INTERNATIONAL JOURNAL OF ADVANCED MULTIDISCIPLINARY STUDIES
Volume IV, Issue 10 October 2024, eISSN: 2799-0664

The Development of Breadnut Seed *(Artocarpos camansi)* Butter

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Abstract — The main purpose of this study is to develop butter from breadnut seeds. Specifically, it aimed to determine the level of acceptability of breadnut seed butter. The experimental research method used was a Complete Randomized Design using breadnut seed formulation was analyzed using Analysis of Variance (ANOVA), Tukey-Kramer Test (TKRT) at 0.05 significance level. The butter was prepared in different peanut and breadnut seed ratios in percent (0:100, 50:50, 100:0) with 100% peanut as the control. The three formulations were evaluated by the 50 respondents in terms of taste, aroma, color, spreading consistency, and general acceptability using the 5-point scale. Regarding the general acceptability of breadnut butter, the evaluators consider the characteristics of T1, which contains 50% peanut and 50% breadnut seeds, and describe them as “Very Much Acceptable”. Microbial analysis shows no pathogens detected in breadnut seed butter. Shelf-life analysis shows that the breadnut seed butter lasted six days at room temperature and seven days for refrigerated conditions. Beyond these days, the product is not safe for consumption. Proximate analysis revealed that breadnut seed butter has Moisture (2.63g), Ash (1.80g), Fat (41.3g) and Protein (10.1g). The results for breadnut butter indicate a significant difference between and among treatments. The formulation of 50% breadnut seeds in peanut butter production resulted in a 23.74% investment Breadnut seed butter is best packaged in a plastic jar.

Keywords- Breadnut Seeds, Butter, Microbial Analysis, Shelf life Analysis, Proximate Analysis

I. INTRODUCTION

The Philippines is regarded as one of the richest countries in the world. Agriculture has a significant impact on our country's economic prosperity. It will assist unemployed Filipinos in finding work that will allow them to live more comfortably in their own homes. Filipinos' crops are local fruits and vegetables. As a result, one of the issues in the Philippines is wasted crops. Many harvests are decaying and going to waste, particularly tropical fruits. Many fruits fall off when they are mature and are no longer usable. Tropical fruits are grown in many locations around the world. Aside from being consumed as fresh fruits, the Philippines offers a variety of tropical fruits that are utilized in a variety of local recipes. They're used to produce sweets and as a side dish. Tropical fruits are distinguished by their shape, color, and flavor. They are also high in nutritional value.

Breadnut, or *Artocarpus Camansi,* is a tropical fruit native to the Philippines.The breadnut, unlike the breadfruit, is densely packed with seeds. The fruit is exceedingly perishable, with a shelf life of only two days at room temperature. When a ripe green breadnut is harvested, it quickly changes. It has a very soft texture after two days, the milky-white

seed develops a brown net-like hard rind, and the flesh turns from white to light yellow. The fruit is quite sensitive to cold. Its short shelf life is due to the combined effects of fast softening and high susceptibility to chilling harm. Breadnut, or *Artocarpus camansi*, is not the same as *rimas*, or *Artocarpus altilis*, which is a type of breadfruit. A single-stemmed evergreen tree that may grow up to 100 feet tall provided this alternate staple meal. Round or flattened seeds with an average of 12-150 per fruit. Tropical climates and coastal provinces are home to *Artocarpus camansi*, the tree that bears the spiky, globular green fruit. It's known as *camansi* or *pakak*. The flesh of the immature breadnut fruit is widely served as a table dish in the Philippines. It's thinly sliced, simmered in coconut milk, then seasoned with a pinch of salt and a few spices found in the kitchen.

According to Ragone (2006), in the Philippines, mature breadnut trees have been recorded to produce 600–800 fruits per season. The average number of seeds per fruit varies, ranging from 32 to 94 per fruit, with each seed weighing 7.7–10 g (0.25– 0.33 oz) on average. Breadnuts are farmed primarily for their nutritious seeds, which are high in protein and low in fat when compared to nuts like almonds, Brazil nuts, and macadamia nuts. At room temperature, the fat recovered from the seed is a light yellow, sticky liquid with a distinctive odor comparable to that of peanuts. It has the same chemical number and physical qualities as olive oil. Its seeds are high in niacin and contain more nutrients than most other nuts.

