

# Organoleptic Quality of Home-Made Chips as Influenced by Preparation Methods and Fortification Level of Kulitis (*Amaranthus viridis*) Chopped Leaves

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Date Submitted:  
**March 12, 2026**

Date Accepted:  
**April 27, 2026**

Date Published:  
**May 18, 2026**

DOI:  
**10.5281/zenodo.20260213**

## ABSTRACT

The increasing demand for nutritious and sustainable food products has prompted the exploration of locally available and underutilized plant resources for snack food development. This study examined the organoleptic quality and acceptability of homemade chips fortified with kulitis (*Amaranthus viridis*) chopped leaves under different preparation treatments. An experimental research design was used, involving four treatments representing varying levels of kulitis incorporation. Thirty evaluators composed of Hospitality Management students, Food Technology-related participants, faculty, and consumers assessed the samples using a structured hedonic scale in terms of appearance, aroma, taste, texture, and general acceptability. Mean, standard deviation, and one-way analysis of variance were used to analyze the data.

Results showed that all kulitis chip formulations were generally acceptable, with Treatment B consistently obtaining the highest mean scores in appearance, taste, texture, and overall acceptability. Significant differences were found in selected sensory attributes, particularly appearance, taste, and texture, while aroma did not significantly differ across treatments. The study concludes that kulitis can be utilized as a functional and locally available ingredient in homemade chip production when incorporated at an appropriate level. The findings support the potential of kulitis-based chips as a healthier snack alternative, a value-added agricultural product, and a possible livelihood innovation for rural communities.

**Keywords:** *Kulitis (Amaranthus viridis), homemade chips, sensory evaluation, acceptability, functional ingredient, food innovation*

## INTRODUCTION

Food in Filipino households is not only a source of nourishment but also a reflection of culture, livelihood, and everyday survival. In agricultural communities such as Pototan, Iloilo, families commonly depend on farming and backyard gardening for food and income. One locally available plant is *Amaranthus viridis*, known as kulitis in the Ilonggo community. It grows abundantly in open spaces and requires little maintenance, yet it remains underutilized despite its nutritional potential.

Kulitis is rich in essential nutrients such as iron, calcium, vitamin A, vitamin C, and dietary fiber, which are important for growth, immunity, and overall health (Achigan-Dako et al., 2014; Sarker et al., 2024). However, its slightly bitter taste and changing dietary preferences often limit its consumption, particularly among children. This is important because undernutrition continues to affect Filipino children, with national data showing continuing levels of stunting, underweight, wasting, and food insecurity (DOST-FNRI, 2023).

At the local level, Iloilo has shown progress in reducing child malnutrition, but nutrition concerns remain in communities where nutrient-rich local foods are not fully utilized (Philippine News Agency, 2024). In Pototan, the issue is not merely food availability but the need to transform available crops into appealing and acceptable

food products. Snack foods such as chips are widely consumed because of their taste, texture, and convenience; however, many commercial snacks are low in nutritional value.

This study addressed this gap by developing kulitis-based homemade chips as a healthier snack alternative. By transforming a familiar leafy vegetable into a convenient snack product, the study aimed to improve acceptability while supporting local food innovation. The study also connects with livelihood and community development, as kulitis can be cultivated and processed as a low-cost raw material for small-scale food enterprises in Pototan and similar agricultural communities.

Specifically, the study determined the level of acceptability of homemade kulitis chips in terms of appearance, aroma, taste, texture, and general acceptability when prepared using different treatments. It also examined whether significant differences existed in the sensory acceptability of the products across treatments.

## Literature Review

### *Kulitis as a Functional Food Ingredient*

Kulitis (*Amaranthus viridis*) has long been part of local diets and is commonly used in vegetable dishes. Its nutritional value includes vitamins, minerals, fiber, and bioactive compounds that support health. Recent food development studies suggest that kulitis can enhance the nutritional quality of food products when properly processed and incorporated at controlled levels (Maldo & Diel, 2025; Sarker et al., 2024).

The use of kulitis in snack products is relevant because vegetable-enriched foods must balance nutritional improvement with sensory appeal. Excessive vegetable incorporation can affect color, taste, texture, and overall preference. Thus, determining an acceptable level of kulitis fortification is essential for developing products that are both nutritious and acceptable to consumers.

### *Organoleptic Quality and Consumer Acceptability*

Organoleptic quality refers to the sensory properties of food products as perceived through sight, smell, taste, touch, and overall impression. In food innovation, sensory acceptability is a key determinant of product success because consumers are unlikely to repeatedly consume a product that is nutritionally improved but unpleasant in taste or texture (Lawless & Heymann, 2021; Stone et al., 2024).

The hedonic scale is commonly used in sensory evaluation to measure consumer liking. Through this approach, respondents can rate products based on attributes such as appearance, aroma, taste, texture, and general acceptability. This method is particularly useful in testing vegetable-fortified products because it identifies the formulation that best balances nutritional value and consumer preference.

