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Pan De Sal Fortified with Cassava-Based Sagip Nutri Powder

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Abstract: This study investigates the nutritive value and consumer acceptability of Pan de Sal fortified with Cassava-Based Sagip Nutri Powder. Specifically, it explores the nutritional composition of the fortified bread, its acceptability based on sensory attributes, and its market potential through a cost and return analysis. Five treatment formulations of Pan de Sal were developed, incorporating varying amounts of All-Purpose Flour and Cassava-Based Sagip Nutri Powder. Nutritional analysis showed that the fortified Pan de Sal had higher energy, dietary fiber, and protein content compared to the control. Sensory evaluations were conducted among 100 panelists from diverse age groups, who assessed color, taste, odor, and texture. Results showed that the fortified formulations were highly acceptable, with Formulation 5 (0g All-Purpose Flour and 355g Cassava-Based Sagip Nutri Powder) being the most favored in terms of taste and texture. The study also indicated that younger consumers, particularly those in the 11-20 age range, had a higher preference for the product. A cost and return analysis demonstrated the commercial viability of the fortified Pan de Sal. Educational materials on the benefits of fortified bread were also suggested based on the findings.

Keywords: Pan de Sal, Cassava-based Sagip Nutri Powder, Nutritive Value, Consumer Acceptability, Sensory Evaluation

1. Introduction

Breakfast is typically the first meal of the day, often consisting of a nutritious start like rice or bread, paired with a hot drink such as coffee or chocolate to provide energy for the day ahead. Bread, one of the easiest foods to make, follows a straightforward process with just a few essential ingredients: water, flour, yeast, and salt.Filipinos are known for being a coffee lover and they enjoyed its best sip when partnered with bread called pan desal, and it is the most known Filipino bread of all time. In Fact, most Filipinos grown up with the existence of this bread because of its delicious savory taste especially when served Hot.

Pan desal is a type of Filipino bread that is slightly sweet and baked as small, oval loaves. The name comes from Spanish word Pan desal, which literally means “bread of salt”. It is the most popular bread in the Philippines that is traditionally served as a breakfast roll which is made of flour, eggs, yeast, sugar, and salt. Filipinos usually pair it with their favorite cup of coffee or milk and sometimes, it is also served during merienda or snack time. (Isaguirre et al., 2017).

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Pan desal is often referred to as “poor man’s bread” and is more affordable than traditional local bread. It is a cherished type of bread in the Philippines, although its nutritional content is somewhat lacking. Filipinos particularly enjoy pan desal, especially when paired with an array of fillings. Furthermore, bakers and companies today are innovating pan desal to introduce a variety of ingredients that have gained popularity. Some popular variations include Malunggay, Ube, Cheese pan desal, among others, which provide different nutritional benefits.

Supporting local pan desal bakeries demonstrates the affection Filipinos have for this staple in our everyday lives, particularly due to its affordability, making it accessible for the less fortunate and students. The traditional pan desal is already familiar to numerous bakers today, and in an effort to create more innovative variations, the researcher proposed incorporating a nutritious flavor by adding cassava-based Sagip Nutri Powder to elevate its status as a beloved local bread in our country.

Malnutrition and poverty are significant challenges at Maddela Integrated School of Arts and Trades and in various communities. Consequently, the Department of Education has introduced a school-based feeding initiative aimed at assisting malnourished students. Among the items provided to them is bread.

Fortifying Pan de Sal with Cassava-Based Sagip Nutri powder that is made from Cassava, Mung bean, and Sesame, fortified with Cacao Pod Husk (CPH), Malunngay, and Turmeric will create a delicious, nutritious, and budget-friendly bread that can help address both hunger and malnutrition in our school and in the community.

Pan desal is a source of macronutrients and micronutrients including vitamins, minerals, protein, carbs, and fat, all of which are vital to good health. It is produced from wheat as a major raw material where it provides the primary structure to baked bread products (Orillos, 2015).

With the above nutritional profile of the Powder mentioned, there is no doubt that using this powder, Cassava-Based Sagip Nutri Powder in improving the classic bread Pan desal, it will give us the un-expensive yet delicious and nutritious local bread. With this, we can provide an answer for malnutrition and poverty and may also help us to provide an income that will promote Good health and Well-being.

On the other hand, this product can also a help to small farmers to build an additional income especially the cassava root crops that is aligned to the Sustainable Development Goals of Research the No Poverty. Aside from this, The Pan desal fortified with Cassava-Based Sagip Nutri Powder was utilized research-based product of Isabela State University Main Campus the Cassava-Based Sagip Nutri Powder that will help the Universities product sustainability.