Gonzalez et al. (2021) examined the nutritional profile of breadnuts, noting their high content of essential nutrients, including proteins, vitamins, and minerals. This makes breadnuts an excellent candidate for developing health-oriented food products. Breadnut's economic potential has also been explored, particularly in regions where it is traditionally grown. Zamora et al. (2017) investigated the use of breadnut as a meat replacement in meatballs, demonstrating its versatility and potential to reduce dependency on imported meat products. This study underscores the crop's potential to contribute to local communities' food security and economic development.

Go et al. (2015) investigated the acceptability of chocolate cookies made with a combination of breadnut seed flour and all-purpose flour, as well as the shelf life of the most acceptable cookie formulation. Breadnut seeds flour (BSF) cookies were highly acceptable at any degree of substitution. The cookie with 50 percent all-purpose flour (APF) and 50 percent breadnut seeds flour (BSF) mixture was the most acceptable formulation based on general acceptance score. It is safe until 6 months or longer, has acceptable sensory qualities, and contains considerable amounts of nutrients, making it an attractive raw material for food manufacturing. As a result, breadnut cultivation, eating, and commercialization are all highly encouraged.

The Department of Agriculture has initiatives supporting the value addition of local crops, encouraging the development of products like breadnut seed butter. This development is supported by research institutions such as the University of the Philippines Los Baños, which conducts studies on the potential of indigenous crops. The development of breadnut products can be driven by community-based initiatives and partnerships with local businesses. For instance, projects funded by the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD) focus on the value addition of regional crops, providing both technical and financial support to local entrepreneurs.

Peanut butter is a high-protein spread that is popular all over the world. It's prepared with roasted ground peanuts that have been combined into a thick paste. Natural peanut butter can be obtained in health food stores and specialty grocery stores.

At present, breadnuts that have ripened are currently discarded and are no longer helpful. Only the immature or young breadnuts are used as dishes. Some products' prices are also rising. Many customers worry about the price of some products, such as peanut butter because they are excessively expensive, which they cannot purchase due to their limited budgets.

The research gap shows that despite the recognized potential of breadnuts, there is limited research on their application in butter forms, particularly regarding consumer acceptability. Most studies have focused on the nutritional benefits or traditional uses of breadnuts, leaving a gap in understanding its market potential in novel product forms.

The main purpose of this study is to develop butter from breadnut seeds. This study will determine the general acceptability of butter from breadnut seeds regarding their sensory attributes: taste, aroma, color, and spreading consistency.

This study aims to develop breadnut butter and assess its acceptability among consumers at the global, national, and local levels. By understanding consumer preferences and perceptions, this research seeks to provide insights into the potential marketability of these products.

The significance of this study lies in its potential to contribute to food innovation and sustainability. By exploring the acceptability of breadnut-based products, the study can support the diversification of food sources, promote the use of underutilized crops, and provide economic opportunities for local communities.

The findings can inform policymakers, entrepreneurs, and researchers about the potential benefits and challenges associated with developing and marketing breadnut products.

Objectives of the Study

This study aimed to develop butter from breadnut seeds. Specifically, it aimed to determine:

1. the microbial load content of breadnut seed butter.
2. the level of acceptability of breadnut seed butter in terms of
    a. taste
    b. aroma
    c. color and
    d. spreading consistency
3. the significant differences in the level of acceptability of the breadnut seed butter using different mixtures in terms of:
    a. taste
    b. aroma
    c. color and
    d. spreading consistency
4. the proximate analysis of the nutrient content of the best treatment of breadnut seed butter and breadnut seed brittle
5. the shelf life of breadnut seed butter
6. the Return of investment (ROI) of the breadnut seed butter
7. the best packaging for breadnut seed butter

II. METHODOLOGY

Research Design

This study is experimental research. Experimental research is a method or practice that involves the control or manipulation of conditions to investigate the relative effects of various treatments applied to members of a sample, or the same treatment applied to members of multiple samples. *(Good in Calderon, 1993)*. Evaluators use the design to

manipulate and control one independent variable for variation while manipulating the dependent variable. *(Caipang, 2004).* In this study, Complete Randomized Design was utilized.

