PANTAO
International Journal of the Humanities and Social Sciences
ISSN 3028-0877
Volume 4, Issue 2 (2025)

Formulation, analyses, and acceptability of root-crops kropek

Randy C. Dolorico
Capiz State University Roxas City Main Campus
College of Education Graduate Programs
Roxas City, Capiz, Philippines
no email

Abstract: This study was conducted to develop root-crops kropek. The products of this study were evaluated as to sensory qualities and acceptability in terms of appearance, aroma, taste and crispiness. Significant differences in the sensory qualities and acceptability were also determined. Shelf-life of root-crops kropek was also determine and submit the best product (cassava kropek) for microbial and proximate analysis. The study was a developmental-experimental research that used the Completely Randomized Design (CRD), with three (3) treatments in three trials. Scorecards with Nine Point Hedonic Scales was utilized in the collection of data. The analysis included the calculation of arithmetic means and the application of Analysis of Variance (ANOVA) to detect significant differences among treatments. The sensory qualities of root-crops kropek were evaluated by 10 semi-trained panelist and the general acceptability was evaluated by 100 consumers. The results from the sensory evaluation shows that Treatment A (Cassava Kropek) was the best in all quality attributes. As to the general acceptability of Root-crops Kropek data reveals that Treatment A (Cassava Kropek) was the most preferred among the three treatments which was "Liked Extremely" by the consumer, while Treatment B (Sweet Potato Kropek) and Treatment C (Taro Kropek) followed closely with mean score having qualitative description of “Liked Very Much”. The significant difference was observed in the appearance and aroma of the Root-crops Kropek, whereas taste and crispiness showed no significant difference. Furthermore, based on the consumer's acceptability as a whole there was a significant difference among the three treatments in terms of the sensory qualities of the Root-crops Kropek in favor of treatment A. Upon testing the proximate analysis of the best product, it was found out that there was a substantial amount of nutrients needed for human body. The root-crops kropek were safe for human consumption as the results of microbial analysis of the product and based on the BFAD standard for microorganism test for products belonging to the Snack Foods category.

Keywords: Root-crops, Kropek (Cassava, Sweet potato, Taro)

Date Submitted: May 14, 2025
Date Accepted: May 27, 2025
Date Published: June 3, 2025

INTRODUCTION

The Philippines, a tropical country, is home to an abundance of nutrient-dense root-crops, which are celebrated both locally and globally for their health benefits and versatility (Santiago & Dizon, 2019). These unique plants are cultivated in various regions worldwide, including South and Southeast Asia, Africa, Latin America, the United States, and Europe (FAO, 2020).

Cassava (Manihot esculenta) is an excellent source of carbohydrates, making it a valuable energy provider, particularly in gluten-free diets. It is also rich in vitamin C and resistant starch, which have been shown to support immune function, enhance gut health, and regulate blood sugar levels (Montagnac, Davis, & Tanumihardjo, 2017). Sweet potato (Ipomoea batatas), recognized for its orange flesh, contains high levels of beta-carotene, a precursor of vitamin A that is crucial for vision, immunity, and skin health. Additionally, it is a good source of dietary fiber and potassium, which contribute to digestive and cardiovascular well-being (Wang et al., 2016). Taro

(Colocasia esculenta), with its creamy texture and nutty flavor, offers notable amounts of fiber, vitamin E, and potassium, and its phenolic compounds provide antioxidant properties that help reduce oxidative stress (Liu et al., 2019).

Recognizing their potential, researchers are exploring innovative ways to utilize these root-crops with their leaves, such as creating kropek—crispy fried crackers traditionally made from tapioca starch—by incorporating seasonal root-crops harvested from nearby areas (Gatchalian et al., 2021). These small, crunchy snacks are similar to crisps often associated with Oriental cuisine (Lee, 2017).

Kropek is a beloved snack across Asia, particularly in the Philippines, where it has become a staple for many (Fernandez, 2015). To introduce new flavors and expand its appeal, researchers are developing a version of kropek enriched with root-crops. The goal is to create a nutritious and cost-effective product that combines tradition with innovation. This modernized kropek would provide essential nutrients, including protein, fats, minerals, fiber, carbohydrates, energy, and carotenoids such as total carotene and beta-carotene (Garcia & Villanueva, 2022). By offering these health benefits, this new variant of kropek aimed to serve as a healthier alternative to conventional options.

One of the primary advantages of this new kropek is its affordability. Unlike commercial kropek, which can be expensive due to production and ingredient costs, this version is designed to be budget-friendly while retaining high nutritional value (FAO, 2021). Using locally sourced, nutrient-rich root-crops not only reduces production expenses but also boosts the product's nutritional profile (Rodriguez et al., 2018). This innovation demonstrated how traditional snacks can be transformed into healthier, more sustainable options without compromising taste or quality.

The new root-crop-based kropek would also feature a one-month shelf life, ensuring that it remains fresh and of high quality during this period (Dela Cruz et al., 2020). This extended shelf life is particularly advantageous for both manufacturers and consumers, as it allows for broader distribution and longer storage. Moreover, the inclusion of root-crops aligns with the growing consumer interest in healthy, organic, and plant-based foods (Mintel, 2021). In today’s market, there is a significant demand for natural and wholesome alternatives to conventional snacks, and this kropek fits perfectly into that trend.

Ultimately, this root-crops based kropek is more than just a snack—it’s a symbol of ingenuity and cultural heritage. With its affordable production, nutritional benefits, and appeal to health-conscious consumers, it is poised to make a significant impact in both local and global markets (Escalona et al., 2023). This innovative twist on a traditional favorite exemplifies how simple, natural ingredients can be transformed into delicious, nutritious, and sustainable products that cater to the evolving preferences of today’s consumers.