### *Preparation Methods, Local Livelihood, and Gastronomic Value*

Preparation methods such as washing, chopping, mixing, shaping, frying time, and frying temperature influence the sensory quality of chips. In vegetable-fortified snacks, preparation is especially important because leafy vegetables contain moisture and fibrous components that can affect crispness and appearance. Standardized preparation helps ensure that variations in sensory results are attributable to formulation and not to inconsistent processing.

In Pototan, Iloilo, kulitis-based chips also offer livelihood potential. Transforming locally available crops into value-added products can increase income opportunities for households, farmers, and small-scale entrepreneurs. The product may also contribute to Iloilo gastronomy by presenting a modern snack based on a familiar Ilonggo vegetable, supporting local identity, tourism, and community-based enterprise development.

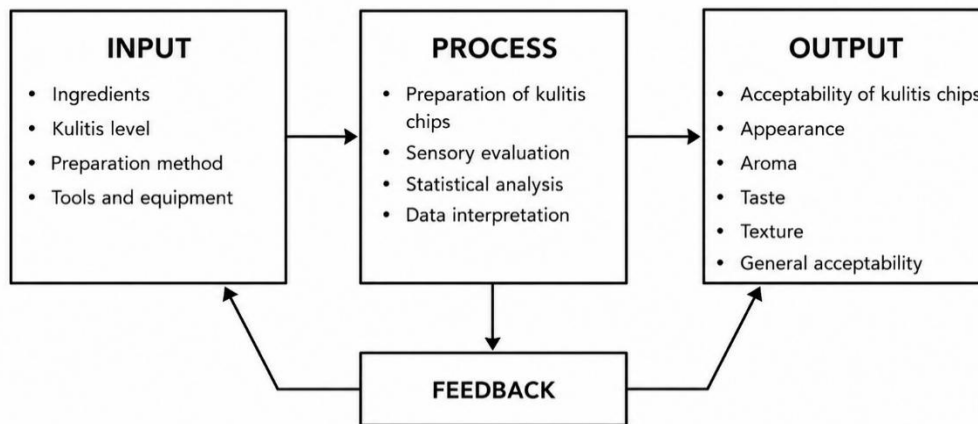


Figure 1. Conceptual framework of the study using the Input-Process-Output model

## METHODS

### Research Design

The study employed an experimental research design to evaluate the organoleptic quality of homemade chips prepared using different levels of kulitis fortification. This design was appropriate because the study compared sensory attributes across formulated treatments under controlled preparation conditions.

### Respondents and Sampling Technique

The study involved thirty (30) purposively selected evaluators composed of Hospitality Management students, Food Technology-related participants, faculty members, and consumers. Purposive sampling was used because the study required respondents who could provide meaningful sensory judgments on the prepared food products.

### Product Treatments and Preparation

Four treatments were prepared using different levels of kulitis incorporation. Treatment A represented 25% kulitis incorporation, Treatment B represented 50%, Treatment C represented 75%, and Treatment D represented 100%. The kulitis leaves were washed, drained, chopped uniformly, mixed with flour, water, salt, and black pepper, shaped into thin chip-like layers, fried until crisp, drained, cooled, and served in labeled containers for sensory evaluation.

Table 1. Treatment descriptions for homemade kulitis chips

Treatment	Kulitis incorporation	Description
A	25%	Low kulitis incorporation
B	50%	Moderate kulitis incorporation
C	75%	High kulitis incorporation
D	100%	Highest kulitis incorporation/control formulation

### Research Instrument

A researcher-made sensory evaluation score sheet based on a hedonic scale was used to determine the acceptability of the kulitis chips. The instrument measured appearance, aroma, taste, texture, and general acceptability. The scale was interpreted as follows: 4.21–5.00 = Very Highly Acceptable, 3.41–4.20 = Highly Acceptable, 2.61–3.40 = Moderately Acceptable, 1.81–2.60 = Slightly Acceptable, and 1.00–1.80 = Not Acceptable.

### Data Gathering Procedure

The study followed three phases: classification of kulitis, profiling of homemade chips based on preparation method and fortification level, and assessment of product acceptability. After recipe standardization, the samples were prepared and labeled according to treatment. Evaluators assessed each sample using the sensory evaluation sheet. Responses were collected, encoded, and analyzed.

### Data Analysis

Mean and standard deviation were used to describe the level of acceptability and the consistency of evaluator ratings. One-way analysis of variance (ANOVA) at the 0.05 level of significance was used to determine whether significant differences existed across treatments in the sensory attributes of the homemade kulitis chips.

## RESULTS AND DISCUSSION

### Acceptability in Terms of Appearance

All treatments were acceptable in terms of appearance. Treatment B obtained the highest mean score ( $M = 4.30$ ,  $SD = 0.556$ ), indicating that the 50% kulitis formulation was the most visually appealing. This suggests that a moderate level of kulitis incorporation produced a favorable color, surface appearance, and overall presentation without making the product look overly vegetable-dense.

Table 2. *Level of acceptability of homemade kulitis chips in terms of appearance*

Treatment	Mean	SD	Interpretation
A	4.24	0.454	Very Highly Acceptable
B	4.30	0.556	Very Highly Acceptable
C	4.15	0.604	Highly Acceptable
D	3.80	0.415	Highly Acceptable

### Acceptability in Terms of Aroma

In terms of aroma, all treatments were rated highly acceptable, with Treatment C obtaining the highest mean score ( $M = 4.188$ ,  $SD = 0.397$ ). Although Treatment C was most preferred for aroma, the differences among treatments were not statistically significant, suggesting that kulitis incorporation did not strongly alter the perceived smell of the chips.