The following were full descriptions of the percentage measurements of peanut and breadnut seeds as the major ingredient in this study:

Treatment 0 (T0) - 100% peanut + basic ingredients
Treatment 1 (T1) - 150 % breadnut + 50 % peanut+ basic ingredients
Treatment 2 (T2) - 100 % breadnut + basic ingredients

Participants of the Study

A total of 50 evaluators, including 40 consumers, 5 TLE Master Teachers, and 5 butter makers. The consumers were twenty (20) residents from Barangay Quinarayan, Narvacan Ilocos Sur, and twenty (20) students from Narvacan National Central High School. There were five (5) TLE master teachers responded from Narvacan National Central High School, while five (5) butter makers came from Baguio City, Benguet.

Research Instrument

The researcher modified the instruments to evaluate breadnut butter *(Abaya, 2015).* Breadnut seed butter's sensory characteristics were taste, aroma, color, and spreading consistency. The following features were described on a 5-point scale:

Numerical Rating	Statistical Limits	Descriptive Rating
5	4.20-5.00	Very much acceptable
4	3.40-4.19	Much acceptable
3	2.60-3.39	Acceptable
2	1.80-2.59	Fairly acceptable
1	1.0-1.79	Unacceptable

Statistical Treatment of Data

The following statistical tools were used to support the presentation, analysis, and interpretation of the data collected in this study:

1. **Weighted Mean** was used to describe the breadnut seeds butter level of acceptance in terms of taste, aroma, color, and spreading consistency.
2. **Analysis of Variance** was utilized to identify the significant differences in taste, aroma, color, and spreading consistency for breadnut seed butter.
3. **Tukey-Kramer Test** was used to see whether the various treatments have significant differences in breadnut seed butter quality.

III. RESULTS AND DISCUSSION

Table 1 presents the results of the analysis conducted in the detection of pathogens of the product formulated with different percentages of breadnut seeds.

Table 1. Microbial Analysis of Breadnut Seed Butter

Product Sample Code	Aerobic	Detection of Pathogens			
		Escherichia	*Salmonella sp.*	*Staphylococcus*	*Molds*

	Plate Count (cfu/g) 10^4	*coli*		*aureus*	
T0-Control (100% Peanut)	15.0	negative	negative	negative	negative
T1-50% breadnut seeds + 50% peanut	18.0	negative	negative	negative	negative
T2-100% breadnut seeds	14.0	negative	negative	negative	negative

Microbial Load Analysis and detection of pathogens are the first moves for the products to undergo further evaluation. Different tests of bacteria like *Echerichia coli*, *Salmonella sp.*, *Staphyloccocus aureus*, and *molds* were analyzed. The microbes found in Table I indicated that the products have a negative result in the detection of pathogens which means that the products are safe for human consumption since they harbor microbial load (Aerobic Plate Count) within the acceptable limit consequently, it is ready for sensory evaluation.

The microbial analysis detailed in Table 1 evaluates the aerobic plate count and the presence of the specific pathogens in the various formulations of the breadnut seeds butter. The control sample consists of 100 percent peanuts that exhibit an aerobic plate count of 15.0 cfu/g. The sample with an equal mix of 50% breadnut seeds and 50% peanut (T1) had a slightly higher count of 18.0 cfu/g while the 100% breadnut seeds sample (T2) showed the lowest count at 14.0 cfu/g. The results indicate that all samples have low aerobic bacterial counts well within the acceptable safety threshold for food products. All samples tested negative for the presence of *Escherichia coli*, *Salmonella sp.*, *Staphylococcus aureus*, and *molds*, indicating there is no contamination of these common and potentially harmful pathogens. The consistent absence of pathogens across all the samples suggests that the incorporation of the breadnut seeds either partially or whole does not adverse the effect of the microbial safety of the butter thus the breadnut seeds can be considered a safe ingredient for use in butter formulation maintaining both low bacterial levels and the absences of the significant foodborne pathogens.

Table 2 represents the summary of the overall acceptability of the qualities of the breadnut seeds butter.

Table 2. Summary of the Overall Acceptability of Breadnut Seed Butter

Overall Acceptability	Experimental Lot	Mean	Descriptive Rating
Breadnut Seeds Butter (Taste, Aroma, Color, and Spreading Consistency)	T0-Control 100% peanut + basic ingredients	4.47	Very Much Acceptable
	T1- 50% peanut + 50% breadnut seeds + basic ingredients	4.38	Very Much Acceptable
	T2- 100 % breadnut seeds + basic ingredients	3.89	Much Acceptable

For the general acceptability of breadnut seed butter, the evaluators consider the characteristics of T1, which contains 50% peanut and 50% breadnut seeds, to be very much acceptable. This is clear from the fact that breadnut seeds play an important role in the production of plant-based food items.