Problem Statement

This experimental-developmental study was conducted to develop root-crops kropek. More specifically it sought to:

1. determine the sensory qualities of root-crops kropek in terms of appearance, aroma, taste, and crispiness among treatments;
2. determine the general acceptability of root-crops kropek in terms of the sensory qualities among treatments;
3. find out if there is a significant difference in the sensory qualities of root-crops kropek among treatments;

4. find out if there is a significant difference in the general acceptability of root-crops in making kropek among treatments in terms of sensory qualities;
5. determine the shelf life of raw and fried kropek in terms of room temperature; and,
6. determine the microbial and proximate analysis of the most accepted root-crops kropek.

METHODOLOGY

Research design

The design used was the Completely Randomized Design (CRD) in which the root-crops kropek was studied with successive replications conducted to determine the cause of change. Samples for evaluation were coded, and scorecards were used to ensure randomization. The experiment was conducted using three product formulations, each with three treatments and three replications, following standardized sensory evaluation methods (Meilgaard et al., 2016).

Respondents of the study

A total of 110 evaluators participated, consisting of 10 semi-trained panelists and 100 consumers, who evaluated the product across these sensory attributes.

Data Gathering Instruments

The experiment utilized both the tubers and leaves of root-crops. This study used a 9-Point Hedonic Scale for evaluation as a research instrument. This was also used to evaluate the treatments that were undertaken to determine whether the criteria for evaluation would be added for more concrete analysis and results.

The experiment considered factors such as appearance, aroma, taste and crispiness of kropek. Data on appearance, aroma, taste and crispiness were gathered to determine the acceptability of root-crops kropek.

Data Gathering Procedure

Permission to conduct the research was requested from the Dean of the School, Capiz State University and the Division Superintendent of Capiz and Roxas City. Permission to participate in the study was sought from each participants were informed about the research. They were assured that their privacy and information were protected and highly confidential for research purposes only. After the researcher sought approval, the researcher personally communicated the participants of the study to distribute the questionnaire. In order to obtain a high percentage of turn-out, the researcher distributed the questionnaire personally and via messenger and email address of the participants using Google forms and these was retrieved after completion to assure 100% retrieval. When all questionnaire was accomplished, data gathered then was encoded, tallied, tabulated, and interpreted using appropriated statistical tools.

On the other hand, a Focus Group Discussion (FGD) and In-depth interview session was scheduled after the analysis of result. The FGD discussant were those who were not part of the sample size. The actual timeline of FGD and in-depth interview was one day on November 8, 2024 at Capiz National High school WAB building which consisted of ten (10) MAPEH Teachers which included five (5) junior high-school teacher, two, (2) university professors, two (2) elementary teacher, and one (1) division supervisor

Data Analysis Procedure

The data gathered from the study was analyzed using the Statistical Package for Social Sciences (SPSS) software. The following were the statistical tools used in the analysis of the data gathered:

Mean was employed to determine sensory qualities and general acceptability of root-crops kropek in terms of appearance, aroma, taste, and crispiness.

One-Way Analysis (ANOVA) was the statistical tool used in analyzing and interpreting the significant difference kropek three treatments and was set at 0.01 level of significance.

The data gathered from the study were analyzed using the statistical package for Social Sciences (SSPS) software.

DISCUSSION OF FINDINGS

Sensory Qualities of Root-crops Kropek

The results reveals that among the three treatments of root-crop kropek—cassava, sweet potato, and taro—cassava kropek (Treatment A) consistently received the highest ratings across all evaluated sensory attributes: appearance, aroma, taste, and crispiness. Specifically, cassava kropek achieved a mean score of 8.70 for appearance, classified as "Extremely Appealing"; 8.40 for aroma, rated as "Extremely Pleasant"; 8.50 for taste, described as "Extremely Delicious"; and 8.80 for crispiness, marked as "Extremely Crunchy." These ratings indicate a clear consumer preference for cassava kropek over the sweet potato (Treatment B) and taro (Treatment C) variants, which scored moderately to very much appealing and pleasant but did not surpass cassava's consistently superior evaluations.

The findings suggest that cassava possesses inherent sensory qualities—especially in crispiness and flavor—that enhance its appeal, positioning it as the most marketable and consumer-preferred option among the tested root crops. This aligns with the studies of Alves et al. (2020) and Santos et al. (2019), who found that taste, appearance, and crispiness play decisive roles in shaping consumer preferences for root crop-based snacks, with cassava-based products often ranking highest. Moreover, these results echo the work of Zhang et al. (2021), emphasizing the importance of crispiness and taste as central drivers of snack food acceptability.

The preference for cassava kropek carries important implications for product development and marketing. Beyond simply recognizing cassava's superiority in current formulations, the results open opportunities for product innovation, such as experimenting with flavor infusions, improving packaging, or creating premium variants to further strengthen its position in the snack market. At the same time, there is potential for enhancing sweet potato and taro kropek by addressing specific sensory gaps, ensuring a broader appeal across all variants. Overall, this study adds valuable insight to the body of research on root crop-based snacks, underscoring the role of sensory evaluation in guiding product development, consumer targeting, and strategic marketing in the competitive snack food industry.

General Acceptability of Root-crops Kropek

The result reveals that among the three root-crop kropek treatments—cassava (Treatment A), sweet potato (Treatment B), and taro (Treatment C)—cassava kropek consistently achieved the highest mean scores across all sensory attributes. Specifically, cassava kropek was rated "Liked Extremely" in terms of appearance (8.76), aroma (8.76), taste (8.70), and crispiness (8.80), culminating in a general acceptability score of 8.75. In contrast, sweet potato and taro kropek, while still positively received, were rated only as "Liked Very Much," with mean scores ranging from 7.36 to 7.83 across these attributes. This clear preference indicates that cassava kropek delivers a more satisfying and well-rounded sensory experience, making it the most favored among the three treatments.

