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FORMULATION, ANALYSES, AND ACCEPTABILITY OF SWEET POTATO AND BELL PEPPER SHORTBREAD COOKIES

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Abstract: This study responds to the growing demand for sustainable, health-oriented snacks by developing a functional shortbread cookie enriched with locally sourced sweet potato and bell pepper. Its objective was to identify the best formulation through sensory evaluation, general acceptability, shelf-life testing, microbial analysis, and proximate analysis, thereby transforming indigenous crops into a market-ready product that supports public health. An experimental-developmental design using a Completely Randomized Design (CRD) was employed, with three formulations containing 100 g of sweet potato and varying amounts of bell pepper (25 g, 50 g, and 75 g). Sensory evaluation by 10 semi-trained panelists and acceptability testing by 100 consumers using the 9-point Hedonic Scale revealed high ratings across all treatments, with Treatment A achieving the highest mean score. Statistical analysis using ANOVA and Kruskal-Wallis Test confirmed no significant differences in sensory attributes and overall acceptability among the three treatments. Shelf-life testing showed stability for 3–4 days at room temperature, while refrigeration extended viability to at least six weeks. Proximate analysis confirmed a balanced nutritional profile, and microbial testing validated product safety and the effectiveness of hygiene protocols. Overall, the study demonstrates that incorporating sweet potato and bell pepper into shortbread cookies is a scientifically sound approach to creating a nutrient-dense, marketable snack.

Keywords: Functional Food, Shortbread Cookie, Sweet Potato, and Bell Pepper.

I. INTRODUCTION

The global food market continues to evolve, with modern consumers seeking functional snacks that are environmentally friendly, healthy, and community-based. There is a rapid evolution in the global food market, driven by health-focused awareness and expanding desire for healthier lifestyles. This trend is especially relevant to the snack industry, as there is demand for healthier alternatives to address the abundance of highly processed products, which contribute to more than 2 billion people worldwide suffering from obesity. Consequently, there is an increasing need to enhance conventional baked products. That indicates new opportunities to introduce bioactive plant bases components, such as sweet potatoes and bell peppers, to tackle micronutrient shortages and boost antioxidant levels into conventional baked products, namely shortbread cookies, which incorporate 3 parts flour, 2 parts fat, and 1 part sugar.

The sweet potato (kamote) is seen as one of the most important food security crops in the Philippines, as well as a multipurpose ingredient for the use in the production of functional foods, due to its high dietary fiber, antioxidant levels and vitamins. There are currently a national program targeting reduction of post-harvest losses along with provision of more nutritious products as substitute for wheat flour-based snacks through alteration of the fresh roots into other products. Aside from this, the bell pepper (siling lara) has also gained national acknowledgement owing to its high level of carotenoid components and ascorbic that play important roles in enhancing immunity. The aimed of this research is to address the health needs by investigating a beneficial way of producing shortbread cookies make from nutritious local ingredients. Integrating these agricultural products in the process of producing an acceptable shortbread cookie recipe, this research plays a foremost role in advancing public health initiatives of the country. Additionally, incorporating finely chopped bell pepper as a strengthening component advances the national initiative for product diversity, transforming lesser-used horticultural crops into shelf-stable, functional snacks.

In the Western Visayas area, a project carried out in Capiz to produce new culinary innovation through program known as “FoodtrIP”. The initiative motivated local business entities to employ local produce in making marketable and healthy snack items. For this particular instance, this research supports in fulfilling the local objectives by developing a novel shortbread cookie that embraces the rich local agriculture and uses the widely cultivated sweet potatoes and bell peppers known for their beautiful colors, and high amounts of vitamins. The incorporation of mashed and finely cut bell peppers

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brings about value addition to the horticultural produce, and adding a functional component to the snack products from local business enterprises.

The current study serves as an essential link between theoretical knowledge and practical application, particularly by refining the researcher's abilities in product formulation and sensory assessment. Through the conversion of experimental results into a certified recipe, the student promotes the Techno Transfer goal of transforming academic outputs into market-ready educational resources. Additionally, the research offers a strategic basis for a career in food innovation and leadership, directly aiding the Entrepreneurship and Community Development initiative by establishing TLE-based business incubation models for local communities. This educational path provides significant professional satisfaction by showcasing how research-based advancements can enhance community nutrition and encourage sustained public health.

