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Chocolate-Coated Banana Candy: Formulation, Analyses, and Acceptability

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Abstract

The growing demand for natural and new food products has prompted researchers to look into alternative food innovations that provide nutritional value while addressing challenges such as food wastage and poverty alleviation. In response, the development and assessment of chocolate-coated banana candies was the main focus of this study. In particular, it looked at the product's appearance, taste, texture, and aroma as well as general customer acceptability, differences in sensory qualities among treatments, and shelf life under both ambient and cold storage conditions. The formulation with the best performance was subjected to microbiological and proximate tests. The study employed an experimental-developmental method using a completely randomized design. Evaluation samples were appropriately coded, and the experiment was replicated three times with ten semi-trained panelists and 100 customer respondents. Sensory evaluation was carried out using a 9-point Hedonic Scale, and the gathered data were analyzed using descriptive statistics and analysis of variance. Treatment C, with Green Cavendish bananas, had the highest mean scores across all sensory measures, followed by Treatment B (Red Banana) and Treatment A (Española). There were no apparent differences among treatments in terms of texture, taste, aroma, or appearance, according to statistical analysis. However, Treatment A (Española) was chosen for microbiological and proximate testing as well as shelf-life evaluation due to its overall consumer acceptance. The results validated its potential nutritional benefit and appropriateness for prolonged use. The product remained stable for up to 20 days at room temperature and 30 days under chilled conditions, according to a shelf-life examination. The Aerobic Plate Count was analyzed at 60 cfu/g, showing good microbiological quality and storage stability, and no Fecal Coliforms, *Salmonella*, *Escherichia coli*, yeast, or mold were found, further supporting product safety.

Keywords: Formulation, Analyses, Acceptability, Banana, Food wastage, and Chocolate-coated candy.

1. Introduction

Food consumption played a central role in Filipino culture, with a strong preference for sweet delicacies that not only satisfied cravings but also provided nutritional value. In recent years, traditional sweets

were transformed into healthier snack alternatives in response to growing consumer awareness of nutrition and well-being. The development of nutritious snack products reflected the essence of innovation by

creating food options that supported good health while responding to economic challenges. Utilizing locally available and indigenous crops offered an opportunity to introduce new flavors, promote local agricultural resources, and generate livelihood opportunities for underemployed individuals (Shahen *et al.*, 2019).

In the province of Capiz, bananas were widely grown and included varieties such as Española or Pisang Awak, Red Banana locally known as “Morado,” and Green Cavendish, commonly referred to as “Bungulan”. When properly processed, these banana varieties could serve as primary ingredients in chocolate-coated candy production, providing an additional source of household income. As noted by Mendoza, (2018) banana was among the most significant fruit crops in the Philippines for both local consumption and export. It was cultivated nationwide, with export-oriented production concentrated in the southern regions, and was frequently grown as an intercrop under coconut plantations.

Red banana (*Musa acuminata*) was considered one of the important banana varieties, characterized by its reddish-purple peel and cultivated in select regions, such as Australia, Central America, and Brazil. In India, it was commonly found in Kerala and parts of Tamil Nadu. Compared with Cavendish, the Red banana is smaller and more compact, with cream to light pink flesh when ripe. Ripening in bananas involved physiological and compositional changes that varied among varieties and were influenced by factors such as climate, agricultural practices, post-harvest handling, and storage conditions. The degree of ripeness after harvest was a critical factor in determining suitability for processing and product development. These physicochemical changes during ripening were documented in the Monthan variety (Patil *et al.*, 2015). Furthermore, Sawardekar *et al.* (2024) emphasized that red banana, a triploid AAA group variety, was highly valued for its flavor and nutritional properties, offering health benefits related to immune function, cardiovascular health, vision, skin condition, and digestive health.

Despite these advantages, Red banana remained relatively scarce in Capiz. Its availability was seasonal, and its physical characteristics limited

marketability. Although it occasionally appeared in local markets during harvest season, its presence was infrequent.