Table 3. *Level of acceptability of homemade kulitis chips in terms of aroma*

Treatment	Mean	SD	Interpretation
A	4.033	0.394	Highly Acceptable
B	3.977	0.371	Highly Acceptable
C	4.188	0.397	Highly Acceptable
D	4.089	0.391	Highly Acceptable

### Acceptability in Terms of Taste

Taste showed clearer differences across treatments. Treatment B recorded the highest mean score ( $M = 4.656$ ,  $SD = 0.621$ ), indicating that the 50% kulitis formulation was the most preferred in flavor. Treatment C obtained the lowest mean score ( $M = 3.267$ ,  $SD = 0.724$ ), suggesting that higher levels of kulitis may begin to produce stronger vegetal notes that reduce taste preference.

Table 4. *Level of acceptability of homemade kulitis chips in terms of taste*

Treatment	Mean	SD	Interpretation
A	3.700	0.528	Highly Acceptable
B	4.656	0.621	Very Highly Acceptable
C	3.267	0.724	Moderately Acceptable
D	3.656	0.780	Highly Acceptable

### Acceptability in Terms of Texture

Texture results also favored Treatment B ( $M = 4.433$ ,  $SD = 0.472$ ), indicating that this formulation produced the most desirable crispness and mouthfeel. Treatments C and D received lower means, implying that excessive kulitis incorporation may affect crispness and the tactile quality of the product.

Table 5. *Level of acceptability of homemade kulitis chips in terms of texture*

Treatment	Mean	SD	Interpretation
A	3.911	0.390	Highly Acceptable
B	4.433	0.472	Very Highly Acceptable
C	3.637	0.520	Highly Acceptable
D	3.589	0.452	Highly Acceptable

### General Acceptability

When the sensory attributes were considered together, Treatment B again emerged as the most acceptable formulation ( $M = 3.889$ ,  $SD = 0.803$ ). Treatment D followed with a mean of 3.467, while Treatments A and C obtained lower but still acceptable ratings. These results indicate that the moderate fortification level produced the best overall balance between sensory quality and the functional use of kulitis.

Table 6. *General acceptability of homemade kulitis chips across treatments*

Treatment	Mean	SD	Interpretation
A	3.344	0.415	Moderately Acceptable
B	3.889	0.803	Highly Acceptable
C	3.077	0.357	Moderately Acceptable
D	3.467	0.746	Highly Acceptable

### Significant Differences Among Treatments

The one-way ANOVA results showed that the preparation treatments significantly influenced selected sensory qualities. Treatment B showed significant effects on appearance, taste, and texture, while aroma remained statistically similar across treatments. These findings indicate that the level and method of kulitis incorporation are especially important for the visual, flavor, and textural quality of the chips.

Table 7. *Summary of one-way ANOVA results on sensory attributes*

Attribute	Significant treatment/result	F-value	p-value	Interpretation
Appearance	Treatment B	5.507	.010	Significant
Aroma	None	—	>.05	Not Significant
Taste	Treatment B	11.842	.000	Significant
Texture	Treatment B	6.149	.006	Significant

Overall, the results suggest that kulitis can be incorporated into homemade chips without compromising acceptability when used at a moderate level. Treatment B consistently produced the best sensory profile, supporting the idea that a balanced formulation is necessary for vegetable-fortified snacks. The findings also show that kulitis chips can serve as a healthier snack alternative and a potential value-added product for local food innovation, livelihood development, and Iloilo gastronomy.

### CONCLUSION

The study concludes that kulitis (*Amaranthus viridis*) is a viable functional ingredient for homemade chip production. All treatments were generally acceptable, but the 50% kulitis incorporation represented by Treatment B produced the most favorable results in appearance, taste, texture, and general acceptability. The results further show that fortification level and preparation method significantly affect key sensory attributes. Moderate kulitis incorporation achieved the best balance between nutritional enhancement and sensory quality, while higher levels may begin to affect taste and texture. Thus, kulitis chips have strong potential as a healthier snack alternative, a culturally relevant Ilonggo-inspired product, and a community-based livelihood innovation.

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### Recommendations

1. Future researchers should conduct nutritional analysis of kulitis chips to strengthen claims regarding their functional food value.
2. Shelf-life testing, packaging studies, and storage stability assessments should be conducted to support product commercialization.
3. The Local Government Unit of Pototan, in collaboration with relevant agricultural and livelihood agencies, may support training programs on kulitis cultivation, processing, packaging, and marketing.
4. Kulitis chips may be developed as a small-scale enterprise product through improved branding, standardized production procedures, and market testing.
5. Schools and community feeding programs may explore kulitis chips as a healthier snack alternative after further nutritional and safety validation.
6. The product may be promoted as part of Iloilo's gastronomic tourism offerings because it highlights a nutritious, locally available, and culturally rooted Ilonggo ingredient.

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