Innovation in Food Processing: Fermentation of Seagrape (Caulerpa Lentillifera)

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ABSTRACT

This study aimed to develop fermented seagrape (Caulerpa lentillifera), locally known as lato in the Philippines, as a value-added product and a possible preservation method for a highly perishable marine alga. The product was developed through multiple formulation trials that varied ingredients and processing conditions. The final formulation used seagrape with carrots, radish, garlic, ginger, apple, spring onion, fish sauce, and mashed potato, with fermentation conducted at room temperature before refrigerated storage. Seventy consumer respondents and three experts evaluated the product using a five-point acceptability scale. The consumer sensory evaluation obtained a grand mean of 4.58, while the expert evaluation obtained 4.89; both were interpreted in the source thesis as highly acceptable. The product was also submitted for microbiological analysis. Reported results included a coliform count of less than 1 CFU/ml, Salmonella below 2.2 MPN, no detected Escherichia coli, and Staphylococcus aureus below 2.2 MPN. The findings indicate that the developed sample was well accepted by the evaluators and showed promising microbiological results. Further controlled shelf-life and process-validation studies are needed before making definitive claims about long-term stability or commercial readiness.

Keywords: Caulerpa lentillifera, seagrape, lato, fermentation, product development, sensory evaluation, microbiological analysis

INTRODUCTION

Food product development can create new uses for underutilized ingredients while addressing issues related to perishability and limited product variety. Caulerpa lentillifera, commonly called seagrape or lato, is an edible green seaweed valued for its salty flavor, distinctive texture, and nutritional content. In the Philippines, it is commonly consumed fresh, including as ensaladang lato. However, fresh seagrape can deteriorate within a few days after harvest, limiting its storage, transport, and marketability.

Fermentation is a traditional food-processing technique that can contribute to preservation and the development of distinctive flavor and texture. Philippine fermented foods include products such as bagoong, burong isda, burong mangga, tapuy, and tuba. Exploring a fermented seagrape product therefore connects a familiar food-processing practice with an ingredient that is often sold fresh. The source thesis describes the need to carefully control processing because seagrape has high moisture content and fragile vesicles that may burst under unsuitable conditions. This study developed and evaluated a fermented seagrape formulation using vegetables and other ingredients. Several trials were undertaken to improve texture, taste, aroma, and fermentation performance. The final sample was assessed through sensory evaluation and microbiological testing to provide preliminary evidence about its acceptability and safety.

OBJECTIVE OF THE STUDY

The study aimed to develop a fermented seagrape (Caulerpa lentillifera) product and evaluate its sensory acceptability and microbiological characteristics.

Specifically, it sought to: (1) develop and refine the product through successive formulation trials; (2) evaluate color, aroma, appearance, texture, taste, unpleasant aftertaste, and overall acceptability using a five-point rating scale; and (3) examine selected microbiological parameters reported for the final sample.

METHODOLOGY

Research Design

The study used an experimental product-development design with descriptive sensory evaluation. Multiple batches were prepared, and formulation and processing adjustments were made based on observations of texture, flavor, pH, and fermentation progress. The final formulation was selected for sensory evaluation and microbiological analysis.

Research Locale and Respondents

The study was conducted in the City of San Jose del Monte, Bulacan. The sensory evaluation involved 70 consumer respondents and three experts in food technology and fermentation. Respondents with seafood or shellfish allergies were excluded, according to the source thesis.

Research Instrument and Data Analysis

A structured questionnaire using a five-point acceptability scale was used to assess aroma, color, appearance, texture, taste, absence of unpleasant aftertaste, and overall acceptability. The source thesis states that frequency and percentage were used to summarize response distributions, while weighted mean was used to determine acceptability.

Product Development Procedure

The tools, utensils, and jars were cleaned and sanitized, and fresh seagrape was washed under cold running water. Vegetables and other ingredients were prepared and combined into a seasoning mixture. The mixture was coated onto the seagrape, transferred to clean jars, and fermented. The final trial used cold salt water for washing, fresh unblanched carrots, salted radish, mashed potato, grated apple and juice, garlic, ginger, spring onion, and fish sauce. The mixture was fermented at room temperature for three days before being transferred to cold storage. The source thesis reports that this trial maintained the desired texture and was selected for further evaluation.

Microbiological Analysis

The final sample was tested for total coliform, Salmonella, Escherichia coli, and Staphylococcus aureus. The values below reproduce the results as stated in the source thesis. The original laboratory reports and applicable standards should be checked when preparing a final publication or making a regulatory compliance claim.

RESULTS AND DISCUSSION

Product Development Results

Four main trials were described in the source thesis. In the first trial, two formulations were compared; both were rejected because one lacked a distinctive flavor and the other became too thick due to chili garlic oil. In the second trial, the product failed by the second day, and the researchers attributed the bursting of seagrape vesicles to the osmotic effect of added sugar. In the third trial, blanched vegetables and refrigerated fermentation slowed the process, and the product later became too spicy and lost its crunchiness. The fourth trial used cold salt water during washing, fresh carrots, salted radish, mashed potato, and apple. It was selected because it maintained texture and had an acceptable taste and pH.

The product-development experience suggests that ingredient preparation and processing conditions were important to the quality of the final sample. The results also show that the fragile vesicles of seagrape require careful handling. The reported storage observations should be treated as preliminary because a longer controlled shelf-life study would be needed to confirm stability over time.

