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Product Development of Coco-Squash Spread

Michelle M. Lomeda-Junio

Assistant Professor 1, College of Technological and Developmental Education, Camarines Sur Polytechnic Colleges, Philippines

Abstract

Developing new food products like Coco-Squash Spread is crucial for addressing global food challenges. By diversifying food sources and utilizing locally available ingredients such as coconut milk and squash, this research aligns with sustainable agriculture principles. Moreover, if Coco-Squash Spread can effectively utilize food byproducts or surplus produce, it can contribute to reducing food waste. The Coco-Squash Spread product has the potential to provide essential nutrients, thereby combating malnutrition. The research encompassed product formulation and sensory evaluation. Quantitative descriptive analysis was employed to assess sensory attributes. The rank preference test was used to determine the most preferred sample of Coco-Squash Spread that evaluated with the same respondents. The research methodology integrated developmental, evaluative, and descriptive approaches. Sensory characteristics, including appearance, aroma, taste, and texture, were influenced by the formulation of raw materials and additional ingredients. Overall, the study provides preliminary insights into the potential of Coco-Squash Spread as a new food product, warranting further research to optimize formulation and explore market potential.

Keywords: Product Development, Sensory Evaluation, Quantitative Descriptive Analysis

1. Introduction

The Philippines, particularly the Bicol region, is renowned for its coconut-based cuisine. Coconut milk, a staple ingredient, is utilized in a myriad of dishes due to the region's abundant coconut trees. Bicol, renowned for its coconut-based cuisine, exemplifies the province's heavy reliance on the coconut industry. As a significant contributor to employment and foreign exchange, coconut has been a cornerstone of the Philippine economy. However, challenges such as domestic production issues, increased global coconut competition, and the emergence of alternative high-lauric oil crops threaten the industry's long-term sustainability. To thrive in the competitive global market, the Philippines must prioritize boosting coconut productivity, reducing processing costs, enhancing product quality, and developing innovative, high-value coconut products. Green and yellow-pigmented vegetables and yellow fruits are very good sources of this vitamin. This is one of the essential materials necessary for proper growth, normal health, and vision. It prevents or protects one from night blindness, toothache, low resistance to illness or infection, stunted growth, and low productivity. It is a fat-soluble vitamin; the other vitamins are known to be soluble in water—hence, not destroyed by heat but by light, especially ultraviolet light. Other dietary sources for Vitamin A include egg yolk, milk and milk products like butter and cheese, and fish liver oils. Squash, locally known as kalabasa, is a vine crop with culinary and nutritional value. The food is packed with Vitamin A, phosphorus, and calcium, so it is considered staple food for many Filipinos. One can easily identify squash because of its bright yellow color, indicating a

high level of Vitamin A in the vegetable. Its cultivation could be quite extensive, but the top-producing squash areas are found in the Ilocos, Cagayan Valley, Southern Tagalog, and Bicol.

Beyond the nutrient-dense food, squash is also a culinary gold mine. The tender shoots do well in salads, just like the mature fruit, which can be used with Bicolano's famous ginataan and savory pies. Even its seeds are a healthy snack when toasted. Concurrent to the coconut industry, the cultivation of squash (Cucurbita moschata Duch) thrives in the Philippines, especially in regions like Bicol. This versatile vegetable is rich in Vitamin A, phosphorus, and calcium, making it a valuable dietary component. Its abundance and nutritional profile present an opportunity for product development. Wanting to leverage the abundance and nutritional value of coconut and squash resources in the Bicol region, this study will focus on developing Coco-Squash Spread as a new and healthy food product. Combining these local ingredients, the research wants to come up with a deliciously healthy spread able to diversify the coconut industry and give consumers a much healthier alternative to traditional spreads. Such innovation answers the need for new coconut-based products and increases the consumption of underutilized squash. Through this initiative, the study promoted food innovation, which contributes to economic growth and better diet choices by using the agricultural strong points in the region.

2. Objectives of the Study

This study aims to develop a kind of spread utilizing locally found products such as Coconut Milk and Squash. Specifically, the researchers sought to answer the following questions:

1. What is the possible formulation of Coco-Squash Spread?
2. What is the sensory characteristics of the three samples of Coco-Squash Spread in terms of appearance (color), aroma, taste, and texture/consistency?
3. What is the most preferred sample for Coco-Squash Spread?