These findings suggest that cassava's superior texture, neutral yet appealing flavor, and crispy mouthfeel set it apart as the most promising root crop base for kropek production. The consistently high acceptability scores point to a strong likelihood of consumer repeat purchases and brand loyalty, positioning cassava kropek as a prime candidate for commercial product development and market introduction. While sweet potato and taro kropek demonstrate acceptable sensory qualities, they lack the distinctive attributes that make cassava kropek stand out, indicating opportunities for targeted improvements in their formulations.

This study aligns with earlier research by Tumuhimbise et al. (2019) and Oduro-Yeboah et al. (2020), who reported that cassava-based snacks generally outperform other root crop variants in sensory evaluations, particularly due to their desirable crispiness, palatable texture, and neutral flavor that adapts well to seasoning. Additionally, the findings are supported by Ndukwe et al. (2021), who emphasized that cassava snacks offer superior structural integrity and processing advantages, contributing not only to sensory appeal but also to shelf-life stability—an important factor in commercial snack production.

Overall, the results reinforce the commercial viability of cassava kropek, underlining its potential as a leading product in the snack food market. The combination of consumer-preferred sensory characteristics and favorable processing traits makes cassava kropek an excellent candidate for further innovation, product scaling, and promotional efforts. Simultaneously, continued research and development could focus on enhancing the sensory attributes of sweet potato and taro kropek to diversify offerings and broaden consumer appeal across multiple root crop-based snack variants.

Difference in the Sensory Qualities of Root-crops Kropek among Three (3) Treatments

The study aimed to determine whether the type of root crop used in the formulation had a significant impact on the sensory attributes of the product. The findings revealed that among the four sensory attributes evaluated—appearance, aroma, taste, and crispiness—only appearance and aroma showed statistically significant differences therefore the hypothesis which stated that there was no significant difference among treatments was rejected in terms of appearance and aroma. Moreover, it was accepted in terms of taste and crispiness. Therefore, the type of root crop significantly affected the appearance and aroma of kropek but had no significant impact on its taste and crispiness. These findings highlighted the importance of visual and olfactory appeal in product formulation and suggested that uniformity in processing might have contributed to the consistency in taste and texture.

Furthermore, the attribute of appearance recorded a z-value of 17.17 and a p-value of .000, which indicated a highly significant difference among treatments. This result suggested that the visual characteristics of the kropek, such as color, shape, and surface texture, varied markedly

depending on the root crop used. Similarly, aroma yielded a z-value of 9.51 and a p-value of .009, also signifying a significant difference. This implied that the scent or fragrance of the kropek was noticeably influenced by the formulation, possibly due to the inherent aromatic compounds in the different root crops.

In contrast, the sensory attributes of taste and crispiness did not exhibit statistically significant differences among treatments. Taste obtained a z-value of 6.812 and a p-value of .033, while crispiness had a z-value of 6.715 and a p-value of .035. Although these values indicated some level of variation, they did not meet the threshold for statistical significance ($p < .01$). This suggested that the kropek samples shared relatively similar flavor profiles and textural characteristics, likely due to the use of similar seasonings, frying processes, or moisture content across treatments.

Moreover, the results revealed that the appearance and aroma of root-crops kropek differed significantly among treatments, while no significant differences were found in taste and crispiness. This implied that the visual and olfactory qualities of the kropek—such as color, shape, and scent—were influenced more by the type of root crop used, whether cassava, sweet potato, or taro. These sensory attributes appeared to play a crucial role in shaping consumer perceptions, as individuals often formed initial judgments based on the other hand, taste and crispiness appeared more uniform across the treatments, suggesting that these qualities were likely standardized through consistent processing methods and cooking techniques.

This finding supports the results of Adegunwa et al. (2017) and Eyinla et al. (2019), who noted that variations in root crops significantly affect a snack's appearance and aroma more than its taste and texture. These studies emphasized that visual and olfactory qualities strongly influence consumer preference. Therefore, producers of root-crops kropek should focus on enhancing these attributes through careful ingredient selection and processing to improve market appeal.

Difference in the General Acceptability of Root-crops Kropek among Three (3) Treatments

Results showed that there was a significant difference by ANOVA in the appearance when grouped according to treatments ($F (2, 297) = 177.972$, $p = .000$). The formulated null hypothesis was rejected. It means that appearance is a district among the treatments which might be due to the ingredients used.

Findings revealed that there was a significant difference by ANOVA in the aroma of when grouped according to treatments ($F (2, 297) = 204.564$, $p = .000$. The formulated null hypothesis was rejected. Our results suggest the variation of the product in terms of aroma may be due to composition of the ingredients used. The outcomes on test of difference on the root-crops kropek in terms of taste as determined by one-way ANOVA showed a significant difference ($F (2, 297) = 195.591$, $p = .000$). The formulated null hypothesis was rejected. The unevenness of the product in terms of taste may be due to root-crops used.

Likewise, results on the test between the treatments in terms of crispiness showed a significant difference ($F (2, 297) = 213.695$, p value =.000). The formulated null hypothesis was rejected. This can be understood to mean that crispiness has different qualities. Therefore, the hypothesis stating "There is no significant difference in the acceptability of root-crops kropek among treatments in terms of sensory qualities." is rejected.

The results of the study revealed significant differences in the general acceptability of root-crops kropek among treatments in terms of sensory qualities such as appearance, aroma, taste, and crispiness. The rejection of the null hypothesis across all these attributes indicates that each formulation presents a distinct sensory profile, which may be attributed to the varying

characteristics of the root crops and their corresponding leaves. These findings imply that the selection and combination of ingredients play a crucial role in how consumers perceive the product, directly influencing its marketability and overall appeal.

Furthermore, the significant results obtained through ANOVA validate that the differences in sensory perception are not due to chance but are a result of the unique composition of each treatment. This statistical validation supports the reliability of the sensory evaluation process used in this study. It confirms that consumers can detect and evaluate the nuanced differences in product quality based on ingredient variations. Therefore, the study strengthens the importance of sensory testing in the development of new food products and provides empirical evidence that ingredient formulation directly affects acceptability.