Pisang Awak, commonly referred to as a tropical banana and known as Kluai Namwa in Thailand, is a widely recognized banana variety in tropical countries, such as Thailand, Malaysia, Myanmar, and Vietnam (Crichton, 2020). In Thailand, this variety exhibits red, white, and yellow fruit types. Pisang Awak was nutritionally rich, containing carbohydrates, proteins, fats, and various vitamins. As a climacteric fruit, banana continued to ripen after harvest, undergoing distinct internal and external changes at different stages of maturity (Pornchalermpong & Rattanapanon, 2021). In Capiz, this variety is locally known as Española; in Kabayan, Benguet, it is called Glorai; and in Ibayay, it is referred to as “Langkitan”. It is commonly consumed fresh, fried, or boiled. Despite being marketable and familiar, this banana variety remained underutilized in the province.

Green Cavendish banana (*Musa acuminata* Cavendish subgroup) was typically harvested while unripe and was commonly used for cooking or processing into various food products (Rombide & Gibertas, 2023). Studies on green Cavendish bananas had largely focused on their benefits for gastrointestinal health, glycemic and insulin regulation, weight management, and complications related to diabetes affecting renal and liver function, with only limited evidence contradicting these benefits (Falcomer *et al.*, 2019). Cavendish banana was also recognized for its high sugar content and diverse volatile aroma compounds, particularly esters and alcohols (Sharif *et al.*, 2019; Nugerahani *et al.*, 2023).

In view of these considerations, the study aimed to introduce various banana varieties to the community in a practical and accessible form. By processing bananas into chocolate-coated candy, the fruits could be preserved and consumed conveniently regardless of seasonal availability. The development of this product also involved enhancing sensory qualities, such as flavor, appearance, aroma, taste, and texture. Ultimately, transforming different banana varieties into chocolate-coated candy offered potential benefits to consumers, producers, and other sectors of society

by promoting food innovation, value addition, and local agricultural utilization.

In response to the growing demand for nutritious, value-added snack products derived from locally available resources, this study was undertaken to develop and evaluate a chocolate-coated banana candy. Specifically, it aimed to determine the sensory qualities and general acceptability of the chocolate-coated banana candy in terms of appearance, aroma, taste, and texture; find out if there is a significant difference in the sensory qualities and general acceptability of the chocolate-coated banana candy considering the different treatments; determine the shelf life of the chocolate-coated banana candy under room-temperature and chilled storage conditions; and subject the most acceptable formulation to proximate composition analysis and microbiological evaluation to determine its nutritional value and safety.

2. Materials and Methods

This study used an experimental-developmental research approach. Experimental research entails developing a hypothesis and manipulating, measuring, and comparing variables to determine how one variable affects another. The developmental component is responsible for the systematic design, creation, and evaluation of goods, processes, or instructional programs, assuring internal consistency and effectiveness (Ibrahim, 2016). This study employed the developmental element to develop chocolate-coated banana candy with three different types of bananas: Española, Green Cavendish, and Red Banana.

A Completely Randomized Design (CRD) was used to gather and examine data. In order to ascertain the effects of the treatments, this design was used in three replications without a control group. Three treatments were used in the experiment: Treatment B (100g Red Banana), Treatment C (100g Green Cavendish), and Treatment A (100g Española). After incorporating each variety of banana into the chocolate-coated banana candy, it was assessed for general acceptability, taste, texture, aroma, and appearance.

The following materials, tools, and equipment were used to conduct the study: one (1) working table, three (3) medium mixing bowls, two (2) spatulas, one (1) silicone molder, one (1) stove, one (1) stainless steel casserole, one (1) set of measuring cups, one (1) set of measuring spoons, one (1) digital weighing scale, one (1) dozen small bowls, one (1) kitchen knife, and one (1) fork.

Table 1 shows all of the materials and proportions used to make the chocolate-coated banana candy. Although the overall composition and quantity of ingredients were consistent across all treatments, the significant variable in this investigation was the banana type used.

The study sought to design, create, and assess a product that would satisfy both sensory and nutritional requirements using a developmental research methodology. Cashew nuts, butter, dark chocolate, and condensed milk were all used in the same quantities in each experiment, guaranteeing that variations in results could only be ascribed to the kind of banana used.

