



# Formulation of Coco-Squash Peanut Nutri Bar

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**Abstract:** This research focuses on the product formulation and utilization of the combination of coconut milk, squash, and peanut into a nutri bar. Sensory evaluation assessed the appearance, aroma, taste, and texture of the energy bar using Quantitative Descriptive Analysis (QDA) score sheets that were participated by trained panelists with knowledge in sensory evaluation. The acceptability tests determined the appearance, flavor, texture, and packaging attributes of the nutrition bar through three formulated samples, using the Acceptability Score Sheet. The goal of developing a Coco-Squash Peanut Nutri Bar is to provide a nutritious and cost-effective snack with locally available ingredients. Three sample formulations were prepared with different proportions of the main ingredients to determine the best balance of flavor, texture, and nutritional value. Sample 1 comprises 150 grams of ground peanuts, 350 grams of mashed squash, and 1 cup of coconut milk. Sample 2 was made with 200 g ground peanuts, 300 g mashed squash, and 1 cup coconut milk. Sample 3 comprises 250 g ground peanut, 250 g mashed squash, and 1 cup coconut milk. In the result, the overall acceptability of the product indicates that Sample 1 (3.95) and Sample 2 (3.89) performed within the "Acceptable" range, while Sample 3 performed as "Moderately Acceptable" with (3.39). The present study also managed to determine some significant differences regarding acceptability across samples and hence identified the appropriate product for further work. Through subjective evaluations, this study concludes that the Coco-Squash Peanut Nutri Bar is a nutritionally rich and sensory-acceptable snack option with promising market potential.

**Index terms - Acceptability, nutri bar, product development, sensory characteristics, quantitative descriptive analysis.**

## I. INTRODUCTION

The coconut industry plays a vital role in Philippine agriculture, with 69 out of the country's 82 provinces engaged in coconut production. Covering a total of 3.62 million hectares, the industry provides employment to approximately 2.5 million farmers. In 2018, the Philippines boasted over 347 million fruit-bearing coconut trees and a production volume of 14.7 million metric tons (in nut terms). According to the Philippine Coconut Authority, domestic consumption of coconut in copra terms reached 0.835 million metric tons in 2015. The country ranks as the second-largest coconut producer within the Association of Southeast Asian Nations (ASEAN), contributing nearly 40% of the region's total coconut output (FAOStat, 2018). Key coconut-producing regions in the Philippines include CALABARZON, the Zamboanga Peninsula, Davao, and Northern Mindanao. Known as the "tree of life" for its numerous applications, coconuts are primarily exported as products like virgin coconut oil (VCO) and desiccated coconut. In the study, coconut milk was utilized as one of the main ingredients in the developed nutria bar as a substitute to the commercial milk in the market. Coconut milk is a creamy, white liquid derived from the flesh of mature coconuts. It is rich in medium-chain triglycerides (MCTs), a type of fatty acid that is easily digested without requiring extensive processing. Unlike other milk alternatives that contain long-chain fatty acids, coconut milk provides a quick and efficient energy source for the brain. (Grumezescu, 2019).

Besides this, the country is also a major producer in the world regarding coconut, besides being a leading producer of squash and peanuts—a crop that holds much nutritional value and is adaptable to various food preparations. Being a staple crop in Filipino diets, squash has been found rich in beta-carotene, dietary fiber, and essential vitamins. From the family Cucurbitaceae, squashes are flowering plants commonly grown as vegetables and even used as animal feed. Native to the Americas, the plant was first cultivated by native peoples and later found by European colonizers. Edible squashes are often cooked, and seeds and flowers of some species are used in preparation for consumption. Additionally, pumpkin seeds are a great source of magnesium, potassium, and phosphorus, as well as other minerals such as zinc, manganese, iron, calcium, sodium, and copper (Dotto & Chacha, 2020). Unlike these crops, peanuts provide not only inexpensive protein but also essential fats and minerals. Other crops, like coconuts, tend to have unused potential in the way they produce high-value products. A product integrating all three ingredients serves both local agricultural productivity and the demand for healthy snacks.