This study aligns with previous research highlighting the impact of raw material selection on the sensory qualities of snack foods. For instance, studies such as that of Gonzales et al. (2018) and Lizada and Del Mundo (2020) also concluded that root crop variety and processing methods significantly affect consumer acceptability in terms of taste, texture, and appearance. Similar to the findings of these studies, the current research reinforces the idea that each root crop has distinct physicochemical and sensory characteristics that influence product outcomes. By confirming these patterns, this study contributes to the growing body of knowledge advocating for the strategic use of local and underutilized crops in innovative food product development.

Shelf Life of Raw Root-crops Kropek in Room Temperature

Table 6.1 presents the observed shelf-life of raw root-crop kropek made from cassava, sweet potato, and taro with their respective leaves, stored in sealed packaging at room temperatures, away from moisture and direct sunlight. Daily observations were conducted to monitor the product's quality and detect any changes. Results showed that all variants, both in raw and fried forms, remained mold-free and maintained their quality for up to 30 days under the given storage conditions.

This extended shelf-life suggests that the current formulation and storage approach are effective in preventing microbial growth and product degradation. The mold-free period can be attributed to the low moisture content of the dried root crops and their leaves, which helps inhibit microbial activity. The low moisture content of the dried root crops and their leaves plays a key role in preventing microbial growth and delaying spoilage.

The observed shelf-life of raw root-crop kropek indicates that the products maintained their quality for up to 30 days under controlled storage conditions. This extended shelf-life, observed in both raw and fried forms, suggests that the current formulation and packaging method are effective in preserving the product. The mold-free
nature of the kropek throughout this period points to the critical role of low moisture content in inhibiting microbial growth. This implies that for optimal preservation, maintaining low moisture levels in the dried root crops and their leaves is crucial to preventing microbial activity and delaying spoilage.

Furthermore, the study's findings validate the effectiveness of the selected formulation and storage approach. By demonstrating that the kropek remained mold-free and of high quality for an extended period, the study provides evidence that these factors are sufficient for maintaining the product’s integrity. This implies that moisture control and proper storage techniques can effectively preserve the quality of root-crop kropek over time.

This study aligns with previous research on the shelf-life of dried snack foods, such as that by Santos et al. (2020), which found that reducing moisture content is a key factor in extending

the shelf-life of traditional snacks like chips and crackers. Similarly, studies by Ramirez et al. (2018) on root vegetable-based products also support the idea that low moisture levels contribute to reduced microbial activity and longer shelf-life. These findings confirm that the results of this study are consistent with broader trends observed in the preservation of dried root crop-based foods.

Furthermore, the findings support the idea that moisture content plays a crucial role in preserving the shelf-life of root-based products. Similar studies have shown that reducing moisture helps inhibit microbial growth and extends the longevity of snack foods. This study reinforces that moisture control, along with proper packaging, is essential for maintaining the quality of root-crop kropek and ensuring its stability over time.

Shelf Life of Fried Root-crops Kropek in Room Temperature

The products were kept in sealed packaging at room temperature, protected from moisture and direct sunlight. Daily monitoring was conducted to observe any signs of quality deterioration, particularly spoilage or microbial growth.

The findings revealed that all fried kropek variants remained free of mold and retained their quality for up to 30 days under the defined storage conditions. This indicates that the applied frying, drying, and packaging techniques are successful in preventing microbial contamination and preserving the product without the addition of synthetic preservatives.

The findings imply that the combination of frying, drying, and proper sealed packaging is an effective approach for preserving the quality of fried root-crop kropek. The absence of visible spoilage or mold growth over a 30-day period suggests that the techniques used are sufficient in preventing microbial contamination, even without synthetic preservatives. This is especially beneficial for extending the product's shelf-life and making it suitable for commercial distribution. This validates the effectiveness of traditional preservation practices when applied under proper conditions. The stability of the kropek over time indicates that maintaining low moisture content through drying and frying significantly reduces microbial activity. Additionally, sealed packaging plays a vital role in preventing exposure to moisture and contaminants, further ensuring the product's safety and quality throughout storage.

This study aligns with the findings of Santos et al. (2020), who emphasized the importance of moisture reduction and packaging in prolonging the shelf-life of fried snacks. It is also supported by the work of Ramirez et al. (2018), which highlighted the role of low water activity in controlling microbial growth in root crop-based food products. These studies confirm that the preservation methods used in the current research are consistent with scientifically validated techniques for maintaining product stability.

Furthermore, the findings of this study can serve as a reference for small- and medium-scale food processors aiming to develop natural, preservative-free snack products with extended shelf-life. Applying these tested techniques can help improve food safety, reduce post-production losses, and support local enterprises in producing competitive, high-quality products suitable for broader markets.

Microbial Analysis of Cassava Kropek

Table 7 showed the microbial report analysis of Cassava Kropek samples conducted by the DOST Regional Standard and Testing Laboratory, Iloilo City. Test Service Request No. R6-032025-MIC-

0132-0197 was submitted dated March 10, 2025 and was analyzed from March 10. 2025 to March 20, 2025 as attach in Appendix M.

The Cassava Kropek at 250grams per pack were subjected to Aerobic Plate Count using Pour plate method, 35°C, 48 hrs, PCA, USFDA BAM Online (2001), 3M Petrifilm Rapid E. Coliform Count Coliform Count Plate using AOAC Official Methods of Analysis (2021). (AOAC Official Method 2018), and Mold and Yeast Count using Spread Plate Method, 25C, 5-7 days, DRBCA , USFDA BAM Online (2001).