3. Scope and Limitation

This study focused on the utilization of coconut milk and squash as the raw materials and other ingredients such as sugar and calamansi. The product was subjected to the following activities such as: formulation of the product with three samples of different proportions, also Quantitative Descriptive Analysis (QDA) was evaluated by the trained panelists and experts based on the sensory characteristics of the Coco-Squash Spread in terms of appearance, aroma, taste and texture (consistency).

The tests for nutritional analysis, shelf life, microbial analysis and sugar content were not included in this study.

4. Review of related literature and Studies

A previous study by Basary et al. (2022) investigated the incorporation of Aloe vera gel into blended fruit jam using papaya and pineapple pulps. Their aim was to assess consumer acceptance of the Aloe vera addition and identify the optimal combination for jam preparation. This involved evaluating both the chemical composition and sensory qualities of the jams over a ten-week storage period. The researchers mixed papaya and pineapple pulps in various proportions according to their treatment groups. Five replicates of each treatment were processed into jam using a completely randomized design (CRD). The jams were then analyzed for their physical and chemical properties, as well as sensory attributes. Interestingly, formulations with higher Aloe vera content (T4: 150:150:15 and T5: 150:150:20) were found to be most favorable on the day of preparation, particularly in terms of sensory

consistency. These findings were further evaluated throughout the ten-week storage period.

Calabaza, a type of winter squash, is gaining popularity in the United States. Despite this, limited research exists on how consumer preferences and willingness to pay are influenced by squash's sensory qualities. This study of Moreno et. al., (2023) compared different calabaza varieties grown in the southeastern U.S., evaluating their sensory characteristics, physical properties, and chemical composition both fresh and frozen.

Consumer preferences varied significantly among the different calabaza varieties. Some varieties were consistently preferred, both fresh and frozen, while others were consistently disliked. Factors like sweetness, texture, and overall liking were closely linked to consumer willingness to pay for fresh calabaza. Consumer interest in frozen calabaza was mainly due to its color, its firmness, and sugar content. The current study tried to identify which of the following sensory characteristics of the product, appearance, odor, taste, or texture- most influenced the consumer preference of the product. In their work, Andersen et al. (2019) have elaborated a theoretical model that explains how overall product liking, sensory satisfaction, and individual sensory attributes of fruit drinks interrelate with each other. Taste was found to dominate all other sensory parameters, such as smell, in driving overall liking and sensory satisfaction. This research shows that the major premise by which consumers evaluate a product is through taste, thus the terms "overall liking" and "sensory satisfaction" could be used interchangeably in this context. Though all sensory factors do combine to give an overall perception, the most dominant factor that influences preference for any consumer is taste. The study conducted by Caliscan et al. (2017) compared convective and freeze-drying methods for the preservation of pumpkin slices. In this respect, freeze-drying was a superior technique in that it was able to maintain the quality of the product more than the convective drying process. The freeze-dried pumpkin slices rehydrated easily compared to other methods of preservation and retained a good quantity of their nutrients, though at high energy consumption in the process. It was also noted in the study that both water temperature and the ratio of water to dried pumpkin impacted the rehydration process. The results shown give some very useful information on how one can optimize pumpkin drying and rehydration methods within the food industry. Piskunova et al. (2024) conducted research on the optimization of musky squash for jam production. It was grounded that a short-term storage period increased the fruit ability to be used for jam making due to the squash maturation and nutrient content studies. The addition of apple juice or apples into the recipe improved the flavor and overall quality of the jam to a great extent. In the end, it can be concluded that musky squash grown in the Moscow region can be successfully transformed into high-quality jam by following the outlined methods. Mukherjee et al. (2023) investigated the feasibility of using squash pulp and peel powder as a healthier substitute in traditional wheat flour-based cookie recipes.