The findings suggest that incorporating breadnut seeds into butter formulations, particularly in combination with peanuts, maintains high levels of consumer acceptability. The high rating for T1 (50% peanut + 50% breadnut seeds) implies that breadnut seeds can effectively complement peanuts to produce a butter that meets consumer preferences.

This has significant implications for the development of new plant-based spreads, offering a nutritious and well-accepted alternative to traditional peanut butter. It also highlights the potential for breadnut seeds to be utilized in various food applications, contributing to the diversification of plant-based product offerings in the market.

Table 3 shows the significant difference in the perception of the sensory characteristics of breadnut seed butter.

Table 3. Result of the F-test Between and Among the Treatments on The Level of Acceptability of the Breadnut Seed Butter

	Sensory Characteristics of Breadnut Seed Butter			
TREATMENTS	**Taste**	**Aroma**	**Color**	**Spreading Consistency**
T0	4.58^{a}	4.69^{a}	4.22	4.40
T1	4.39^{ab}	4.36^{ab}	4.40	4.38
T2	3.62^{b}	3.78^{b}	4.19	3.98
Computed f	6.55*	7.47*	0.59^{ns}	1.82^{ns}
P-value	0.0310	0.0235	0.5855	0.2418
CV	8.1745	7.0809	6.1538	7.0910

*Legend: *-significant at 0.05 level ns-not significant*

Taste. For taste, the control treatment (T0) scored significantly higher (4.58) compared to the modified treatment T2 (3.62), with an F-value of 6.55 and a p-value of 0.0310, indicating a significant difference. This suggests that the control recipe was preferred by respondents in terms of taste. Further analysis using Tukey Kramer test proved a significant difference as found between T0 vs T2 but not differ significantly between T0 vs T1 and T1 vs T2. This implies that both treatments are comparable in terms of taste.

Aroma. A significant difference between and among treatment means in terms of aroma as evidenced by the computed value of 7.47 and -value of p-0.0235. Again, further analysis was employed and dictates that T0 vs T2 was found significantly different, but no differences were found in T0 vs T1 and T1 vs T2.

Color. The table shows no significant differences were found in color among the treatments, as indicated by non-significant F-values (0.59) and p-values (0.5855). These results suggest that while taste and aroma were affected by the modifications, the color remained consistent across treatments. This implies that the incorporation of breadnut seeds to peanuts in any proportion has a perceived similar color as the control.

Spreading consistency. Spreadability is a significant physical property of peanut butter to consumers. Based on the table, no significant differences were found in spreading consistency (F = 1.82, p = 0.2418) among the treatments. This suggests that these attributes are less influenced by the processing variations applied in this study.

Table 4 shows the proximate analysis of breadnut seed butter with 50% peanut and 50% breadnut seed. The tests included analyzing moisture, ash, crude fat, and crude protein The proximate nutritional composition of breadnut seed butter was estimated using the Official Method of Analysis of AOAC International 21st Edition, 2019.

Table 4. Proximate Analysis of Breadnut Seed Butter

Parameters	Unit	Test Method	Result
Moisture	g/100g	Vacuum Oven Drying	2.63
Ash	g/100g	Ignition-Gravimetry	1.80
Fat	g/100g	Soxhlet Extraction	41.3
Protein (N x 6.25)	g/100g	Kjeidahl	10.1

Moisture content. Moore (2020) defines moisture content as the number of water molecules incorporated into a food product. Moisture content analysis is important to the food industry to regulate the product's quality and shelf life, in addition to helping food manufacturers adhere to regulatory and labeling standards. The moisture content in breadnut seed butter is 2.63g/100g. It was done utilizing the oven vacuum drying procedure. This indicates that the breadnut seed butter has a low water content, which is beneficial for shelf life as lower moisture reduces the risk of microbial growth and spoilage.

Ash content. According to Marshall (2010), ash is the inorganic residue that remains after the ignition or complete oxidation of organic matter in a food product. The ash content reflects the total mineral composition, which is 1.80 g/100 g. This indicates an acceptable amount of essential minerals.