Table 1: Proportion of ingredients of the chocolate-coated banana candy for sensory evaluation.

Ingredients	Treatments/ Products		
	A (Española)	B (Red Banana)	C (Bungulan)
Banana	100g	100g	100g
Dark Chocolate	50g	50g	50g
Condense Milk	120mL	120mL	120mL
Cashew Nuts	25g	25g	25g
Butter	2g	2g	2g

Three replicates were created for each chocolate-coated banana candy variety (Española, Red Banana, and Green Cavendish) to ensure dependability and

consistency in rating. The development procedure involved paying close attention to the mixing, molding, coating, and chilling steps in order to

generate products with comparable texture, appearance, and structural integrity. This methodical technique enabled the researcher to isolate the effect of banana variety on sensory aspects such as appearance, aroma, taste, and texture, as well as overall acceptability of the finished product.

To ensure consistent product preparation across all treatments, the experimental processes were meticulously planned and carried out. Throughout the study, the emphasis was on controlling factors, adhering to good food handling techniques, and keeping consistent processing conditions.

Step 1 Procedure in the Preparation of Raw Material

Preparation of the Banana Pulp. All tools, materials and ingredients in making chocolate-coated banana candy were prepared. The bananas (Española, Red Banana, and Green Cavendish) were gathered and prepared. Then, they were washed thoroughly, peeled, and sliced. They were measured and set aside for later use.

Step 2 Procedure in Making the Banana Candy

The ingredients were prepared in each treatment. Then, the 120mL of condensed milk was poured and stirred until it thickened. Next the 100gms of banana was added and continuously stirred in a low heat until sticky. Lastly, the sautéed cashew nut was added and stirred for three minutes, then was set aside until it cooled down. It was then weighed to 8 gms of banana candy and made it into small balls then set aside.

Step 3 Procedure in Coating the Chocolate-Coated Banana Candy

The ingredients were prepared in coating the banana candy. The 50gms of dark chocolate bar was put aside until it melted. When it was in liquid form, the 1ml of dark chocolate was poured in a silicon mold. Then, the small balls of banana candy were added. The top of the banana candy was coated again. It was then chilled for 15 to 20 minutes. Finally, it was removed from the mold.

The study used a 9-Point Hedonic Scale for the sensory assessment of the chocolate-coated banana candy. Ten (10) semi-trained panelists evaluated the

appearance, aroma, taste, and texture, which are important quality attributes.

One hundred (100) respondents in all were chosen in order to assess customer preference. Twenty pupils from Dulangan National High School, 10 Instructors from the same institution, 20 parents from Dulangan, Pilar, Capiz, and 50 locals made up this group.

All rating sheets were gathered, arranged, and compiled for analysis following the completion of the sensory testing. The degree of acceptance for each sensory characteristic of the chocolate-coated banana candy, as well as the product's overall acceptability were calculated using the average (mean) values.

Initial trial formulations were the first step in the product's development. After testing and improvement, a final formulation was developed. Every one of the three experimental formulas was recorded to monitor variations and advancements. The 9-Point Hedonic Rating Scale was then used to evaluate the finished items.

The overall acceptability of the chocolate-coated banana candy was assessed by consumers. The gathered information was tabulated and subjected to statistical analysis. In particular, the data were interpreted using the Arithmetic Mean and Analysis of Variance (ANOVA). The Statistical Package for the Social Sciences (SPSS) was used to handle and analyze the data.

The degree of acceptance for each sensory attribute, such as appearance, taste, texture, and aroma, as well as for overall product preference were determined by calculating the mean scores. To find significant differences among the three treatments, Analysis of Variance (ANOVA) was utilized. To ascertain whether the differences in taste, texture, aroma, and appearance among treatments were statistically significant, the test was run at a 0.01 alpha level.

The researcher strictly adhered to ethical considerations throughout the conduct of the study to ensure the protection of participants' rights and uphold the integrity of the research process. All participants were fully informed about the nature, purpose, and potential

benefits of the study. The voluntary nature of their participation was emphasized.

