributes of alugbati breadsticks with varying levels of alugbati incorporation (10g, 15g, 20g). Treatment 2 (15g alugbati) received the highest scores for color (8.16), aroma (8.22), and texture (7.90), indicating it had the most appealing appearance, aroma, and crispiness. However, Treatment 1 (10g alugbati) was rated highest for general acceptability (7.54), suggesting it had the best overall balance of sensory qualities. The control formulation scored lower in most attributes. The results imply that moderate alugbati

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incorporation (15g) enhances color, aroma, and texture, but the overall acceptability is influenced by a balance of sensory attributes. The study suggests that optimizing alugbati level and formulation can improve the sensory appeal and market potential of vegetable-enriched baked goods

Level of Consumers acceptability of Best Formulation of the alugbati breadsticks

Table 3. Level of Consumers acceptability of Best Formulation of the Alugbati Breadsticks

Quality Attributes	Mean	Interpretation
Appearance	8.16	Like Extremely
Aroma	8.22	Like Extremely
Taste	7.94	Like Very Much
Texture	7.90	Like Very Much
General Acceptability	7.40	Like Very Much

The Alugbati Breadsticks received high ratings in all sensory attributes. Color scored 8.16 ("like moderately"), suggesting room for improvement in visual appeal. Aroma scored 8.22 ("like extremely"), indicating a highly appealing scent. Taste (7.94) and texture (7.90) were both "like very much", showing a well-balanced flavor and crispiness. Overall acceptability scored 7.40 ("like very much"), reflecting a harmonious blend of sensory attributes. The results imply that the breadsticks' formulation successfully delivered a pleasant sensory experience. To enhance market competitiveness, subtle adjustments in color intensity, uniformity, or surface finish could be explored. The study highlights the importance of balancing sensory attributes to meet consumer expectations and drive repeat consumption. By maintaining the balance of flavor, texture, aroma, and visual appeal, the Alugbati Breadsticks can continue to satisfy consumers and remain competitive in the market .

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Microbiological Analysis

Table 4. Microbial analysis of Alugbati Breadsticks

Sample Description	Parameter	Results	Acceptable Level	Interpretations
Alugbati Breadsticks	Yeast, CFU/g	<10	10	Less than the acceptable level
	Mold, CFU/g	$<10^2$	10^2	Less than the acceptable level
	Aerobic Plate Count, CFU/g	$<10^4$	10^4	within the acceptable level
	Coliforms, CFU/g	<10	10	Less than the acceptable level
	Salmonella/2.5g	Not Defected/Absence		No Salmonella detected: safe for consumption

These results indicate the breadsticks are microbiologically safe for consumption, reflecting proper baking, handling, and storage practices. The low microbial counts minimize risks of spoilage, off-flavors, and foodborne illness. The product meets guidelines from ICMSF (2011) and FDA (2017), confirming its safety, quality, and market acceptability

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Analysis of Variance of Alugbati Breadsticks

Test of Significant Difference in Consumer Acceptability Between the Best Formulation of Alugbati Breadsticks and Control

Attributes	Treatment	Mean	Sd	t-value	p	Effect Size	Decision
Color	Alugbati Breadsticks	8.16	0.93	1.39	.171	0.20	Do not Reject Ho
	Control	7.92	0.90				
Aroma	Alugbati Breadsticks	8.22	0.74	**8.82**	**< .001**	**1.25**	**Reject Ho**
	Control	6.22	1.45				
Taste	Alugbati Breadsticks	7.94	0.82	0.35	.725	0.05	Do not Reject Ho
	Control	7.86	1.25				
Texture	Alugbati Breadsticks	7.90	0.79	1.78	.082	0.25	Do not Reject Ho
	Control	7.30	2.06				
General Acceptability	Alugbati Breadsticks	7.40	0.97	-0.45	.652	-0.06	Do not Reject Ho
	Control	7.52	1.72				

The addition of Alugbati leaves enhanced aroma significantly and maintained appearance, taste, and texture comparable to the control. The breadsticks' overall acceptability was on par with the control, indicating Alugbati incorporation can improve nutritional value without compromising sensory appeal. The results suggest Alugbati breadsticks have strong market potential

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CONCLUSIONS

Moderate incorporation of alugbati (15 grams) enhances color, aroma, taste, texture and general acceptability, contributing to high consumer acceptability. Alugbati enrichment significantly improves the aroma of breadsticks without negatively affecting color, taste, texture, or general acceptability. The sensory attributes of alugbati breadsticks are comparable to or slightly better than the control, indicating that vegetable enrichment is feasible without compromising consumer satisfaction. Microbiological analysis confirms that alugbati breadsticks are safe for consumption and meet international safety standards.

RECOMMENDATIONS

Anent with the findings of the study, the following recommendations are put forward to improve the developed Alugbati breadsticks:

1. Use 15 grams of alugbati per batch to achieve the optimal balance of sensory qualities and consumer acceptability.
2. Focus on maintaining consistent baking processes to preserve aroma, crispiness, and overall sensory appeal.
3. Explore minor adjustments in color enhancement techniques to further improve visual attractiveness.
4. Market alugbati breadsticks as a functional, vegetable-enriched snack that is both appealing and safe for consumption.
5. Conduct shelf-life studies to ensure sensory qualities and microbial safety are maintained over time.

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