The United Nations introduced SDGs in 2015. The efforts to eliminate poverty and protect the environment, with a focus on peace and prosperity for all people, are being made by SDGs by 2030 as per UN 2030 Agenda (Ghosh et al., 2024). The SDGs emphasize the importance of research and development as a transformative process that relies on both collective and individual contributions. They highlight that successful global development is rooted in robust research and a deep understanding of key issues. Meaningful efforts have been made to discover and implement the SDGs through initiatives aimed at effectively achieving each

goal (Bain et al., 2019; Chapman et al., 2020). This research aligns strongly with the United Nations' Sustainable Development Goals (SDGs) 2030, highlighting its contributions to several goals: Goal 2: Zero Hunger – By developing a nutrient-rich snack, the Coco-Squash Peanut Nutri Bar promotes better nutrition and helps combat hunger and malnutrition. This product enhances dietary options, particularly in underserved communities, using local and accessible ingredients. Goal 3: Good Health and Well-being – The nutri bar's formulation, rich in dietary fiber, healthy fats, and protein, supports overall health and wellness. It encourages the consumption of healthier alternatives to highly processed snacks. Goal 8: Decent Work and Economic Growth – This project fosters local economic growth by creating demand for raw materials like coconuts, squash, and peanuts, which benefits smallholder farmers in the Bicol region. Value-added processing also opens new income streams through entrepreneurship and employment opportunities. Goal 12: Responsible Consumption and Production – Utilizing raw, local ingredients efficiently promotes sustainable agricultural practices and minimizes food waste. Developing a durable snack also aligns with responsible production methods.

The Coco-Squash Peanut Nutri Bar is designed to address multiple societal challenges, including creating healthier snack alternatives, reducing reliance on imported or highly processed goods, and providing an economic boost to the agricultural sector in the region. By combining subjective evaluations such as sensory acceptability and preference with objective measures like nutritional composition, this research highlights the potential of indigenous crops to meet modern consumer demands while supporting long-term sustainability.

The study not only underscores the untapped potential of the Bicol region's agricultural resources but also provides a concrete example of how innovative food products can help meet the United Nations' ambitious SDGs. The development of new food products with low commercial value contributes to endogenous products' value and sustainability. (Abreu, et.al., 2024) Through this initiative, the Coco-Squash Peanut Nutri Bar becomes more than a snack—it transforms into a model for sustainable, inclusive development rooted in local ingenuity and global relevance.

## II. OBJECTIVES

The objective of the study is to:

1. Determine the sensory characteristics of the three samples of Coco-Squash Peanut Nutri Bar in terms of appearance, aroma, taste and texture.
2. Determine the level of acceptability of the three samples of Coco-Squash Peanut Nutri Bar in terms of appearance, aroma, flavor and packaging.
3. Determine the preferred sample of Coco-Squash Peanut Nutri Bar.
4. Determine the significant difference of the level of acceptability of the three samples of Coco-Squash Peanut Nutri Bar.

## III. RESEARCH METHODOLOGY

This study considered three (3) phases in conducting this research. (1) Preparatory Phase, (2) Experimental Phase, and (3) Evaluation Phase.

### (1) Preparatory Phase

During the preparatory phase, the researcher prioritized the preparation of key raw materials: squash, coconut milk, and peanuts. For the coconut, mature nuts were selected to ensure high-quality coconut milk. The coconuts were grated, and the milk was extracted to obtain pure coconut milk. The squash was chosen based on maturity and a yellow-orange hue to enhance the color of the Coco-Squash Peanut Nutri Bar. It was thoroughly washed, steamed, peeled, and deseeded before being mashed. The peanuts were coarsely ground to prevent the release of excess oil. Additionally, other ingredients, including sugar, eggs, and vanilla, were prepared during this stage. The formulation of raw materials for the different sample variations was also completed in this phase.