Given the abundance of squash and its increasing gluten-free product demand, this study discussed the nutritional and functional properties of squash powder in cookie formulations. Rice flour was mixed with different levels of squash powder to develop a wholesome and palatable cookie. The optimum formulation with a 3:1 ratio of rice to wheat flour and 30% squash pulp powder increased the fiber content and the content of vitamin C in the cookie, without modifying its taste or texture. This study has shown that squash can be a very useful ingredient in bakery products for healthier food. A study by Ajogun et al. (2023) determines the viability of coconut milk as a replacement for conventional dairy in yogurt production. Comparing coconut milk yogurt to regular cow milk yogurt and a mixed version, it was established that while coconut milk yogurt had more fat content, it scored low in protein, energy,

taste, texture, and overall acceptability. These findings suggest that, while coconut milk can serve as a base in the production of yogurt, additional modifications are still required to increase its sensory acceptability and nutritional value for consumers. In the study of Patil, et. al., 2023, coconut milk is a stable emulsion, primarily owing to the presence of naturally occurring proteins acting as emulsifiers. While additional stabilizers may be added to enhance this stability, the process of breaking such an emulsion naturally is an important step in extracting VCO. The efficiency of the destabilization step directly impacts the amount and quality of the resultant VCO product rich in beneficial medium-chain fatty acids. Ahmed et al. (2019) developed several plant-based condensed milk replacers based on soy milk and coconut milk in various proportions. The study evaluated these formulations based on chemical makeup and organoleptic properties. After all, a soy milk-only formulation emerged as most preferred, and it had higher preference over formulations with soy and coconut milk. This clearly indicates the potential of soy milk to be a good base for plant-based condensed milk products.

5. Research Methodology

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

(1)In the preparatory phase, the researcher focused on the preparation of raw materials such as squash and coco milk. In the selection of squash, it must be mature and yellow orange in color, a good quality peanut and coco milk from mature coconut. The squash was washed and steamed until tender and mashed, and pure coconut milk from mature coconut meat. Likewise, other ingredients like sugar and lemon were also prepared including the formulation of raw materials by sample were done in this phase.

(2)In this study, three samples were formulated for Coco-Squash Spread to determine the most acceptable proportion. The formulations contain different amounts of mashed squash but the same amount of coconut milk.

(3)In evaluation phase the researcher conducted subjective evaluation in answer to the sensory characteristics of the product. For the subjective evaluation it was focused on the sensory evaluation-based on the sensory characteristics of the coco-squash spread in terms of appearance, aroma, taste and texture. It was done by the trained panelists and experts from the Food Technology and Food Service Management students and faculty. Quantitative Descriptive Analysis was used in this evaluation. Likewise, after the evaluation, the three samples of coco-squash spread were ranked to get the best sample.

6. Results and discussion

Table 1. Formulation of Coco-Squash Spread

Sample 1	Sample 2	Sample 3
1 cup Squash	¾ cup Squash	½ cup Squash
1 cup Coconut Milk	1 cup Coconut Milk	1 cup Coconut Milk

Table 1 shows three formulations for a Coco-Squash Spread, differing primarily in the amount of squash used, while keeping the coconut milk constant at 1 cup across all samples. Sample 1 contains the highest amount of squash (1 cup), which likely gives it a thicker texture and a more pronounced squash flavor. Sample 2, with ¾ cup of squash, offers a middle-ground option, while Sample 3, with just ½ cup of squash, may produce a lighter spread with a more pronounced coconut flavor. The consistent use of 1 cup of coconut milk in each sample provides a creamy base, balancing the squash and enhancing the

spread's texture. By varying the amount of squash, each sample can offer different flavor intensities and textures, guiding further experimentation. Additional variations could introduce ingredients like sweeteners or spices to explore even more flavor profiles.

Table 2. Sensory Characteristics of Coco-Squash Spread

Sensory Attributes	Sample 1		Sample 2		Sample 3	
	Mean	**Description**	**Mean**	**Description**	**Mean**	**Description**
Appearance: Color	2.5	Yellow	3.1	Yellow	2.0	Yellow
ma:						
Coconut Milk	2.0	Moderate	2.1	Moderate	2.5	Moderate
uash	2.0	Moderate	2.1	Moderate	2.1	Moderate
Taste:						
Coconut Milk	1.9	LessPronounced	2.4	Pronounced	2.9	Pronounced
uash	2.0	Pronounced	2.5	Pronounced	2.0	Pronounced
Texture:	1.6	Soft	1.5	Soft	3.5	Firm