Crude Fat. According to the NHS Website (2023), fat contains necessary fatty acids, which the body cannot produce. Vitamin A, vitamin D, and vitamin E are all absorbed by the body through fat. These vitamins are fat-soluble, which means they can only be absorbed in the presence of fats.. The Soxhlet Extraction technique is used to assess crude fat. Breadnut seed butter has a high-fat content of 41.3 g/100 g. This high-fat content makes it a significant source of energy.

Crude Protein. Hobson (2019) defines crude protein as a chemical analysis of food in which the amount of nitrogen present is utilized to estimate the amount of protein in the food. The crude protein was evaluated using the Kjeldahl technique. The protein content of 10.1 g/100 g suggests that breadnut seed butter is a good protein source, vital for body repair and growth.

Table 5 displays the shelf-life analysis of the best product developed. Breadnut seed butter samples were given to the laboratory for testing and observation using microbiological analysis, and they were monitored for two weeks.

Table 5. Shelf life Analysis of Breadnut Seed Butter

Different periods of Observation	Aerobic Plate Count (cfu/g) 10^3	Detection of Pathogens			
		Escherichia coli	*Salmonella sp.*	*Staphylococcus aureus*	*Molds*
Room Temperature					

Day 0	12.0	negative	negative	negative	negative
Day 1	10.0	negative	negative	negative	negative
Day 2	12.0	negative	negative	negative	negative
Day 3	14.0	negative	negative	negative	negative
Day 4	17.0	negative	negative	negative	negative
Day 5	16.0	negative	negative	negative	negative
Day 6	21.0	negative	negative	*positive*	negative
Day 7	23.0	negative	negative	*positive*	negative
Refrigerated Condition					
Day 0	8.0	negative	negative	negative	negative
Day 1	13.0	negative	negative	negative	negative
Day 2	10.0	negative	negative	negative	negative
Day 3	12.0	negative	negative	negative	negative
Day 4	15.0	negative	negative	negative	negative
Day 5	15.0	negative	negative	negative	negative
Day 6	16.0	negative	negative	negative	negative
Day 7	20.0	negative	negative	*positive*	negative

The initial aerobic plate count for room temperature storage is 12.0 on Day 0. It shows a progressive increase from Day 1 to Day 7, peaking at 23.0. The increase in aerobic plate count shows microbial growth over time, which is expected at room temperature given the favorable environment for bacterium development.

Escherichia coli, Salmonella sp., and *molds* were undetectable during the monitoring period. Staphylococcus aureus was positive on Days 6 and 7. Beyond these days, the products are not safe for human consumption. It is advisable to disregard this product because it can cause undesirable side effects on the part of the person eating the product. The absence of *E. coli and Salmonella sp.,* indicates no contamination with these organisms. The presence of *Staphylococcus aureus* on Days 6 and 7 is alarming and suggests possible contamination risks, most likely owing to inappropriate handling or storage circumstances.

For refrigerated storage, the aerobic plate count on Day 0 is 8.0. The aerobic plate count fluctuates but steadily increases to 20.0 by Day 7. *Escherichia coli* and *Salmonella* were undetectable during the monitoring period. *Staphylococcus aureus* tested positive on Day 7 but negative for the remainder of the period. *Molds* remained negative during the monitoring period. The presence of *Staphylococcus aureus* only on Day 7 suggests initial contamination, which could have been mitigated by further refrigeration. The absence of additional pathogens is a good sign of the product's safety under refrigerated conditions.

The recurring occurrence of *Staphylococcus aureus* indicates a risk of contamination that could endanger health. The initial detection of Staphylococcus aureus requires attention to initial handling and hygiene practices.

Breadnut seed butter stored at room temperature may have a lower shelf life due to the presence of *Staphylococcus aureus*. This storage approach increases the danger of deterioration and potential health concerns, whereas refrigerated conditions are more successful at suppressing microbial development and ensuring product safety over time. However, early contamination should be reduced through careful handling and hygiene procedures. Thus, breadnut seed butter should be refrigerated to increase its shelf life and maintain safety. Strict hygiene measures should be followed throughout preparation and before handling to avoid infection, particularly with Staphylococcus aureus.

