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REDUCING FOOD WASTE: UTILIZING MANGO PEEL AS GUMMIES

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ABSTRACT

This study examined mango peels—an often-discarded food waste—and explored their potential for reducing waste by transforming them into gummies. The research highlights how repurposing fruit by-products can minimize environmental impacts related to waste production and disposal. Using a quantitative descriptive-developmental design guided by the IPO model, the study focused on creating and evaluating mango peel gummies as a sustainable snack alternative. The innovation benefited various groups, including children, parents, the community, students, business owners, TLE teachers, and future researchers. It supported sustainable development by promoting responsible consumption and raising awareness about food waste utilization. Respondents gave positive feedback, showing satisfaction with the product's quality and purpose. The gummies met consumer expectations, proving that mango peels can be turned into an edible, safe, and sustainable product. However, some respondents suggested further improvements in sensory qualities, particularly texture and color. The researchers recommended conducting shelf-life and nutritional analyses to enhance the product's stability and determine its nutritional value over time. These improvements would provide more comprehensive data and strengthen the development of mango peel gummies as an eco-friendly food innovation.

KEYWORDS: *Developmental; Mango Peel; Mango Peel Gummies; Food Waste*

I. INTRODUCTION

The common way of eating mango was only by its flesh, while the seeds and skins were thrown away. Many people just ate their mangoes every day, and one must not have wasted such by simply throwing away the mango peel. It was better to take advantage of these mango peels and turn them into snacks like gummies. This study explored the use of mango peels to create edible gummies, turning food waste into a useful and enjoyable product. Instead of discarding mango peels, the study aimed to promote sustainability, provide livelihood opportunities, support a cleaner environment, and inspire students to develop small businesses through innovative thinking. The study aligned with several Sustainable Development Goals (SDGs). It supported SDG 9 (Industry, Innovation, and Infrastructure) by transforming waste materials into innovative food products (United Nations,2020)[4]. It contributed to SDG 11 (Sustainable Cities and Communities) by reducing food waste and promoting better waste management (Global Goals, 2024)[2]. Lastly, it addressed SDG 12 (Responsible Consumption and Production) by encouraging sustainable practices through the reduction of food waste and the development of innovative food products(Willson, 2023)[5] .

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Figure 1 and 2. Formulated Mango Peel Gummies
(Left: Figure 1, Right: Figure 2)

II. Objectives

1. To formulate mango peel gummies using mango peel as a primary ingredient.
2. To analyze the mango peel gummies in terms of:
2.1. pH level;
2.2. Microbial quality, including:
   2.2.1. Staphylococcus aureus count;
   2.2.2. Salmonella spp. count;
   2.2.3. Escherichia coli count;
   2.2.4. Yeast count; and
   2.2.5. Mold count.
3. To evaluate the sensory attributes of the mango peel gummies in comparison with commercially available gummy products in terms of:
3.1. Appearance;
3.2. Color;
3.3. Aroma;
3.4. Texture; and
3.5. Taste.
4. To determine whether there is a significant difference in the sensory evaluation of the formulated mango peel gummies and commercially available gummy products.

III. METHODOLOGY

The researchers prepared the ingredients, materials, tools, and equipment needed in creating the mango peel gummies. Validator experts ensured the validity and reliability of the questionnaire. The mango peels underwent washing, boiling, air frying, and pulverizing before formulation. The researchers conducted pH level analysis, microbial analysis, and sensory analysis to determine product safety and acceptability. After data collection, the researchers analyzed and interpreted the findings.

Table 2. Mango Peel Gummies Formulation

Ingredients	Percentage (%)
Mango Peels	1.20%
Gelatin Powder	10.04%
White Sugar	20.08%
Glucose Syrup	20.08%
Lemon Juice	2.41%
Water	24.10%
Green Agar-Agar Bar	4.02%
Water for Gelatin	18.07%

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IV. SAMPLING DESIGN

Table 1. Total Number of Respondents

Respondents	Frequency	Percentage (%)
Teachers	2	6.66%
Field Experts	4	13.33%
Students	24	80%
Total	30	100%

This study used a Developmental method of quantitative research design. Developmental quantitative research design is an approach which involves creating, refining, and assessing procedures and outputs that meet the consistency and efficiency standards. Also, it includes collecting data in quantitative form and performing statistical analysis. The respondents consisted of three (3) TLE Teachers, three (3) field experts, and twenty-four (24) students whose courses were related to food technology at Nueva Ecija University of Science and Technology, Sumacab and General Tinio Campus.