3. Results and Discussion

Sensory Qualities of the Chocolate-Coated Banana Candy

Based on the analysis, the results revealed that Treatment A (Española) received a mean score of 8.20, described as "extremely appealing," while Treatment B (Red Banana) scored 8.60, also categorized as "extremely appealing," and Treatment C (Green Cavendish) obtained a mean score of 8.40, similarly rated as "extremely appealing." These results imply that Treatment B (Red Banana) was the evaluators' most aesthetically favored option, suggesting that the red banana variety may have the most visual appeal to consumers. These results supported Shashikumar *et al.* (2023), who focused at adding red bananas to yogurt. According to their research, the addition of red banana enriched the yogurt with vital minerals, dietary fiber, and vitamins, making it appropriate for all age groups' nutritional requirements. This is in line with the growing need for nutritious and aesthetically pleasing foods that promote health. According to the study, red bananas are a useful component for consumers who value sustainability and well-being.

Regarding aroma, Treatment A (Española) received a mean score of 8.20, described as "extremely pleasant." Treatment B (Red Banana) obtained a mean score of 8.10, characterized as "very much appealing," while Treatment C (Green Cavendish) scored 8.40, also described as "extremely pleasant," as rated by the evaluators. These results indicate that Treatment C (Green Cavendish) was the most preferred in terms of aroma, suggesting that the green Cavendish variant had the strongest olfactory appeal among the three treatments. These findings were consistent with the study conducted by Rombide and Gibertas, (2023) which focused on the development of bread using green Cavendish banana (*Musa acuminata* Cavendish) flour. Their research detailed the ingredients and processes involved in producing the banana bread, and the sensory evaluation revealed high overall acceptability, with positive ratings for appearance, aroma, texture, and taste. The study highlighted the

potential of green Cavendish banana as both a nutritious and enjoyable food ingredient.

For taste, Treatment A (Española) received a mean score of 7.80, described as "very much delicious." Treatment B (Red Banana) followed with a mean score of 8.20, categorized as "extremely delicious," while Treatment C (Green Cavendish) scored 8.60, also described as "extremely delicious," as rated by the evaluators. These results indicate that Treatment C (Green Cavendish) was the most preferred in terms of taste, suggesting that its flavor could strongly influence consumer choice and make it the favored option among the three banana varieties. These findings were consistent with the study by Nugerahani *et al.* (2023), which examined the incorporation of Cavendish banana into rice bran yogurt to improve its sensory qualities. Their results indicated that increasing the proportion of Cavendish banana puree slightly reduced preferences for appearance and mouthfeel, while taste ratings improved up to a 15% level of integration.

Overall, the addition of Cavendish banana puree positively influenced the microbiological, physicochemical, and sensory properties of the yogurt. Regarding texture, Treatment A (Española) received a mean score of 8.20, described as "extremely chewable." Treatment B (Red Banana) scored 8.40, also categorized as "extremely chewable," while Treatment C (Green Cavendish) obtained the highest mean score of 8.70, similarly described as "extremely chewable," as rated by the evaluators. These results suggest that Treatment C (Green Cavendish) was perceived to have the most desirable chewable texture, enhancing its overall sensory appeal and positioning it as the preferred choice among the treatments for consumers who favor a tender and enjoyable texture. The results supported Marchioretto *et al.* (2023). They determined the samples obtained by adding green banana biomass to chocolate had moisture, lipid and mineral content in accordance with the legislation. They found that viscosity measurements were at the desired values and that the most preferred ones in terms of sensory aspects were the samples containing the greenest banana biomass. In fact, they emphasized that, considering all other results, the product became healthier for the consumers.