In conclusion, the shelf-life analysis shows that breadnut seed butter is more stable and safer when stored under refrigeration. However, careful sanitation and handling techniques are required to avoid initial contamination and maintain product quality.

Table 6 summarizes the cost and return analysis of the various products formulated**.**

Table 6. Cost and Return Analysis for Peanut-Breadnut Seed Butter

Particulars	Treatment		
	T0	**T1**	**T2**
Sales	150.00	150.00	150.00
Expenses	133.72	121.22	108.72
Net Income	16.28	28.78	41.28
ROI %	12.17%	23.74	37.96%

. In terms of peanuts, the basic formulation without the presence of breadnut seeds has the lowest return on investment of 12.17% compared to the combination of 50% peanut and 50% breadnut seeds with an ROI of 23.74%, and the highest ROI of 37.96% with a 100% breadnut seeds. This indicates that the breadnut seeds price is lower than the peanut. More importantly, breadnuts are widely available in the locality. The incorporation of breadnut seeds in the formulation provides more benefits than peanuts.

Table 7 shows the summary of the results of the evaluation on breadnut seed butter.

Table 7. Results of Evaluation on the Packaging of the Breadnut Seed Butter

INDICATORS	GLASS		PLASTIC		STAND-UP POUCH	
	Weighted Mean	Descriptive Equivalent	Weighted Mean	Descriptive Equivalent	Weighted Mean	Descriptive Equivalent
1. Level of Technical Performance	4.2	Very Much Acceptable	4.64	Very Much Acceptable	4.38	Very Much Acceptable
2. Economic Viability	3.85	Much Acceptable	4.75	Very Much Acceptable	4.15	Much Acceptable
3. Environmental Soundness	3.65	Much Acceptable	3.85	Much Acceptable	3.8	Much Acceptable
4. Social Acceptability	4.35	Very Much Acceptable	4.55	Very Much Acceptable	4.2	Very Much Acceptable
Overall Mean	**4.01**	**Much Acceptable**	**4.44**	**Very Much Acceptable**	**4.13**	**Much Acceptable**

For glass packaging, the technical performance indicators include safety, efficiency, accuracy, originality of design, weight, space efficiency, and overall appearance. Glass scored well resulting in an overall mean of 4.2, which is “Very Much Acceptable”. However, its economic viability was rated lower, with an overall mean of 3.85 which is “Much Acceptable”, due to relatively high costs. In terms of environmental soundness, glass had an overall mean of 3.65 which is “Much Acceptable”, indicating some concerns. Social acceptability for glass was high, with a mean of 4.35 which is “Very Much Acceptable” Overall, the weighted mean for glass packaging was 4.01 and rated as “Much Acceptable”.

On the other hand, plastic packaging outperformed the different materials in several areas. It achieved high marks across all technical performance indicators, particularly in design originality, weight, and overall appearance, with an overall mean of 4.64 which is "Very Much Acceptable". Economically, plastic was deemed highly viable, scoring 4.75 which is "Very Much Acceptability" on affordability and cost competitiveness. Environmental soundness for plastic received a lower score, with an overall mean of 3.85 which is "Much Acceptable", reflecting some environmental concerns. Plastic again scored high in social acceptability, with an overall mean of 4.55 rated as "Very Much Acceptable". The weighted mean for plastic packaging was 4.44, making it "Very Much Acceptable".

The stand-up pouch packaging also performed well. Its technical performance was rated highly, particularly for design originality and overall appearance, achieving an overall mean of 4.38 which is "Very Much Acceptable". Economically, it scored 4.15, indicating it as "Much Acceptable" due to moderate cost competitiveness. Its environmental soundness scored 3.8 rated as "Much Acceptable", which indicated room for improvement like the other materials. Social acceptability for the stand-up pouch was high, with an overall mean of 4.2, and was rated as "Very Much Acceptable". The weighted mean for stand-up pouch packaging was 4.13, making it "Much Acceptable".

In conclusion, plastic packaging scored the highest overall with a weighted mean of 4.44, followed by stand-up pouch at 4.13, and glass at 4.01. Both plastic and stand-up pouches were rated "Very Much Acceptable" across most indicators, while the glass was rated "Much Acceptable". Plastic packaging was favored for its technical performance and economic viability, with stand-up pouch performing well but slightly less preferred in some technical and environmental aspects.