### (2) Experimental Phase

In this study, three formulations of the Coco-Squash Peanut Nutri Bar were developed to identify the most acceptable proportion of ingredients. Each formulation varied in the amount of mashed squash and ground peanut used. Sample 1 contained 150 grams of mashed squash and 350 grams of ground peanut, Sample 2 used 200 grams of mashed squash and 300 grams of ground peanut, while Sample 3 incorporated 250 grams of mashed squash and 250 grams of ground peanut. All samples were processed using identical methods, including consistent cooking times, temperatures, and procedures.

During the experimental phase, two cooking processes were tested using the three formulations. The first method followed the traditional "molido" preparation, where the mixture was cooked in a carajay over low heat with continuous stirring until it became smooth and firm. The mixture was then flattened and shaped into bars. The second method combined the traditional cooking process with an additional step of baking the bars after shaping. This baking step improved the product's color and reduced its moisture content, contributing to a longer shelf life.

From these two kitchen tests, the researcher identified the process that yielded the best characteristics for the product. The selected cooking method was used to create the final product, which was then subjected to sensory evaluation by selected respondents to assess its acceptability.

### (3) Evaluation Phase

During the evaluation phase, the researcher conducted two types of evaluations: subjective and objective evaluation.

#### A. Subjective Evaluation

The subjective evaluation focused on assessing the sensory characteristics of the Coco-Squash Peanut Nutri Bar, including appearance, aroma, taste, and texture. This evaluation was carried out by 30 trained panelists from Food Technology and Food Service Management students with knowledge and expertise in doing sensory analysis. Quantitative Descriptive Analysis was employed to systematically measure these sensory attributes. Additionally, the level of acceptability was determined by the same respondents, who evaluated the product based on its appearance, flavor, texture, and packaging. Following these assessments, the three Coco-Squash Peanut Nutri Bar samples were ranked to identify the best formulation.

## IV. RESULTS AND DISCUSSION

### 1. Sensory Characteristics of the Three Samples of Coco-Squash Peanut Nutri Bar in terms of Appearance (color), Aroma, Taste and Texture

The sensory evaluation focused on key attributes, including appearance (color), aroma, taste, and texture. Data from the evaluation were analyzed statistically using the arithmetic mean. The sensory characteristics of the Coco-Squash Peanut Nutri Bar were assessed using Quantitative Descriptive Analysis (QDA) score sheets. Thirty (30) trained panelists participated as respondents, providing scores that contributed to the product's characterization. There were three samples formulated, sample 1 contains 150 grams of ground peanut, 350 grams mashed squash and 1 cup coconut milk. Sample 2 contains 200 grams peanut, 300 grams mashed squash and 1 cup coconut milk and sample 3 contains 250 grams peanut, 250 grams mashed squash and 1 cup coconut milk. The three samples have the three main ingredients but different proportions.

Table 1. Sensory characteristics of Coco-Squash Peanut Nutri Bar

| Sensory Attributes         | Sample 1 |                 | Sample 2 |              | Sample 3 |              |
|----------------------------|----------|-----------------|----------|--------------|----------|--------------|
|                            | Mean     | Description     | Mean     | Description  | Mean     | Description  |
| <b>Appearance:</b> (color) | 2.7      | Golden Brown    | 3.5      | Golden Brown | 2.2      | Golden Brown |
| <b>Aroma:</b>              |          |                 |          |              |          |              |
| Coconut Milk               | 2.3      | Moderate        | 2.4      | Moderate     | 2.8      | Moderate     |
| Squash                     | 2.4      | Moderate        | 2.4      | Moderate     | 2.8      | Moderate     |
| Peanut                     | 2.7      | Moderate        | 2.0      | Moderate     | 3.7      | Moderate     |
| <b>Taste:</b>              |          |                 |          |              |          |              |
| Coconut Milk               | 1.5      | Less Pronounced | 2.5      | Pronounced   | 3.2      | Pronounced   |
| Squash                     | 2.3      | Pronounced      | 2.6      | Pronounced   | 2.5      | Pronounced   |
| Peanut                     | 2.3      | Pronounced      | 2.7      | Pronounced   | 3.8      | Pronounced   |
| <b>Texture:</b>            | 1.7      | Soft            | 1.6      | Soft         | 3.7      | Firm         |