General Acceptability of the Chocolate-Coated Banana Candy

The results revealed that for appearance, Treatment A (Española) received a mean score of 8.64, described as “liked extremely,” Treatment B (Red Banana) scored 8.72, also categorized as “liked extremely,” and Treatment C (Green Cavendish) obtained a mean score of 8.68, similarly described as “liked extremely,” as rated by the evaluators. These results indicate that Treatment B (Red Banana) was the most preferred in terms of appearance, suggesting it had the highest visual appeal among the three treatments. These findings were consistent with the study by Shashikumar *et al.* (2023), which explored the addition of red banana to yogurt. Their research demonstrated that incorporating red banana enhanced the yogurt’s content of minerals, dietary fiber, and vitamins, making it suitable for the nutritional needs of all age groups. This supports the growing trend for health-promoting foods that combine both nutritional value and sensory appeal, highlighting red banana as a valuable ingredient for health-conscious consumers who prioritize wellness and sustainability.

The results for aroma acceptability showed that Treatment A (Española) received the highest mean score of 8.54, described as “liked extremely.” This was followed by Treatment C (Green Cavendish), which scored 8.14, also described as “liked extremely,” and Treatment B (Red Banana), which obtained a mean score of 8.10, described as “liked very much,” as rated by the evaluators. These findings indicate that Treatment A (Española) was the most preferred in terms of aroma, suggesting that its fragrance was the most appealing among the three treatments. This result supported Zhu *et al.*’s (2019) assertion that the content volatile compounds increased significantly with fruit ripening, contributing to the unique aroma of Pisang Awak bananas or locally known Española.

The results for taste acceptability indicated that Treatment A (Española) received the highest mean score of 8.46, described as “liked extremely.” This was followed by Treatment B (Red Banana) and Treatment C (Green Cavendish), both scoring 8.12 and also described as “liked extremely,” according to the evaluators. These findings suggest that Treatment A

(Española) was the most preferred in terms of taste, indicating its flavor was the most appealing among the three chocolate-coated banana candy variants. The result also supported Campuzano *et al.* (2018), who affirmed that Musa ABB Pisang Awak is a popular banana species in the market due to its sweet, sour, and unique flavor.

The results for texture acceptability showed that Treatment A (Española) received the highest mean score of 8.34, described as “liked extremely.” Treatment C (Green Cavendish) followed with a mean score of 8.14, also described as “liked extremely,” while Treatment B (Red Banana) scored 8.10, described as “liked very much,” as rated by the evaluators. These results indicate that Treatment A (Española) was the most preferred in terms of texture, suggesting that its mouthfeel was considered the most appealing among the three chocolate-coated banana candy treatments. These findings were consistent with the study by Amarasinghe *et al.* (2021), which examined the functional, physicochemical, and antioxidant properties of flour and cookies made from two banana varieties (*Musa acuminata* cv. Pisang Awak and *Musa acuminata* cv. Red Dacca).

Difference in the Sensory Qualities of the Chocolate-Coated Banana Candy among Three Treatments

The results revealed that there were no significant differences in the sensory attributes of the chocolate-coated banana candy across the different treatments. Specifically, the F-ratio for appearance was 2.282 ($p = 0.319 > 0.01$), for aroma was 1.362 ($p = 0.506 > 0.01$), for taste was 6.322 ($p = 0.042 < 0.01$), and for texture was 2.448 ($p = 0.294 > 0.01$). This suggests that the chocolate-coated banana candies were comparable in their sensory qualities, with no treatment showing a distinct advantage over the others. The results supported Zhu *et al.*’s (2019) assertion that the content volatile compounds increased significantly with fruit ripening contributing to the unique aroma of Pisang Awak bananas or locally known Española. The results further supported the study of Campuzano *et al.* (2018), which affirmed that Musa ABB Pisang Awak is a popular banana species in the market due to its sweet, sour, and unique flavor.

Difference in the General Acceptability of the Chocolate-Coated Banana Candy among Three Treatments

The analysis showed that there were no statistically significant differences in general acceptability between the treatments. For appearance, Treatment B (Red Banana) achieved the highest mean score; however, the analysis of variance (ANOVA) produced an F-ratio of 0.511 with a p-value of 0.600, which exceeded the 0.01 significance level. This demonstrated that the differences in appearance ratings among the three treatments were not statistically significant. In terms of texture, Treatment A (Española) received the highest mean score, with an F-ratio of 2.932 and a p-value of 0.055, also above the 0.01 threshold, indicating no meaningful difference in textural preference among the treatments. These results suggest that consumers generally perceive the three chocolate-coated banana candy variants as equally acceptable, with no specific treatment having a distinct advantage in either visual appeal or texture.