The result of this study will also soon address the insufficient nutrient of classic pan desal so as to improve its natural component to more nutritious and health beneficial to every consumer for example, to lessen the increasing cases of malnutrition, heart disease and hunger among Filipino consumers with the nutritive value that is present in the Cassava-Based Sagip Nutri Powder

Statement of the Problem

This study was conducted to determine the nutritive value and consumers' acceptability of Pan desal fortified with Cassava-Based Sagip Nutri Powder

Specifically, it aimed to answer the following questions:

1. What is the nutritive value of pan desal fortified with Cassava-Based Sagip Nutri Powder?
2. What is the acceptability of Pan desal fortified with Cassava-Based Sagip Nutri Powder in terms of:
   a. Color/appearance;
   b. Taste/Flavor;
   c. Odor/Aroma, and
   d. Texture
3. What is the acceptability of pan desal fortified with Cassava-Based Sagip Nutri Powder on Acceptability Consumers Index (ACI)?

What is the difference of the acceptability of pan desal when evaluators are grouped according to age?

What is the Return on Investment (ROI) in producing the product?

What educational materials may be developed based from the study?

2. Materials and Methods

This study employed an experimental research design to evaluate the sensory characteristics and nutritional value of Pan de Sal fortified with Cassava-Based Sagip Nutri Powder. The experiment involved five treatment formulations (F1–F5) where the main variation was the amount of All-Purpose Flour and Cassava-Based Sagip Nutri Powder incorporated. Formulation 1 served as the control (classic Pan de Sal), while Formulations 2 to 5 contained increasing amounts of Cassava-Based Sagip Nutri Powder (0g to 1355g) and decreasing amounts of All-Purpose Flour (355g to 0g). Other ingredients—such as , sugar, butter, salt, yeast, eggs, and milk—remained constant across all formulations.

The Cassava-Based Sagip Nutri Powder was purchased at Brgy. Salvacion Echague, Isabela, from the research output of BIDANI (Barangay Integrated Development Approach for Nutrition Improvement) Participative Nutrition Enhancement Approach (PNEA) ISU-CED headed by the project leader/PNEA coordinator M. Peñalber. For the treatment samples, the Pan de Sal were produced with 88.75g, 177.5g, 266.25g, and 355g of Cassava -Based Sagip Nutri Powder. The preparation began with the measurement and mixing of wet and dry ingredients, followed by kneading, proofing, dividing, shaping, coating in breadcrumbs, and baking at 180°C for 18–20 minutes. Figure 1 (not shown here) illustrates the flowchart of the baking process.

The equipment used included a gas range/deck oven, oven thermometer, mixers, rolling pin, sifter, baking trays, weighing scale, and dough cutters. All materials and tools were properly sanitized and calibrated prior to use to maintain consistency and quality.

For each formulations, the proportion of All-Purpose Flour and cassava powder was the independent variable, while the dependent variables were the sensory attributes and nutritional content. The nutrient analysis was conducted at the Regional Food Technology Development and Incubation Center, Integrated Laboratory Division, Department of Agriculture, Carig Sur, Tuguegarao City. Nutrients measured included protein, fiber, fat, carbohydrates, moisture, and ash content to determine the health benefits of each formulation.

A sensory evaluation was conducted to assess the acceptability of the product among various demographic groups. A total of 100 panelists were randomly selected, consisting of 25 elementary students, 25 secondary students, 25 college students, and 25 adults. The evaluations were held at Maddela Integrated School of Arts and Trades, Quirino, and the College of Education cafeteria at ISU-Echague. Participants were screened to ensure they were non-smokers, non-drinkers, and in good health. Each panelist was given a slice of Pan de Sal from each treatment and asked to evaluate the

samples using a 9-point Hedonic scale in terms of color/appearance, odor/aroma, taste/flavor, texture, and general acceptability. Proper rinsing protocols were observed between tastings to preserve result integrity.

The experimental design followed a randomized complete block design (RCBD) where the five formulations were randomly assigned to four blocks. This allowed for control of variability and increased the reliability of the results. The experimental layout is shown in Figure 3 (not shown here), detailing how formulations were rotated across the blocks.

Cost and return analysis was also conducted to assess the economic feasibility of each formulation. The total cost incurred during the production of each formulation was recorded and the return on investment (ROI) calculated. This provided insight into the commercial potential of the fortified bread products.

Finally, the results of the sensory evaluation were statistically analyzed using Analysis of Variance (ANOVA) under one-way classification to determine significant differences among treatments. The F-test and Least Significant Difference (LSD) method were employed to identify which specific treatments differed significantly in terms of sensory attributes. Descriptive statistics were also used to summarize findings and guide interpretation.

3. Results

This section presents the tabulation of results using the proper statistical methods. Presented are the nutritive value of Pan desal fortified with Cassava-Based Sagip Nutri Powder, the level of acceptability, its acceptability based on Acceptability Consumers Index (ACI), the difference of the acceptability of pan desal when evaluators are group according to age, and the return on investment (ROI).