OBJECTIVES OF THE STUDY

This study generally aimed to develop, analyze, and assess the acceptability of shortbread cookies enriched with sweet potato and bell pepper.Specifically, it sought to answer the following objectives:

1. describe the sensory qualities of sweet potato and bell pepper shortbread cookies in terms of appearance, aroma, taste, and texture;
2. determine the general acceptability of sweet potato and bell pepper shortbread cookies in terms of appearance, aroma, taste, and texture;
3. find out if there is a significant difference in the sensory qualities of sweet potato and bell pepper shortbread cookies among the three treatments;
4. find out if there is a significant difference in the general acceptability of sweet potato and bell pepper shortbread cookies among the three treatments;
5. determine the shelf-life of the sweet potato and bell pepper shortbread cookies in terms of room and chilling temperature; and,
6. submit the best product for microbial and proximate analysis.

II. METHODOLOGY

Methods of Research

The research employed an experimental-developmental design to methodically explore the incorporation and use of sweet potato and bell pepper within a classic shortbread cookie recipe focused on key sensory attributes, including appearance, aroma, taste, texture, and overall acceptability.

Experimental Treatments

The experimental treatments consisted of three distinct formulations of shortbread cookies, each designed to explore the effects of sweet potato and bell pepper quality.

Treatment A - 25g of bell pepper incorporated with 100g of sweet potato
Treatment B - 50g of bell pepper incorporated with 100g of sweet potato
Treatment C - 75g of bell pepper incorporated with 100g of sweet potato

Each formulation was replicated three times to determine differences in taste levels and ensure the reliability and validity of the results.

Research Instrument

The study used a 9-point Hedonic Scale as its primary data collection instrument. The data gathering included two groups: semi-trained panelists offering technical perspectives and general consumers, reflecting the target audience. The shortbread cookie samples were evaluated by both groups in a randomized presentation order to remove "position bias." The 9-point scale was used with 9 representing "liked extremely" and 1 representing "disliked extremely" to quantify the panelists' degree of liking for the product's appearance, aroma, taste, texture and overall acceptability.

Data Gathering Procedure

The sweet potato and bell pepper shortbread cookies were carefully measured and prepared to processed a shortbread cookie formulation following standardized food preparation procedures. The finished products were baked and presented to the evaluators and consumers during sensory evaluation. Shelf-life evaluation was conducted under room and chilling temperature conditions by observing daily changes in appearance, aroma, texture, and spoilage indicators. The best performing formulation for the general acceptability was submitted to Negros Prawn Producers Cooperative Analytical and Diagnostic Laboratory, Inc in Bacolod City to underwent for microbial and proximate analyses.

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Statistical Tools and Analysis

For a systematic and unbiased interpretation of the results, the data's statistical analysis utilized two (2) main tools: 1) Descriptive Statistics, which summarized the gathered sensory data; and 2) Analysis of Variance (ANOVA), which examined the significant differences in sensory characteristics among the shortbread cookie treatments —specifically the varying proportions of the bell pepper—were either statistically significant or merely due to random chance. When the ANOVA results showed a significant difference among the treatments, Kruskal-Wallis Test was used as the post hoc comparison method to identify precisely which formulation outperformed the others, ensuring that the ultimate suggestion for the "best" shortbread cookie made with sweet potato and bell pepper was supported by strong statistical data.

III. RESULTS AND DISCUSSION

The study developed a shortbread cookie made from sweet potato and bell pepper. This innovative baked product combines locally sourced ingredients to create a flavorful, nutritious, and unique snack. The findings indicated that Treatment A (25g) was the superior formulation across all evaluated attributes, achieving the highest overall sensory quality score, particularly in appearance, aroma, taste, and texture.

In terms of general acceptability, Treatment A (25g) got the most successful and optimized version of the product. Its superiority was rooted in its ability to achieve the highest qualitative rating of "Liked Extremely" across all sensory dimensions—appearance, aroma, taste, and texture—outperforming the 50g and 75g variations, which showed slight qualitative declines in specific attributes.

The sensory evaluation of sweet potato and bell pepper shortbread cookies indicates that all tested formulations are highly palatable, with Treatment A emerging as the most refined version. While Treatment B and C showed slight declines in aroma and texture appeal. Treatment A secured the highest possible qualitative score of "Liked Extremely" across sensory category. Consequently, while every formulation is a viable option, Treatment A is the definitive choice for maximizing consistent consumer satisfaction

There were no significant differences across all sensory attributes among the different treatments. Evaluators found the samples to be statistically similar in terms of appearance, aroma, taste, and texture.