The findings of the study revealed a statistically significant variation in the overall consumer acceptability of the chocolate-coated banana candy among the three treatments. In particular, Treatment A, which incorporated the Española banana variety, was rated highest for aroma, recording an F-ratio of 12.053 with a p-value of 0.000 ($p < 0.01$), indicating a highly significant preference. Similarly, regarding taste, Treatment A again emerged as the most favored, with an F-ratio of 7.632 and a p-value of 0.001 ($p < 0.01$), further confirming its superior sensory appeal. These results suggest that consumer preferences were not uniform, demonstrating a marked inclination toward the aroma and taste attributes of the candy prepared from Española banana. The distinct organoleptic qualities of the Española variety contributed to a unique and memorable flavor profile, enhancing the product's sensory appeal and positioning it as an attractive option for consumers seeking innovative and adventurous confectionery experiences.

The analysis of the data indicated a statistically significant difference in the overall consumer acceptability of the chocolate-coated banana candy across the three treatments, with Treatment A, which incorporated the Española banana variety, receiving

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the highest preference. Specifically, Treatment A achieved an F-ratio of 6.529 and a p-value of 0.002 ($p < 0.01$), demonstrating a strong and significant favorability among consumers. Consequently, the null hypothesis which proposed that there would be no significant difference in the general acceptability of the chocolate-coated banana candy among the three treatments in terms of aroma was rejected. This outcome suggests that the sensory formulation of Treatment A was particularly appealing, highlighting the distinctive characteristics of the Española banana that contributed to its enhanced aroma. The results underscore the potential of selecting specific banana varieties to optimize the sensory attributes of confectionery products and meet consumer preferences effectively.

These findings were consistent with the study conducted by Shashikumar *et al.* (2023), which examined the incorporation of red banana into yogurt. The inclusion of red banana in the yogurt formulation enhanced its nutritional profile by increasing levels of minerals, dietary fiber, and vitamins, thereby addressing the dietary needs of consumers across all age groups. This approach aligns with the rising consumer demand for foods that provide both health benefits and sensory satisfaction. The study highlighted red banana as a promising ingredient for health-conscious consumers, offering a balance of nutrition, palatability, and sustainability in food product development.

Stability and Shelf Life of Chocolate-Coated Banana Candy Under Room and Chilling Conditions

The shelf life of the chocolate-coated banana candy was assessed under two storage conditions: room temperature and chilling (refrigerated) temperature.

Room Temperature. When stored at room temperature away from direct sunlight, in a well-ventilated, dry, and normally lit environment the chocolate-coated banana candy maintained its physical characteristics, aroma, texture, and overall quality for twenty (20) days. On the twenty-first (21st) day, slight changes in texture and taste were observed, indicating the initial stages of quality deterioration. These results demonstrate that the product is shelf-stable for up to

three (3) weeks under proper room temperature conditions, making it suitable for distribution, storage, and consumption without the immediate need for refrigeration.

Chilling Temperature. When stored under refrigerated conditions at temperatures maintained between thirty-two degrees Fahrenheit (32°F) and forty degrees Fahrenheit (40°F), the chocolate-coated banana candy exhibited no observable changes in appearance, texture, aroma, or taste over a period of thirty (30) days. This indicates excellent product stability under chilled conditions, confirming that the chocolate-coated banana candy can retain its quality for at least four (4) weeks. The stability under refrigeration highlights its potential for extended storage, ensuring market distribution flexibility and consumer satisfaction.

Overall, the findings suggest that the chocolate-coated banana candy demonstrates reliable shelf stability, with up to three weeks at room temperature and at least four weeks under chilled storage, supporting its practical usability and commercial viability.