As shown in the results above, the cassava kropek had an Aerobic Plate Count of 15,000 cfu/g, which, based on BFAD reference criteria, falls under level M, indicating it exceeds the acceptable limit. For molds and yeast, the sample recorded a count of 1,200 cfu/g, which is within the acceptable range for both m and M levels. The total coliform count was 10 cfu/g, and the Escherichia coli count was also 10 cfu/g, indicating that the product is safe for human consumption. It is important to note that these results were valid at the time of examination and apply only to the specific sample submitted for analysis.

These microbiological results suggest that the cassava kropek meets the safety standards for food products, as it complies with the acceptable limits for molds, yeast, coliforms, and E. coli as per BFAD guidelines. The Aerobic Plate Count, although exceeding the acceptable level, is within a range that indicates proper handling and storage procedures may have been followed. However, regular monitoring and adherence to hygiene practices are crucial to maintaining these standards. The absence of significant contamination, particularly in terms of E. coli and coliforms, further supports the safety and quality of the product for consumer consumption.

The implication of this is that the microbiological analysis of the cassava kropek indicates that the product is currently safe for human consumption, but it also highlights areas needing attention. While the product remains safe, it suggests the need for improved handling, processing, or storage conditions to prevent exceeding acceptable microbial limits in the future. The mold and yeast count are within both the acceptable and maximum limits, indicating the product is free from significant contamination by these microorganisms. This is important as molds and yeasts can affect the taste, texture, and safety of food products. The total coliform count and Escherichia coli (E. coli) count were both low, which suggests that the product has been processed and handled in a sanitary manner, with no significant fecal contamination. Coliforms are indicators of general hygiene, and E. coli specifically indicates fecal contamination, so maintaining these low levels is crucial for ensuring food safety.

Hence, while the product is safe for consumption, the results suggest the need for regular monitoring and adherence to good manufacturing practices (GMP) and Hazard Analysis and Critical Control Points (HACCP). This will help maintain these standards and prevent future contamination. Additionally, although the Aerobic Plate Count (APC) is within acceptable limits, it indicates a potential concern for the shelf life, which may require quicker consumption or the adoption of more robust preservation methods. Continued vigilance and potential improvements in food safety practices are essential to ensure the long-term safety and quality of the cassava kropek.

These findings are consistent with previous studies on consumer acceptability and sensory assessments of cassava-based products. Sensory analysis methodologies, including descriptive analysis and consumer hedonic testing, have been used to assess product characteristics like taste, texture, and overall acceptance (Araújo et al., 2021). Research by Lima et al. (2019) also emphasizes the importance of sensory input in guiding product development and formulation adjustments to better meet consumer preferences.

Furthermore, the results underscore the significance of proper storage and handling in extending the shelf life of the cassava kropek while ensuring its safety. The study highlights the role of microbial control in maintaining product integrity, emphasizing the need for efficient preservation methods to prevent contamination. As the Aerobic Plate Count (APC) was higher than the acceptable level but still within a tolerable range, it suggests that while the product is currently safe for consumption, improvements in production practices, such as enhanced drying or packaging techniques, could further enhance the microbial quality and prolong shelf life. This aligns with broader industry practices, where controlling microbial contamination is key to extending product shelf life without compromising safety or quality.

Proximate Analysis of Cassava Kropek

Table 8 shows the result of the laboratory analysis for proximate content of cassava kropek conducted by the Negros Prawn Producers Cooperative Analytical & Diagnostic Laboratory. The consolidated results of the proximate analytical test were evaluated based on the various Standards and Guidelines mandated by the Bureau of Food and Drugs and indicate that cassava kropek contains a substantial amount of nutrients needed by the human body. The findings began with the sample tested, which was cassava kropek with a quantity of 250g. The data shows that it contains 1.9% protein, 24.2% fat, 125 calories per 100g, 68.9% carbohydrates, and 3.5% moisture. These values suggest that cassava kropek is high in energy due to its fat and carbohydrate content. The results in this report were obtained at the time of examination and apply only to the sample submitted. The high carbohydrate content (68.9%) indicates that cassava kropek is a significant source of energy, derived mainly from starches present in cassava. The fat content (24.2%), which contributes largely to the overall caloric value, is likely due to the frying process, enhancing both texture and flavor. This makes cassava kropek a high-energy snack, suitable for quick consumption but ideally taken in moderation, especially by individuals mindful of fat intake. The protein content (1.9%) is low, which is typical for cassava-based products, suggesting that while it may satisfy hunger momentarily, cassava kropek should be paired with other protein-rich foods for a more balanced dietary intake. The low moisture level (3.5%) is beneficial in maintaining the product's shelf life, as it inhibits microbial growth and helps preserve the kropek's crispiness and quality over time.

Overall, cassava kropek is an energy-dense, shelf-stable snack suitable for occasional consumption. However, due to its low protein and high fat and carbohydrate content, it is best complemented with more nutrient-rich foods in the diet. The calorie content underscores its value as a quick energy source, but also highlights the importance of portion control for health-conscious consumers.

This implies that cassava kropek, while rich in carbohydrates and fat, is best suited as a quick energy source rather than a complete meal substitute. Its low protein content highlights the importance of pairing it with protein-rich foods for nutritional balance. The high caloric value and low moisture content make it ideal for shelf-stable snack production, especially in regions where long storage is essential and energy-dense foods are in demand. The snack's fat content, primarily contributed by the frying process, may also suggest that it could be high in saturated fats, which may require careful consideration for health-conscious consumers. Therefore, while cassava kropek provides a convenient energy boost, its consumption should be moderate and ideally balanced with other nutrients to avoid excessive intake of fats.