V. STATISTICAL DESIGN

Table 3. Likert Scale (Five-Point Satisfaction Scale)

Interval	Verbal Description
5	Very Satisfied
4	Satisfied
3	Neutral / Neither Satisfied nor Dissatisfied
2	Dissatisfied
1	Very Dissatisfied

The data gathered from the respondents were tabulated and tallied using frequency, percentage, weighted mean, t-test independent, and interpretation. By utilizing standardized measures like Likert Scale, the researchers ensured consistency and reliability in data collection, having an accurate interpretation and analysis of the results (Bhandari P. and Nikolopoulou, K., 2020)[1]

VI. GEOGRAPHICAL AREA

The collection of mango peels was from the vendors of mango graham shake “Mango Bravo” at Sumacab Este, Cabanatuan City, Nueva Ecija. While the production and preparation were conducted at the food laboratory of NEUST General Tinio Campus. The pH level and microbial analysis were examined at NanoTech Laboratory at Central Luzon State University. And lastly, the sensory evaluation was conducted at NEUST General Tinio and Sumacab Campus during the Academic Year 2024–2025.

VII. RESULTS

Table 4. Test Result

Parameter	Overall mean	Verbal description/remarks
pH Level	4.57	Slightly Acidic, within acceptable range
Microbial Analysis	ND	No growth detected (safe)
Appearance	3.77	Satisfied
Color	3.77	Satisfied
Aroma	3.71	Satisfied
Texture	3.72	Satisfied
Taste	3.72	Satisfied

The pH testing of mango peel gummies revealed an average pH of 4.57 over 14 days, which is slightly acidic and within a safe range for such products. Measurements were taken on days 1,7 and 14, with an average of 4.57. Microbial analysis of the gummies confirmed safe, showing no harmful microorganisms like Staphylococcus aureus, E. coli, or salmonella. Factors such as acidity and proper storage prevented microbial growth, highlighting the relationship between pH stability and microbial safety. The study evaluated the sensory characteristics of both formulated and commercial gummies, assessed by experts, teachers, and students. The formulated gummies consistently received a rating of "satisfactory," while commercial gummies were rated "very satisfied." Improvements in texture, color, and consistency of the mango peel gummies are recommended to enhance consumer experience and meet satisfaction levels. This indicates that the result aligns with other studies that with the escalation of mango peel powder incorporation, the cakes displayed a progressive augmentation in their flavor scores (Shafi SY, et al. 2025)[3].

VIII. SUGGESTIONS

The researchers suggest that establishing a shelf-life analysis for mango peel gummies is necessary to ensure product quality, safety, and stability over time, which are critical for consumer satisfaction and successful market distribution. There is a

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necessity for a comprehensive nutritional analysis of the gummies, focusing on bioactive compounds to assess their health benefits when included in gummies. Enhancing the sensory attributes of the product, specifically texture, appearance, and color, is crucial for improving consumer perception and satisfaction. These improvements would boost the gummies' appeal and increase their market success, aligning with consumer expectations. There is a market potential for mango peel gummies, necessitating an analysis of consumer trends, demand for sustainable products, and the competitive landscape to assess their viability and future positioning in the eco-friendly and functional foods sector.

IX. CONCLUSIONS

Based on the data gathered by the researchers, it is concluded that the formulation of the mango peel gummies started when the researchers collected, washed, boiled, and cooked the mixture for the gummies until it set into the silicon molder. The physicochemical analysis of the formulated mango peel gummies that have a decreasing level of pH for fourteen (14) days, and it is said to confirm the relationship between pH and microbial load in mango peel gummies. That is why these two are being tested.

The sensory attributes are assessed which include the appearance, aroma, color, texture, and taste of the mango peel gummies are proven to be accepted and all attributes are ranked by the respondents as "satisfied". Meaning to say, the mango peel gummies meet the consumers' standards as a gummy snack. Lastly, a comparative analysis is being done to compare the two products, which are the commercial product and the formulated product. Even though the commercial product was being ranked as "very satisfied" by the respondents, the formulated gummies can compete and are keeping up with the commercial ones.

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