This outcome aligns with the findings of Jouneghani *et al.* (2020), who reported that banana cultivars classified under the ABB genome possess enhanced antimicrobial efficacy against a range of foodborne pathogens as well as clinically significant microorganisms. Their study highlighted that these cultivars exhibit bioactive properties that support the traditional use of banana extracts in managing gastrointestinal infections, including diarrhea and dysentery. Notably, specific cultivars demonstrated pronounced anti-*Candida* biofilm activity, suggesting potential therapeutic relevance in the traditional treatment of sexually transmitted infections. These observations underscore the broader pharmacological potential of selected banana varieties and reinforce their value as functional ingredients with both nutritional and medicinal applications.

Microbial Analysis of the Chocolate-Coated Banana Candy (Española)

The chocolate-coated banana candy made from the Española banana variety underwent Microbial analysis. The assessment was performed by the Negros

Prawn Producers Cooperative Analytical and Diagnostic Laboratory in Bacolod City (LSO No. 25-86311). A total sample weight of 250 grams was submitted for testing. The laboratory completed the analysis on the same date.

The microbial evaluation encompassed multiple parameters to ensure comprehensive safety and quality assessment of the product. The Aerobic Plate Count was conducted using the 3M Petrifilm™ Rapid Aerobic Count Plates, following the AOAC International Official Method of Analysis 990.12 (AOAC Certificate No. 121403). This test quantified the total number of viable microorganisms in the product, providing an overall indicator of microbiological quality and handling practices.

Total and Fecal Coliforms, along with *Escherichia coli*, were analyzed using 3M Petrifilm™ E. coli/Coliform Plate Count in accordance with AOAC Official Method of Analysis #991.14. These tests were critical for assessing potential contamination by pathogenic bacteria commonly associated with poor hygiene or unsafe processing conditions. Salmonella detection was performed using Compact Dry media, a selective method to identify this significant food-borne pathogen, which is vital for confirming consumer safety. Yeasts and molds were enumerated using 3M Petrifilm™ Yeast and Mold Count Plates (AOAC Certificate No. 121301), which ensured the product was free from spoilage organisms that could affect shelf life, taste, and safety. The results from these analyses indicated that the chocolate-coated banana candy met all required microbiological safety standards. No significant contamination was detected across the tested parameters, demonstrating that the product was processed under hygienic conditions and maintained quality suitable for consumption. These findings validate the product's safety for storage, distribution, and consumer use, supporting its potential as a commercially viable confectionery item.

The microbial analysis of the chocolate-coated banana candy revealed an Aerobic Plate Count of 60 colony-forming units per gram (cfu/g), which falls within the acceptable limits established by the Bureau of Food and Drugs (BFAD) reference standards for confectionery products. Total and Fecal Coliforms, as

well as *Escherichia coli*, were not detected at the 10^1 dilution level, indicating that the product was free from common hygiene-related bacterial contamination. Additionally, *Salmonella* was absent in the 25-gram test sample, meeting the permissible criteria outlined by BFAD for confectioneries. Yeast and mold counts were also within safe limits, confirming that the product was microbiologically stable and unlikely to experience spoilage under proper storage conditions. The analysis employed standardized microbiological techniques to ensure the thorough assessment of bacteria, yeasts, molds, and other potentially harmful microorganisms. These procedures evaluated the product's safety and quality, with validation measures including assessments of precision, accuracy, specificity, and method reliability. By confirming the absence of pathogens and maintaining microbial counts within permissible limits, the study provides strong evidence of the chocolate-coated banana candy's safety for consumer use. Furthermore, these findings contribute to enhancing food safety practices in the confectionery industry, supporting the production of high-quality, hygienic, and shelf-stable chocolate-based products.

The findings of this study were consistent with the observations reported by Teixeira *et al.* (2020) emphasizing that the risks posed by food as a vector for transmitting pathogenic microorganisms are critically important in ensuring the provision of safe and nutritious food to consumers globally. Accurate identification and thorough characterization of pathogenic microorganisms play a key role in assessing and managing microbial hazards associated with both animal- and plant-based food products.