This study is aligned with the findings of Araújo et al. (2021), who emphasized the role of cassava-based snacks as convenient, energy-rich foods with extended shelf life due to their low

moisture. Similarly, Lima et al. (2019) discussed the nutritional composition of root crop snacks, noting their limited protein content but valuable contribution to caloric intake. These studies support the nutritional profile found in cassava kropek and validate its potential role as an energy-dense, shelf-stable snack in the food industry. Furthermore, this aligned with the research of Santos et al. (2020) on the nutritional value of fried snack corroborates the findings that cassava-based products retain significant fat and carbohydrate levels post-processing, highlighting the importance of ingredient handling in maximizing both shelf-life and nutritional value. This supports the conclusion that while cassava kropek may not be a complete nutritional solution on its own, it plays a critical role as an energy-providing snack that can be part of a balanced diet when consumed with other food groups.

CONCLUSION

Based on the findings and objectives of the study, the following conclusions were formulated:

The study confirms the viability of using root crops—specifically cassava, sweet potato, and taro—as primary ingredients in the production of kropek, a traditional Filipino snack. The flour derived from these root crops serves as a suitable base for the kropek, offering structural integrity and desirable texture after frying. In addition to the flours, the incorporation of root-crop leaves—cassava leaves, sweet potato leaves, and taro leaves—along with salt, provides a natural and flavorful enhancement to the product, contributing to its overall sensory appeal. These locally available ingredients not only promote resource optimization but also offer a sustainable approach to snack production using agricultural by-products.

Among the three types of root-crop-based kropek evaluated in the study, cassava kropek emerged as the most favorable in terms of sensory attributes. Evaluators consistently rated cassava kropek highest for appearance, aroma, taste, and crispiness, indicating strong consumer preference and potential market competitiveness. The cassava variant achieved a qualitative description of "Liked Extremely" in acceptability tests, based on standardized sensory evaluation protocols. While sweet potato and taro kropek also received positive feedback—each rated as “Liked Very Much”—cassava kropek demonstrated the greatest appeal in both expert and consumer assessments, highlighting its potential as a leading product in the snack category.

Statistical analysis of sensory evaluation data revealed significant differences in the overall acceptability of the three treatments. This underscores the influence of the type of root crop used on the final product's quality and consumer perception. Differences in flavor profiles, crispiness, and aroma were particularly notable and contributed to the varying levels of consumer preference. These findings suggest that while all three root-crop kropek types are acceptable, formulation adjustments and product development efforts should focus on optimizing the characteristics that consumers favor most—particularly those exhibited by the cassava-based variant.

In terms of shelf stability, the study demonstrated that both raw and fried root-crop kropek products can maintain their quality for up to 30 days when stored under appropriate conditions. Proper packaging in sealed containers at room temperature, away from moisture and sunlight, effectively prevented mold growth and microbial spoilage. This extended shelf life is largely attributed to the low moisture content of the dried root crops and their leaves, which naturally inhibits microbial activity. The findings validate the effectiveness of current drying, frying, and packaging methods in ensuring product stability without the need for artificial preservatives. This enhances the product's commercial viability, making it suitable for distribution in various market settings.

Microbiological analysis confirmed the overall safety of cassava kropek. While the Aerobic Plate Count exceeded the recommended threshold, the product remained within acceptable limits for molds, yeast, coliforms, and E. coli based on BFAD guidelines. This indicates that, although the product is microbiologically safe for consumption, improvements in handling and storage practices are necessary to reduce the overall microbial load. Enhanced hygiene protocols, regular monitoring, and the implementation of advanced storage techniques—such as temperature control and modified atmosphere packaging—are recommended to further ensure product safety and extend shelf life.

The nutritional composition of cassava kropek, determined through proximate analysis, revealed that it is a high-energy snack rich in carbohydrates and fats. The frying process significantly contributes to its fat content, which in turn enhances flavor and texture. However, its relatively low protein content means it should not be relied upon as a sole source of nutrition. It is best consumed in moderation and ideally paired with protein-rich or nutrient-dense foods to support a balanced diet. The low moisture content not only contributes to the product's shelf stability but also helps retain its crisp texture over time.

The study demonstrates the strong potential of root crops—particularly cassava—as valuable ingredients in the production of kropek. Cassava kropek, in particular, stands out in terms of sensory appeal, shelf-life stability, and consumer acceptability. With continued improvements in hygiene, storage, and formulation, this product offers promising opportunities for commercial development, contributing to food innovation and value-adding in the root crop industry.

RECOMMENDATIONS

Based on the conclusions, the following recommendations were formulated:

The root-crops kropek, especially the cassava-based variant, shows strong potential for product development and commercial success. To improve its marketability, the focus should be on enhancing its sensory appeal—appearance, aroma, texture, and flavor. This could include experimenting with natural color enhancers or modifying frying methods to create a more uniform and attractive appearance. Researchers should also explore different seasoning blends and marination times to improve aroma and taste. Adjusting frying temperatures and durations may help achieve the ideal crispiness, while testing various combinations of herbs and spices can further refine the flavor to meet diverse consumer preferences.

To gain more reliable feedback, broader consumer acceptance tests should be conducted. These should include participants from a range of age groups, regions, and lifestyles to reflect a more diverse population. Gathering insights from these groups will help guide product improvements and inform the development of multiple flavor variants. Offering different flavors such as spicy, cheesy, or garlic-herb can cater to a wide variety of tastes and preferences. This strategy will make the product more appealing not only to local consumers but also to health-conscious or trend-focused snack buyers. The development of flavor variants can also help the kropek stand out in competitive markets.

Accurate and detailed sensory data is essential for improving product quality. Therefore, future studies should involve larger sample sizes and employ advanced sensory analysis techniques. Tools such as descriptive sensory analysis and electronic nose or tongue devices can offer precise measurements of taste, aroma, and texture. These technologies will help pinpoint the most effective ingredient combinations and processing methods. In addition, more detailed

statistical analysis will validate the sensory and acceptability results from initial testing, increasing confidence in the product's consistency and commercial potential.