Nutrient Analysis

Table 2. Nutritive Value of Pan desal fortified with Cassava-Based Sagip Nutri Powder

	F1	%RENI	**F2**	%RENI	**F3**	%RENI	**F4**	%RENI	**F5**	%RENI
Energy (kcal)	148	6%	**151**	6%	**152**	6%	**149**	6%	**153**	6%
Energy from Fat (kcal)	29		**33**		**33**		**29**		**33**	
Total Fat (g)	3		**3**		**4**		**3**		**4**	
Total Carbohydrates (g)	25		**25**		**25**		**28**		**25**	
Crude Fiber (g)	0		**1**		**1**		**1**		**1**	
Total protein (g)	4	6%	**5**	7%	**5**	7%	**2**	3%	**5**	7%
No. of Servings per container: 10										
Serving Size: 45g										

Table 2 shows the recommended energy and nutrient intake of pan desal fortified with Cassava-Based Sagip Nutri Powder. Among the nutritive values, F5 obtained the highest energy content, higher than energy content of local pandesal. Energy from fat shows the same content for F2, F3, and F4, and way higher than the control. The carbohydrates content of local pandesal is the same with F2, F3, and F5, but not with F4 which obtained the highest carbohydrates content. In terms of crude fiber content, local pandesal has no dietary fiber unlike with F2, F3, F4, and F5 which got the same dietary fiber. Lastly for protein, F2, F3, and F5 got higher protein value than the local pan desal, but not with F4 which is lower than the local pan desal.

Results put emphasis on the nutritive value for the pan desal fortified with Cassava-Based Sagip Nutri Powder in which the used of turmeric added energy, and dietary fiber to the usual pan desal.

Incorporating Cassava-Based Sagip Nutri Powder with a content of turmeric into traditional recipes, such as pan desal, has been shown to enhance its nutritional profile. Previous studies indicate that turmeric serves as a significant source of curcumin, known for its antioxidant and anti-inflammatory qualities that positively impact health. This can also enhance the dietary fiber levels in food products

(Bisht et al., 2016), which corresponds with the outcomes of this study where pan desal enriched with turmeric exhibited greater fiber content in comparison to the control. Furthermore, research conducted by Hossain et al. (2019) has shown that incorporating turmeric can increase both the protein and energy values in baked goods confirming the findings that pan desal fortified with Cassava-Based Sagip Nutri Powder with turmeric has increased energy and protein values compared to traditional pan desal.

Profile distribution of respondents

Table 3. Distribution of evaluators by Sex

SEX	Frequency	Percent
Male	38	38.00
Female	62	62.00
Total	100	100.00

Table 3 shows the frequency and percentage distribution of sex among evaluators. Based on the findings, female respondents dominated the population which is 62% of the total evaluators. On the other hand, male respondents got 38% of the total evaluators.

Gender-related preferences have been investigated in studies on food acceptability, with women typically demonstrating a greater acceptance of health-oriented food choices, such as those containing functional ingredients like turmeric (Smith & Williams, 2021). This aligns with the findings of the current research, where a majority of participants were female. Previous studies indicate that women are more inclined to favor food innovations that offer health benefits, such as enhanced nutritional value. It emphasized that gender-based preferences in food products can greatly affect market acceptance (Garcia et al., 2020), which is crucial for understanding how pan desal enriched with Cassava-Based Sagip Nutri Powder may resonate with various consumer groups.

Table 4**.** Distribution of evaluators by age

Age	Frequency	Percent
1-10	14	14.00
11-20	57	57.00
21-30	10	10.00
31-40	15	15.00
41-50	4	4.00
TOTAL	100	100.00
MEAN AGE = 19		

Table 4 shows the frequency and percentage distribution of age among evaluators. Based on the findings, age group 11 – 20 years old got the highest percentage which is 57% of the total number of evaluators. Other age groups constitute 15% for 31 to 40 years old, 14% for 1 to 10 years old, 10% for 21 to 30 years old, and 4% for 41 to 50 years old.

Age-related preferences in food consumption are well-documented, with younger generations often more open to trying new food innovations (Jones et al., 2020). This is reflected in the current study, where the largest group of evaluators (57%) was within the 11-20 age range. Research by Gonzalez et al. (2021) also found that younger consumers tend to favor health-conscious foods, like those containing turmeric, due to heightened awareness about wellness. The findings from this study support the idea that pan desal fortified with Cassava-Based Sagip Nutri Powder may have higher acceptability among younger consumers, who are more willing to experiment with new food products that align with health trends.