Table 1. Summary of Product Development Trials

Trial	Processing approach	Observation/result	Decision
1	Two formulations using seagrape, mashed potato, seasonings, and vegetables; one formulation used chili garlic oil.	Both formulations were rejected: one lacked uniqueness and the oil-based formulation became too thick.	Revise the formulation and remove the unsuitable oil-based approach.
2	Adjusted ingredients and added sugar.	The product failed by the second day; vesicles burst.	Avoid direct addition of refined sugar in the next formulation.
3	Used blanched vegetables and refrigerated fermentation.	Fermentation was slow; the product became spicier and lost crunchiness.	Revise vegetable preparation and fermentation conditions.
4	Used cold salt water for washing, fresh carrots, salted radish, mashed potato, apple, and other seasonings; fermented at room temperature for three days.	Maintained texture and acceptable taste and pH according to the thesis.	Selected as the final formulation for further testing.

Consumer responses showed that 54.3% of the 70 consumers had tried seagrape before, while 45.7% had not. The source thesis also reported varied consumption of fermented products among consumers, suggesting different levels of familiarity with fermented foods.

Table 2. Consumer and Expert Sensory Evaluation Results

Sensory attribute	Consumer mean	Expert mean	Interpretation reported in thesis
Color	4.51	4.67	Highly Acceptable
Aroma	4.48	5.00	Highly Acceptable
Appearance	4.61	4.67	Highly Acceptable
Texture	4.51	5.00	Highly Acceptable
Taste	4.64	5.00	Highly Acceptable

Overall acceptability	4.74	5.00	Highly Acceptable
Grand mean	4.58	4.89	Highly Acceptable

The sensory evaluation yielded a consumer grand mean of 4.58 and an expert grand mean of 4.89. Among consumers, overall acceptability received the highest mean (4.74), followed by taste (4.64) and appearance (4.61). Aroma had the lowest consumer mean at 4.48, although it remained within the highly acceptable range reported in the thesis. Experts rated aroma, texture, taste, and overall acceptability at 5.00, while color and appearance received 4.67.

Table 3. Intensity of Unpleasant Aftertaste

Attribute	Consumer mean	Expert mean	Interpretation
Unpleasant aftertaste	1.54	1.00	Low intensity / no or negligible aftertaste reported

The low scores for unpleasant aftertaste indicate that evaluators generally did not detect a strong undesirable aftertaste. Because this attribute is reverse-scored relative to positive sensory attributes, its interpretation should be explained separately from the overall acceptability scale.

Table 4. Laboratory Sensory Evaluation

Property	Reported observation
Color	Light orange to opaque mustard yellow
Texture	Smooth, semi-viscous, syrupy liquid body with crisp, fibrous, crunchy vegetable pieces; astringent mouthfeel
Aroma	Strong herbal scent resembling seagrape with a slightly acidic undertone
Appearance	Viscous, opaque liquid base with visible seagrape foliage
Taste	Creamy, strong herbal or seagrape taste with a chili aftertaste

Table 5. Microbiological Analysis Results

Test	Reported actual value	Standard value stated in thesis
Coliform count	Less than 1 CFU/ml	Less than 10 CFU/ml
Salmonella	Less than 2.2 MPN	Less than 3 MPN
Escherichia coli	Not detected	Absent / not detected
Staphylococcus aureus	Less than 2.2 MPN	Less than 10 CFU/ml

The microbiological results were reported as within the comparison limits listed in the source thesis. However, the test units and methods should be verified against the original laboratory report and the exact food category and regulatory standard before stating formal compliance. These results apply to the tested sample and do not, by themselves, establish safety for all batches or throughout a claimed shelf life.

CONCLUSION

The study developed a fermented seagrape product through successive formulation trials. The final formulation used seagrape with vegetables, apple, mashed potato, and seasonings, and was selected because it retained texture and showed acceptable sensory characteristics. The consumer grand mean of 4.58 and expert grand mean of 4.89 indicate high acceptability among the evaluators who participated in the study.

The microbiological results reported for the tested sample were within the comparison limits presented in the thesis. Nevertheless, verification of the original laboratory report, applicable standards, and test units is recommended before making definitive regulatory claims. The study provides preliminary support for fermented seagrape as a value-added food product, but further controlled work is needed to establish reproducible fermentation conditions, microbiological safety, and shelf life.

RECOMMENDATIONS

- Conduct controlled shelf-life studies using defined storage temperatures, packaging materials, fermentation periods, and formulation conditions.
- Repeat product-development trials to refine aroma, texture, and flavor while preserving the characteristic texture of seagrape.
- Verify microbiological test methods, units, and applicable standards using the original laboratory report and relevant regulatory guidance.
- Use larger and more diverse consumer groups in future sensory evaluations.
- Standardize sanitation, ingredient quantities, pH monitoring, and fermentation procedures so that future batches can be compared consistently.
- Assess nutritional composition and physicochemical changes during fermentation before making specific health or functional-food claims.

Ethics Statement

The source thesis describes sensory evaluation involving consumer respondents and experts. It does not provide a detailed ethics approval statement in the supplied document. Before publication, the researchers should confirm and report how informed consent, voluntary participation, confidentiality, and any required institutional approval were handled.

Data Availability Statement

The supplied thesis does not state a formal data availability policy. The researchers may provide the sensory evaluation records, trial logs, and laboratory reports upon reasonable request, subject to participant confidentiality and institutional requirements, if those materials are available.

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