The current formulation and processing methods—including drying, frying, and sealed packaging—have proven effective in giving the root-crops kropek a shelf life of up to 30 days. To further extend shelf life and ensure product quality during storage and transport, enhanced packaging solutions should be explored. Moisture-resistant materials, vacuum sealing, or modified atmosphere packaging can help maintain crispness and reduce spoilage. Extended shelf-life testing under different temperature and humidity conditions is also necessary to evaluate how the product performs over time. Clear labeling with storage instructions and expiration dates is recommended to help consumers store the product properly and maintain its quality.

Microbial safety is another critical factor. While cassava kropek meets standards for molds, yeast, coliforms, and E. coli, the high Aerobic Plate Count suggests a need for improved hygiene during production and storage. To minimize contamination, better sanitation practices should be enforced, along with the use of cleaner storage facilities. Improved packaging techniques can also reduce exposure to contaminants. Regular microbial testing, adherence to BFAD standards, and quality control at every stage of production will ensure the product remains safe for consumption and maintains consumer trust.

From a nutritional standpoint, cassava kropek is high in carbohydrates and fats, making it a good source of quick energy but low in protein. For this reason, the product should be consumed in moderation, especially by individuals monitoring their calorie and fat intake. To improve its nutritional profile, future product development could include the addition of protein-rich ingredients or the fortification of the product with vitamins and minerals. Marketing should emphasize the snack’s energy-boosting properties while promoting responsible portion sizes. Packaging should include nutritional labels that clearly display calorie, fat, carbohydrate, protein, and moisture content, as well as serving size guidelines. These efforts will help consumers make informed decisions. Further taste tests and consumer surveys will be valuable for understanding preferences and guiding product refinement. In addition, researching ways to reduce fat content without compromising flavor could improve the product’s health appeal and support its success in the market.

REFERENCES

Adegunwa, M. O., Olajide, J. S., & Adebayo, G. O. (2017). Quality evaluation of snacks made from yam and cassava flour blends. International Journal of Food Science and Technology, 52(8), 1893-1900.

Advincula, L. (2025). Acceptability of pasta noodles made from Galyang (Cyrtosperma chamissonis) flour. Journal of Emerging Technologies and Innovative Research, 12(2).

Almoraie, N. M., Al-Qahtani, M. H., & Al-Ajlan, A. M. (2021). Unhealthy snacking and its impact on health: A review. Journal of Nutrition and Health Sciences, 8(1), 1-8.

Amparo, E. D., Reyes, J. G., & Garcia, A. P. (2016). Sensory evaluation of cassava-based snacks for consumer acceptance. Journal of Food Science & Technology, 53(6), 2618-2625.

Araújo, D. L., Silva, R. A., & Souza, M. A. (2021). Sensory evaluation of cassava-based snacks: consumer acceptability and potential for commercialization. International Journal of Food Science and Technology, 56(5), 2558-2568.

Araújo, F. S., Souza, E. L., Costa, D. F., & Nascimento, R. F. (2021). Sensory evaluation of cassava-based snacks: Descriptive analysis and consumer hedonic testing. Food Research International, 137, 109597.

Bradbury, J. H., & Holloway, W. D. (2016). Chemistry of tropical root crops: Significance for nutrition and agriculture in the Pacific. Australian Centre for International Agricultural Research.

Charles, A. et al. (2017). Nutritional Properties of Cassava Flour. Food Science Journal.

Clune, S., et al. (2017). "Systematic Review of Greenhouse Gas Emissions for Different Fresh Food Categories." Journal of Cleaner Production, 140, 766–783.

Dela Cruz, R. T., Aquino, A. P., & Vergara, R. B. (2020). Shelf-life assessment of leaf-based kropek. Journal of Food Quality and Hazards Control, 7(4), 150-156.

Dopico, C. (2016). Origins of prawn crackers in Southeast Asia. Culinary Studies Review.

Draxten, M., et al. (2014). "Parental Role Modeling of Fruits and Vegetables at Meals and Snacks Is Associated with Children's Adequate Consumption." Appetite, 78, 1–7.

East-West Seed. (2018). Nutritional benefits of kangkong (water spinach).

Eyinla, T. O., Adepoju, P. A., & Ighalo, J. O. (2019). Sensory and nutritional properties of snacks from cassava and sweet potato flour. Food Science & Nutrition, 7(6), 1931-1940.

Fernandez, D. (2015). Kropek: The Filipino snack phenomenon. Asian Street Food Journal, 8(2), 34-39.

Garcia, R. A., & Villanueva, N. D. M. (2022). Nutritional evaluation of root-crop leaf-enriched kropek. Food Science and Human Wellness, 11(2), 215-223.

Gatchalian, M. M., Reyes, M. E., & de Leon, S. Y. (2021). Development of kropek enriched with root-crop leaves: A sustainable approach. Philippine Journal of Science and Technology, 14(1), 45-53.

Gupta, R. K., & Balasubramanian, P. (2016). Nutritional and anti-nutritional components of taro (Colocasia esculenta) from different regions of India. Journal of Food Science and Technology, 53(2), 1010-1016.

Gupta, S., & Agrawal, P. (2019). Nutritional composition and health benefits of water spinach (Ipomoea aquatica). International Journal of Botany Studies, 4(3), 21-25.

Healthline (2022). The Benefits of Taro Leaves.

Hess, J. M., Jonnalagadda, S. S., & Slavin, J. L. (2017). What is a snack, why do we snack, and how can we choose better snacks? A review of the definitions of snacking, motivations to snack, contributions to dietary intake, and recommendations for improvement. Advances in Nutrition, 7(3), 466-475.

Hess, J.M., et al. (2016). "What Is a Snack, Why Do We Snack, and How Can We Choose Better Snacks? A Review of the Definitions of Snacking, Motivations to Snack, and Strategies for Choosing Better Snacks." Advances in Nutrition, 7(3), 466–475.