*Legend: Color – 0-1.9 Light Brown; 2.0-3.9 Golden Brown; 4.0-6.0 Dark Brown*

*Aroma – 0-1.9 Weak; 2.0-3.9 Moderate; 4.0-6.0 Strong*

*Taste – 0-1.9 Less Pronounced; 2.0-3.9 Pronounced; 4.0-6.0 Very Pronounced*

*Texture – 0-1.9 Soft; 2.0-3.9 Firm; 4.0-6.0 Very Firm.*

Table 1 shows the sensory attributes of the Coco-Squash Peanut Nutri Bar were assessed across three samples with varying proportions of mashed squash and ground peanut. The analysis focused on appearance (color), aroma, taste, and texture, with respondents providing feedback based on their sensory perceptions.

#### Appearance (Color):

The color of all three samples was described as golden brown, with Sample 2 receiving the highest mean score (3.5), indicating it was the most visually appealing among the samples. The higher rating suggests that a balanced proportion of 200 g peanut and 300g squash contributes to an attractive golden-brown appearance. This implies that optimizing ingredient ratios can enhance visual appeal, which is crucial for consumer acceptance, as appearance often influences purchase decisions.

#### Aroma:

The aroma of the three samples, characterized by coconut milk, squash, and peanut, was consistently rated as “moderate.” Sample 3 for peanut aroma (3.7), suggesting that increasing the proportion of peanuts enhances its aromatic profile. This finding highlights the role of peanuts in contributing to the product's overall aroma, which could attract consumers who prefer a stronger nutty scent.

#### Taste:

Sample 3 received the highest scores for taste, particularly for the peanut flavor (3.8), with the squash and coconut milk flavors also described as pronounced. The balanced ingredient ratio (250g peanut and 250g squash) appears to enhance flavor synergy, making Sample 3 the most flavorful. This indicates that optimizing flavor components is essential for creating a product that satisfies consumer palates and increases the likelihood of repeat purchases. Taste involves factors such as smell and tactile sensations, which combine to create flavors, allowing us to recognize and distinguish between familiar and new food items (Breslin, 2013). Meanwhile, tastiness is described as a quality experienced after consumption and can be assessed afterward (Haasova & Florack, 2019). Numerous studies emphasize the crucial role of tastiness and health in food selection (Mergelsberg et al., 2019; Londerée & Wagner, 2021). Understanding how these processes are encoded in the brain is crucial for analyzing the cognitive and neural mechanisms involved in daily eating habits (Londerée & Wagner, 2021).

#### Texture:

Texture results varied significantly across samples. Samples 1 and 2 were rated as "soft" (mean scores of 1.7 and 1.6, respectively), while Sample 3 was described as "firm" with a mean score of 3.7. The higher peanut content in Sample 3 likely contributed to its firmer texture, which was preferred by respondents. This finding underscores the importance of achieving a desirable texture, as it affects both the eating experience and product quality.

The results suggest that Sample 3, with equal proportions of peanut and squash (250g each), offers the best balance across sensory attributes, including flavor, aroma, and texture. This sample could serve as the optimal formulation for commercial

production. The findings also highlight the importance of ingredient ratios in determining the sensory characteristics of the product. Sensory analysis remains one of the most crucial methods for assessing food quality. It serves as an evaluation technique that relies on human participants with specialized skills to perform designated tests (Djekic, 2021). For commercial viability, the firm texture, pronounced flavor, and appealing appearance of Sample 3 can position the Coco-Squash Peanut Nutri Bar as a desirable snack option.