Legend: *Color – 0-1.9 Light Yellow; 2.0-3.9 Yellow; 4.0-6.0 Dark Yellow*
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 Firmed

The emphasis of the sensory evaluation was on the appearance (color), aroma, taste and texture. Results of the sensory evaluation were collected through statistical analysis using arithmetic mean. Using Quantitative Descriptive Analysis score sheets, the Coco-Squash Spread was characterized. Score given by the thirty (30) respondents from the 4th year BS Food Technology students and Food Service Management students and faculty who are considered as trained panelists and experts in one of the State University in Bicol, were measured from the scales.

The sensory evaluation revealed in Table 1, that while color was consistent across all samples, it did not significantly differentiate consumer preference. Aroma profiles were relatively similar, with a moderate presence of coco milk and squash.

Taste assessments indicated a balanced flavor profile for all samples, with sample 3 standing out due to a more pronounced coco milk taste. Texture emerged as the most distinguishing factor, with samples 1 and 2 offering a soft mouthfeel and sample 3 providing a firmer texture. These findings suggest that texture could be a key determinant of consumer choice, while flavor balance is consistent across products.

Table 3. Most Preferred Sample

Sample	Arithmetic Mean	Rank
1	1.9	1st
2	2.0	2nd
3	2.06	3rd

Among the three samples presented to the panelists, one sample emerged as the most preferred product based on the Rank Preference Test conducted among the 30 trained/experts panelists. Through rank

preference test, the panelist of evaluators ranked the three samples based on their preferred best sample up to the least liked. The lower mean score on rank preference test will be the first and the sample with the highest mean score will automatically be ranked third.

Respondent preference leaned heavily towards Sample 1, followed by Sample 2, and then Sample 3. This preference is primarily attributed to Sample 1's superior performance across sensory attributes and overall acceptability. The relative proportions of key ingredients significantly influenced product quality.

The clear preference for Sample 1 underscores the significant impact of ingredient ratios on product quality. This suggests that optimizing the formulations of Samples 2 and 3 to more closely align with Sample 1 could elevate their overall acceptability. Given the substantial lead of Sample 1, marketing efforts should prioritize this product while leveraging its success to drive consumer interest in the entire product line. Moreover, in-depth analysis of the specific qualities that make Sample 1 so appealing can inform the development of future, improved products within the Coco-Squash Spread category.

7. Recommendations:

To support the successful development and commercialization of the Coco-Squash Spread, several key areas should be further investigated. First, a comprehensive nutritional analysis is recommended to determine the spread's macronutrient and micronutrient profile, especially focusing on its fiber, vitamin, and mineral content contributed by squash and the healthy fats from coconut milk. This data can provide valuable information for marketing the spread as a nutritious, plant-based option. Additionally, microbial testing is essential to ensure product safety, as this will help identify any potential bacterial or fungal contaminants that could affect consumer health and compliance with food safety standards. Following this, a shelf-life study should be conducted to evaluate how long the Coco-Squash Spread can remain fresh and safe for consumption under various storage conditions. Determining the optimal storage conditions and any necessary preservatives will be crucial for retail. Finally, a marketing strategy should be developed to position the product effectively in the market. Emphasizing its unique combination of tropical flavors and potential health benefits can attract consumers seeking innovative and nutritious spreads. Market research will be essential to understand consumer preferences and competitive pricing, helping to maximize the product's appeal and commercial success.

8. Conclusions

The study's findings demonstrate that varying the amount of squash in the Coco-Squash Spread formulations significantly influences sensory characteristics, particularly texture, which emerged as a key determinant of consumer preference. Sample 1, with the highest squash content, was consistently favored by the panelists due to its optimal balance of flavor, texture, and overall acceptability, outperforming the other samples. The results indicate that adjusting the formulations of Samples 2 and 3 to more closely match the attributes of Sample 1 could improve their consumer appeal. For market introduction, Sample 1 should be prioritized, leveraging its sensory appeal to build consumer interest and brand recognition for the Coco-Squash Spread product line. These insights provide a foundation for refining the product and exploring additional enhancements to meet consumer expectations effectively.

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