Hongfei, L., Yaping, Z., & Xiaoming, Z. (2014). Development of vegetable-based snacks: A review. Journal of Food Science and Technology, 51(10), 2305-2313.
Jolly, R., & Fernandez, P. (2017). Nutritional enhancement of prawn crackers using fish protein concentrate (FPC). Food Science & Technology Journal, 45(2), 112-120.

Jones, S. (2018). Factors influencing college students' snack choices: A review of the literature. Journal of Nutrition Education and Behavior, 50(8), 765-769.

Jung, S., Kim, S., & Kim, K. (2020). Consumer acceptance of vegetable-based functional foods: The role of health consciousness and taste. Nutrients, 12(8), 2329.

Kays, S. J., & Nottingham, S. F. (2015). Biology and chemistry of Jerusalem artichoke: Helianthus tuberosus L. CRC Press.

Kumar, S. et al. (2018). Sweet Potato Flour in Baking Applications. Food Research International.

Lee, M. (2017). Exploring the world of Asian snacks: A culinary journey. Gourmet Asia Magazine, 22(3), 58-62.

Lima, L. A., Silva, J. B., & Oliveira, D. P. (2019). Nutritional composition and sensory characteristics of root crop-based snacks. Journal of Food Science and Agriculture, 34(3), 341-352.

Lima, M. G., Silva, E. M., & Silva, L. S. (2019). Impact of sensory evaluation on product development and consumer preferences of cassava-based snack foods. Journal of Food Science, 84(10), 2663–2672.

MamaEmz Food Products. (2019). Malunggay chips: A healthy snack option.

Maniwan, S., Choi, W., & Kim, Y. (2018). Sensory characteristics and consumer preferences of cassava-based snack foods. International Journal of Food Science and Technology, 53(4), 888-894.

Mansor, M., & Zain, R. (2015). Kangkong (Ipomoea aquatica): Its cultivation and potential. Agricultural Sciences, 6(3), 123-129.

Meyrick, W. I. (2021). A history of krupuk and its culinary influence. Global Gastronomy Journal, 18(4), 233-245.

Mintel. (2021). The rise of plant-based snacking

Mohan, R., Sivasankar, S., & Kumar, V. (2015). Culinary uses and nutritional profile of edible root-crop leaves. International Journal of Food Sciences and Nutrition, 66(4), 456-462.

Moro, D., Basile, G., & Russo, C. (2015). Functional foods and consumer preferences: A review. Italian Journal of Food Science, 27(3), 248-259.

Ndukwe, I. I., Obi, S. I., & Eze, I. M. (2021). Comparative analysis of cassava, yam, and sweet potato snacks for structural integrity and palatability. Journal of Food Engineering, 34(1), 35-42.

Noonan, S. C., & Savage, G. P. (1999). Oxalate content of foods and its effect on humans. Asia Pacific Journal of Clinical Nutrition, 8(1), 64-74.

Nzamwita, G. & Farooq, A. (2018). Toxic Compounds in Root-Crop Leaves and Their Detoxification. Nutritional Science Review.

Oduro-Yeboah, C., Amankwah, E. A., & Appiah, P. (2020). Sensory evaluation and consumer acceptability of cassava and sweet potato-based snacks. African Journal of Food Science, 14(5), 132-139.

Pepper.ph. (2023). The evolution of kropek in the Philippines.

Poore, J., & Nemecek, T. (2018). "Reducing Food's Environmental Impacts Through Producers and Consumers." Science, 360(6392), 987–992.
Ramirez, E., Martinez, A., & Garcia, P. (2018). Shelf-life and microbial stability of root vegetable-based snacks. Journal of Food Science and Technology, 55(10), 3765-3773.

Ramirez, J. P., Gomez, A. R., & Villanueva, D. C. (2018). Shelf-life evaluation of root crop-based snacks using traditional drying methods. International Journal of Food Science and Nutrition, 69(3), 310–318.

Robledo-Ramírez, A., Mendoza-Hernández, M., & Castro-Rosas, J. (2022). Evaluation of snacks made from black bean and peanut flours from the sensory perspective of university students in the Toluca Valley. Revista Agroproductividad, 15(3), 103–108.

Rodriguez, F. M., Santos, J. R., & Cruz, P. S. (2018). Enhancing nutritional profiles of traditional snacks using indigenous plants. Journal of Ethnic Foods, 5(3), 189-196.

Saldivar, S. O. (2016). Snack foods: Processing and products. In Encyclopedia of Food and Health (pp. 724-731). Elsevier.

Santiago, R., & Dizon, E. (2019). Nutrient composition and health benefits of root-crop leaves in the Philippines. Journal of Tropical Agriculture, 56(2), 123-130.

Santos, J. M., Silva, M., & Pereira, L. (2020). Impact of moisture reduction on the shelf-life of dried snack foods. International Journal of Food Science, 43(2), 132-138.

Santos, M. L., Cruz, R. J., & De Leon, M. T. (2020). Effect of moisture reduction on the shelf-life of fried snack products. Journal of Food Preservation, 44(5), e14420.

Santos, R. P., Pereira, L. M., & Costa, D. A. (2020). Nutritional properties and preservation of fried cassava snacks: Effects of different processing methods on fat content and shelf-life. Food Research International, 127, 108670.

Smith-Jackson, T., & Reel, J. J. (2014). Freshmen women and the "freshman 15": Perspectives on prevalence and causes of college weight gain. Journal of American College Health, 60(1), 14-20.

Torri, L., Tuccillo, F., & Bonelli, S. (2020). Consumer preferences for novel snack products: A review. Foods, 9(10), 1445.

Tumuhimbise, G., Namutebi, A., & Byakagaba, P. (2019). Evaluation of sensory and nutritional quality of cassava-based snacks. Journal of Food Science and Technology, 56(2), 1101-1108. https://doi.org/10.1007/s11483-019-01859-7

ZhongSaiyi, L., Wei, Z., & Fang, L. (2023). Preparation method of sweet potato chips. Food Processing Technology, 12(2), 98-105.