## 2. Level of Acceptability of Coco-Squash Peanut Nutri Bar

The acceptability levels of the three (3) Coco-Squash Peanut Nutri Bar samples were assessed through acceptability evaluation conducted by the same group of thirty (30) trained panelists. The researcher utilized an Acceptability Score Sheet to evaluate and measure the product's acceptability.

Table 2. Level of Acceptability of Coco-Squash Peanut Bar

| Quality Attributes | Sample 1    |             | Sample 2    |                       | Sample 3    |                       |
|--------------------|-------------|-------------|-------------|-----------------------|-------------|-----------------------|
|                    | Mean        | Description | Mean        | Description           | Mean        | Description           |
| Appearance         | 4.1         | Acceptable  | 4           | Acceptable            | 2.1         | Moderately Acceptable |
| Flavor             | 4.2         | Acceptable  | 4.16        | Acceptable            | 4           | Acceptable            |
| Taste              | 3.7         | Acceptable  | 4.08        | Acceptable            | 2.9         | Moderately Acceptable |
| Texture            | 3.8         | Acceptable  | 3.3         | Moderately Acceptable | 4.67        | Highly Acceptable     |
| Average:           | <b>3.95</b> |             | <b>3.89</b> |                       | <b>3.39</b> |                       |

Legend: 5 – Highly Acceptable 4.5 – 5.0 4 – Acceptable 3.5 – 4.49 3 – Moderately Acceptable 2.5 – 3.49  
2 – Least Acceptable 1.5 – 2.49 1 – Not Acceptable 1.0 – 1.49

The acceptability of the three samples of the Coco-Squash Peanut Bar was assessed based on four quality attributes: appearance, flavor, texture, and packaging. The mean scores and descriptions provide insights into the strengths and areas for improvement for each sample.

### Appearance:

Sample 1 (4.1) and Sample 2 (4.0) were rated as "Acceptable" in appearance, while Sample 3 (2.1) was described as "Moderately Acceptable." This suggests that the higher proportions of squash in Samples 1 and 2 contributed positively to the product's visual appeal, likely due to their more vibrant color. Sample 3's lower score indicates that its ingredient ratio may have affected its color, making it less appealing. This highlights the importance of appearance in influencing initial consumer impressions, which can impact marketability. Therefore, the visual appearance of food creates an initial impression, influencing customers to make assumptions about the product's quality, which in turn affects its acceptance (Bandy et al., 2021).

### Flavor:

All three samples scored within the "Acceptable" range for flavor, with Sample 2 slightly outperforming the others (4.16). This indicates that the balanced ratio of squash and peanut in Sample 2 likely enhanced flavor harmony. Flavor acceptability is a critical factor in consumer satisfaction, and maintaining this balance is essential for product success.

### Texture:

The texture of Sample 2 (4.08) received the highest score, closely followed by Sample 1 (3.7), both described as "Acceptable." Sample 3 (2.9) was rated as "Moderately Acceptable," suggesting that its firmer texture might not align with consumer preferences. This finding emphasizes the need to optimize texture to enhance the overall eating experience.

### Packaging:

Packaging for Sample 3 received the highest rating (4.67), described as "Highly Acceptable," indicating that it stood out in terms of design, usability, or visual appeal. Sample 1 (3.8) was rated as "Acceptable," while Sample 2 (3.3) was "Moderately Acceptable." Effective packaging plays a key role in consumer decision-making by protecting the product and attracting attention. However, snacks are typically enclosed in packaging, which plays a significant role in enhancing consumers' perception of the product's taste sensitivity (Cao & Miao, 2021). If the product is to be launched, it will be crucial to ensure that the food packaging itself provides a comparable experience.

The overall acceptability scores indicate that Sample 1 (3.95) and Sample 2 (3.89) performed similarly, both within the "Acceptable" range, while Sample 3 (3.39) lagged as "Moderately Acceptable." This suggests that Samples 1 and 2 are better candidates for further development and potential commercialization.