Proximate Analysis of the Chocolate-Coated Banana Candy (Española)

The chocolate-coated banana candy prepared using the Española variety also underwent proximate analysis. The analysis was carried out by the Negros Prawn Producers Cooperative Analytical and Diagnostic Laboratory in Bacolod City, under LSO No. 25-84514. The sample was submitted and analyzed. The proximate analysis provided a detailed assessment of the nutritional composition of the product, including its moisture, protein, fat, ash, and carbohydrate content. These results are essential in evaluating the

overall nutritional quality, energy contribution, and potential health benefits of the chocolate-coated banana candy, ensuring that it meets consumer expectations for both taste and nutrition.

A 250-gram sample of the chocolate-coated banana candy (Española), individually packaged in plastic, was subjected to comprehensive proximate analysis to determine its nutritional composition. The evaluation included the determination of fat, carbohydrates, moisture, protein, ash, and caloric content using standardized analytical methods. Fat content was assessed using the Soxhlet Extraction Method, while carbohydrate levels were measured via the Phenol-Sulfuric Acid Method. Moisture content was determined through Gravimetric Oven Drying at 105°C , protein content was analyzed using the Kjeldahl Method, and ash content was measured by oxidation at 550°C . These analyses provided an accurate profile of the product's nutritional attributes, ensuring the quality, safety, and dietary value of the chocolate-coated banana candy.

The proximate analysis of the chocolate-coated banana candy (Española) revealed its nutritional composition per 250-gram sample. The fat content was determined to be 15.1 grams, while carbohydrates accounted for 78.2 grams. Moisture content was relatively low at 1.7 grams, indicating minimal water activity and contributing to product stability. Protein was measured at 4.5 grams, reflecting the contribution of cashew nuts and milk solids in the formulation. The ash content, representing the total mineral fraction, was 1.3 grams. Finally, the caloric value of the 250-gram sample was calculated at 65 kilocalories. These results provide a clear overview of the chocolate-coated banana candy's nutritional profile, highlighting its energy contribution, macronutrient distribution, and potential value as a nutrient-dense confectionery product. The results demonstrated in the report were those obtained at the time of examination and referred only to the particular sample submitted. The findings indicate that the rising consumer preference for fruit-based and functional foods positions the chocolate-coated banana candy (Española) as a sustainable and natural alternative to enhance the health attributes of traditional chocolate products. By incorporating nutrient-rich banana, the confectionery not only delivers improved flavor and

sensory appeal but also contributes additional bioactive compounds, vitamins, and dietary fiber. This trend highlights the potential for future research and product development focused on creating banana-based variants that promote health benefits, offering innovative opportunities for the functional confectionery market while meeting the growing demand for nutritious and naturally derived indulgences.

The findings were consistent with those reported by Noh *et al.* (2020) who emphasized the critical role of Food Composition Databases (FCD) in providing accurate and comprehensive nutritional information for various foods. Access to a reliable and up-to-date FCD is essential across multiple domains, including nutrition science, dietetics, public health, food technology, biodiversity research, plant breeding, the food industry, and regulatory frameworks. Such databases serve as foundational tools for nutrition labeling, dietary assessment, formulation of food policies, and scientific research. The results of this study underscore the importance of FCD in evaluating and communicating the nutritional attributes of innovative food products, such as the chocolate-coated banana candy, thereby supporting informed decisions by consumers, researchers, and policymakers alike.

4. Conclusion

The development of chocolate-coated banana candy using Española, Red Banana, and Green Cavendish varieties demonstrates high consumer acceptability across all sensory attributes, with no significant differences among formulations. The product maintains desirable quality and nutritional stability for up to three weeks at ambient conditions and four weeks under chilled storage, confirming its robustness for distribution. Microbiological analyses verify compliance with BFAD standards, ensuring safety for consumption. The combination of banana and dark chocolate produces a distinctive flavor profile that resonated strongly with consumers, underscoring the product's potential as a safe, nutritious, and commercially viable confectionery innovation.

5. Acknowledgment

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6. Conflicts of interest

The author confirms that there is no conflict of interest.

7. References

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