IV. CONCLUSIONS

Based on the data gathered salient findings are as follows: The microbes found in Microbial Load Analysis found that the breadnut seed butter has a negative result in the detection of pathogens which means that the product is safe for human consumption since it harbors microbial load (aerobic plate count) within the acceptable limit. For the general acceptability of breadnut seed butter, the evaluators considered Treatment 1 which contains 50% peanut and 50% breadnut seeds, to be "Very Much Acceptable". This study showed that there was a significant difference between and among the treatments of breadnut seed butter. The proximate analysis of breadnut seed butter with 50% peanut and 50% breadnut seeds shows high-fat content which is 41.3g/100g. The shelf life analysis shows that the breadnut seed butter is more stable and safer when stored under refrigeration. Treatment 1 which is composed of 50% peanut and 50% breadnut seed has 23.74% ROI. In terms of packaging, plastic packaging scored the highest overall mean of 4.44 and rated it as "Very Much Acceptable". Plastic packaging was favored for its technical performance and economic viability.

Conclusion

The findings of this study are used to conclude such as:

1. Breadnut seed butter is safe for human consumption.
2. Breadnut seed butter with 50% peanut and 50% breadnut seed substitution is very much acceptable on the sensory qualities of the products.
3. There was a significant difference between and among the treatments for breadnut seed butter.
4. When peanuts are replaced with breadnut seeds in butter formulation, the nutritional composition, taste, aroma, color, and spreading consistency all affect the overall characteristics of the butter.

6. The nutritional value of peanut butter improves with the addition of breadnut seeds, which enhances the fat and protein content.

7. Breadnut seed butter has 6 days shelf life when refrigerated and lasts 7 days in refrigerated condition.

8. The substitution of 50% breadnut seeds in peanut butter production resulted in a 23.74% ROI.

9. A plastic jar is excellent for storing breadnut seed butter.

V. RECOMMENDATIONS

The following lists of recommendations are based on the study's results and conclusions:

1. Breadnut seed can be used to substitute peanuts, and it has the potential to be a fat-protein supplement.

2. When processing breadnut seeds, oven drying, and dehydration are recommended for other drying alternatives.

3. It is also recommended that further analysis of the nutritional facts of the breadnut butter and breadnut brittle is ready for commercialization.

4. Other studies will be undertaken on the use of breadnut pulp and seeds.

5. Breadnut seeds will be used as an alternative to peanuts in the production of butter and other products.

6. Create environmentally friendly packaging materials.

REFERENCES

[1] Breadnut, chestnut of the Tropics. Taste Belize Food & Culture Tours. (n.d.). Retrieved March 29, 2022, from https://tastebelize.com/2013/03/breadnut-chestnut-of-the-tropics/#:~:text=Breadnut%20or%20Artocarpus%20Camansi%2C%20is,and%20falls%20to%20the%20ground

[2] Go, M. B., Velos, S. P., Minyamin, A. V., Bagsit, R. D., & Pableo, R. G. (2015). Sensory evaluation, shelflife and nutritional composition of breadnut (Artocarpus camansi) cookies. *Tropical Technology Journal*, *19*, 1-7.

[3] Gonzalez, R. M., et al. (2021). Nutritional profile of breadnut and its applications. *Journal of Food Science*.

[4] Marshall, M. R. (2010). ASH analysis. In Food science text series (pp. 105–115). https://doi.org/10.1007/978-1-4419-1478-1_7

[5] Website, N. (2023, April 18). Fat: the facts. nhs.uk. https://www.nhs.uk/live-well/eat-well/food-types/different-fats-nutrition/

[6] PROTEIN what do the terms mean? (n.d.). SA Mohair Growers. https://www.angoras.co.za/article/protein-what-do-the-terms-mean

[7] News-Medical. (2020c, March 25). Why is Moisture Content Analysis of Food Important? https://www.news-medical.net/life-sciences/Why-is-Moisture-Content-Analysis-of-Food-Important.aspx

[8] Ragone, D. (2006). Artocarpus camansi (breadnut). The Breadfruit Institute, National Tropical Botanical Garden. Hawaii.

[9] Zamora, C. M., Vasquez, J. L., Ebison, M. A. C., & Sibucao, M. (2017). Utilization of breadnut (Artocarpus camansi) as a meat replacement for meatballs. In DLSU Research Congress (pp. 20-22).