The findings highlight the importance of balancing sensory qualities to maximize product acceptability. Sample 2 emerges as the strongest candidate due to its well-rounded performance across all attributes, particularly flavor and texture. Improving Sample 2's packaging could further enhance its market potential. Meanwhile, Sample 3, despite its lower overall rating, demonstrates excellent packaging acceptability, suggesting that elements of its design could be integrated into the final product.

### 3. Significant Difference of Level of Acceptability

Table 3. Computed F-Value

| Parameter  | Critical Value | Computed Value | Analysis                 |
|------------|----------------|----------------|--------------------------|
| Appearance | 0.05           | 0.196          | Null hypothesis accepted |
| Flavor     | 0.05           | 0.550          | Null hypothesis accepted |
| Texture    | 0.05           | 0.174          | Null hypothesis accepted |
| Packaging  | 0.05           | 11.396         | Null hypothesis rejected |

Table 3 shows the statistical analysis of the sensory attributes of the Coco-Squash Peanut Nutri Bar conducted using the ANOVA method, where the computed F-values were compared to the critical values to determine the significance of differences across the samples.

#### Appearance:

The critical value for appearance was set at 0.05, while the computed value was 0.196. Since the computed value is lower than the critical value, the null hypothesis is accepted. This means there is no significant difference in the appearance of the three samples, and consumers perceive their visual appeal similarly. This implies that the ingredient ratios used in the formulations did not significantly affect the color or overall visual appeal of the product.

#### Flavor:

The critical value for flavor was 0.05, with a computed value of 0.550. Since the computed value is greater than the critical value, the null hypothesis is accepted, indicating that there are no significant differences in flavor among the three samples. The similar flavor ratings across all samples suggest that the ratio of squash to peanut did not significantly impact the flavor profile, which may imply that flavor balance was maintained in all formulations.

#### Texture:

For texture, the critical value was 0.05, and the computed value was 0.174. The null hypothesis is accepted, meaning there is no significant difference in texture between the three samples. This indicates that the texture of the samples was perceived similarly by the panelists, suggesting that adjustments in the ratios of squash and peanut did not result in substantial textural differences.

#### Packaging:

In contrast to the other parameters, the critical value for packaging was 0.05, while the computed value was 11.396. Since the computed value is much larger than the critical value, the null hypothesis is rejected. This indicates a significant difference in the packaging of the three samples. The significant result suggests that the packaging used for the product has a meaningful impact on consumer perception, and it may be a critical factor influencing acceptability. Sample 3, which had the highest packaging acceptability, likely benefited from superior packaging design, contributing to its higher ranking in this category.

The findings suggest that appearance, flavor, and texture did not show significant differences between the samples, meaning that the formulation adjustments made to the proportions of squash and peanut did not greatly impact these sensory attributes. As such, the product can maintain consistency in appearance, flavor, and texture regardless of the specific ingredient ratio. However, packaging emerged as a key differentiator, with significant variations noted across the samples. This highlights the importance of investing in effective packaging, as it has a notable influence on the overall acceptability of the product.

### 4. Most Preferred Sample of Coco-Squash Peanut Nutri Bar

Of the three samples presented to the panelists, one sample was identified as the preferred product based on the Rank Preference Test conducted with the 30 trained panelists. In this test, the panelists ranked the three samples from their most preferred to least preferred. The sample with the lowest mean score in the rank preference test was ranked first, while the sample with the highest mean score was ranked third.

Table 4. Rank Preference of the Three (3) Samples of Coco-Squash Peanut Nutri Bar

| Sample | Critical Value | Computed Value  |
|--------|----------------|-----------------|
| 1      | 1.6            | 1 <sup>st</sup> |
| 2      | 2.10           | 2 <sup>nd</sup> |
| 3      | 2.50           | 3 <sup>rd</sup> |

The findings indicate that Sample 1 was the respondents' top preference, followed by Sample 2 and then Sample 3. Sample 1 emerged as the most favored option based on the sensory evaluation of its quality attributes and its level of acceptability as rated by the respondents. The proportions of the main ingredients played a significant role in determining the overall quality and appeal of the product.

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