The shelf-life evaluation of the sweet potato and bell pepper shortbread cookies revealed that no mold growth or spoilage was observed when stored at room temperature for up to four (4) days. Under chilled storage conditions, the cookies remained free from mold and spoilage for as long as fifteen (15) days, after which initial signs of mold formation and minor deterioration began to appear.

The Sweet Potato and Bell Pepper Shortbread Cookie successfully complied with the microbial and proximate standards established by the FDA for bread and pastries, as verified by Analytical and Diagnostic Laboratory of the Negros Prawn Producers Cooperative (NPPC) in Brgy. Banago, Bacolod City, bearing reference number 26-0040.

The cookies demonstrated outstanding sanitary quality, with results for Aerobic Plate Count, Yeast and Mold, and Coliforms all falling below the detectable threshold of < 10 CFU/g. The specific pathogens Escherichia coli and Salmonella sp. were confirmed absent, verifying that the baking process served as an effective "kill step". All microbial levels were significantly below the FDA "Satisfactory" threshold, indicating rigorous adherence to Good Manufacturing Practices (GMP).

IV. CONCLUSION

Based on the results and findings of the study, the following conclusions were drawn:

The sensory qualities of the sweet potato and bell pepper shortbread cookies highlight their success as a functional, nutrient-rich snack. All variations performed well in appearance, aroma, taste, and texture, showing that the addition of nutrient-dense vegetables does not compromise the classic shortbread experience. With its golden color, pleasant aroma, and signature crumbly texture, the product remains highly appealing and demonstrates strong consumer acceptability.

This study demonstrates that vegetable-enriched shortbread cookies can be successfully developed as a functional and innovative food product. By integrating sweet potato and bell pepper into the formulation, the research highlights the potential of nutrient-dense ingredients to enhance consumer health while maintaining the sensory qualities that make

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shortbread highly acceptable. The results affirm the viability of this product as both a nutritious snack and a marketable item, contributing to food innovation and sustainable dietary practices.

The shelf life of the sweet potato and bell pepper shortbread cookie is heavily influenced by its storage environment due to the moisture introduced by the vegetable components. Refrigeration serves as a critical preservation technique, significantly slowing microbial metabolism and extending the product's viability.

The results for the aerobic plate count, total coliforms, Escherichia coli, and mold and yeast counts all fell within permissible limits. This concludes that the cookies are microbiologically safe for human consumption and met the required quality standards.

V. RECOMMENDATIONS

Based on the findings of the study, various suggestions were made to improve the quality and market potential of the sweet potato and bell pepper shortbread cookie. For optimal sensory attributes, Treatment A (25g) is recommended as the main formulation for commercial production, as it uniquely earned a "Liked Extremely" rating while consistently surpassing other treatments in appearance, flavor, and texture. Moreover, to enhance the nutritional profile and cater to the "functional food" market, it is suggested that future research investigate approaches to boost the crude fiber content.
Producers are encouraged to strategically market these shortbread cookies as "functional snacks", as they offer a nutrient-dense alternative to conventional snacks by utilizing indigenous ingredients rich in beta-carotene (sweet potato) and Vitamin C (bell pepper). Since statistical analysis showed no significant detectable differences in appearance, aroma, taste and texture across all treatments, manufacturers may maintain the flexibility to increase vegetable concentrations (Treatments B and C). This allows them to target niche health-conscious sectors without compromising general consumer approval.
To maintain quality and safety, sweet potato and bell pepper shortbread cookies should be consumed within 3–4 days when stored at room temperature. For longer shelf life, refrigeration is strongly recommended, as chilled storage prevents mold growth and preserves product integrity for up to 42 days. Since the organic ingredients are sensitive to moisture, temperature control is the key factor in extending shelf life. Future research should explore natural humectants or improved dehydration methods for sweet potato and bell pepper to reduce moisture content and further prolong stability at room temperature.
The product is positioned as a nutritious snack that blends traditional sweets with added health benefits. Marketing may highlight its microbiological safety to build consumer trust. The strong acceptability of higher vegetable levels in Treatments B and C suggests opportunities to diversify into health-focused variants, such as High-Fiber or High-Vitamin options, while maintaining the flavor and quality established in the study.

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