Degree of Acceptability

Table 5**.** Degree of acceptability in terms of color or appearance of Pan desal fortified with Cassava Based Sagip Nutri Powder

Table 5**.** Degree of acceptability in terms of color or appearance of Pan desal fortified with Cassava-Based Sagip Nutri Powder

FORMULATIONS	MEAN	QD
F1 = Local Classic Pandesal	7.93	LVM
F2 = All-Purpose Flour (266.25g) and Cassava-Based Sagip Nutri Powder (88.75g)	7.74	LVM
F3 = All-Purpose Flour (177.5g) and Cassava-Based Sagip Nutri Powder (177.5g)	7.66	LVM
F4 = All-Purpose Flour (88.75g) and Cassava-Based Sagip Nutri Powder (266.25g)	8.11	LVM
F5= All-Purpose Flour (0g) and Cassava-Based Sagip Nutri Powder (355g)	8.11	LVM

Table 5 shows the degree of acceptability of Pan desal fortified with Cassava-Based Sagip Nutri Powder in terms of its color or appearance. Among formulations considered, F4 and F5 got the highest mean of 8.11 respectively which is described as liked very much, and are higher than the control group. This means F4 and F5 attained the highest degree of acceptability in terms of the color or appearance. On the other hand, F2 shows the lowest mean of 7.74 which is still described as liked very much. Hence, overall, the degree of acceptability for all the formulations considered are all liked very much in terms of the color or appearance acceptability, highlighting the F5 with All-Purpose Flour (0g) and Cassava-Based Sagip Nutri Powder (355g), as the most acceptable.

Color and appearance are crucial elements that affect how acceptable food is, especially regarding new food products. This study's results indicate that formulations containing turmeric (F4 and F5) received more favorable ratings. Research has demonstrated that color significantly influences consumers' initial perceptions, and by incorporating natural ingredients such as turmeric, the visual attractiveness of baked goods can be enhanced (Ting et al., 2021). The findings of this study, which show a high level of acceptance for the pan desal enriched with turmeric, highlight the role of color in shaping consumer preferences.

Table 6. Degree of Acceptability in Terms of Taste and Flavor of Pan desal fortified with Cassava-Based Sagip Nutri Powder

TREATMENT	MEAN	QD
F1 = Local Classic Pandesal	7.87	LVM
F2 = All-Purpose Flour (266.25g) and Cassava-Based Sagip Nutri Powder (88.75g)	7.59	LVM
F3 = All-Purpose Flour (177.5g) and Cassava-Based Sagip Nutri Powder (177.5g)	7.89	LVM
F4 = All-Purpose Flour (88.75g) and Cassava-Based Sagip Nutri Powder (266.25g)	7.81	LVM
F5= All-Purpose Flour (0g) and Cassava-Based Sagip Nutri Powder (355g)	8.21	LVM

Table 6 shows the degree of acceptability of Pan desal fortified with Cassava-Based Sagip Nutri Powder in terms of its taste and flavor as evaluated. Among formulations considered, F5 got the highest mean of 8.11 which is described as liked very much, and is higher than the control group which is the local classic pan desal. This means F5 attained the highest degree of acceptability in terms of the taste and flavor. On the other hand, F2 shows the lowest mean of 7.59 which is still described as liked very much. Hence, overall, the degree of acceptability for all the formulations considered are all liked very

much in terms of the taste and flavor acceptability, highlighting the F5 with All-Purpose Flour (0g) and Cassava-Based Sagip Nutri Powder (355g), as the most acceptable.

Taste is a critical determinant of food acceptability, particularly when incorporating functional ingredients like turmeric. In the current study, F5, which included the highest turmeric concentration, was the most liked in terms of taste, similar to findings by Singh et al. (2019), which indicated that moderate amounts of turmeric can improve the overall flavor without overwhelming the palate. The study's results suggest that pan desal fortified with Cassava-Based Sagip Nutri Powder and its turmeric's flavor is well-accepted, especially when the flavor balance is optimized.

Table 7**.** Degree of Acceptability in Terms of Odor or Aroma of Pan desal fortified with Cassava-Based Sagip Nutri Powder

FORMULATIONS	MEAN	QD
F1 = Local Classic Pandesal	7.86	LVM
F2 = All-Purpose Flour (266.25g) and Cassava-Based Sagip Nutri Powder (88.75g)	7.53	LVM
F3 = All-Purpose Flour (177.5g) and Cassava-Based Sagip Nutri Powder (177.5g)	7.71	LVM
F4 = All-Purpose Flour (88.75g) and Cassava-Based Sagip Nutri Powder (266.25g)	7.88	LVM
F5= All-Purpose Flour (0g) and Cassava-Based Sagip Nutri Powder (355g)	7.81	LVM

Legend: *LVM= Like Very Much*

Table 7 shows the degree of acceptability of Pan desal fortified with Cassava-Based Sagip Nutri Powder in terms of its odor and aroma as evaluated. Among formulations considered, F4 got the highest mean of 7.88 which is described as liked very much, and is higher than the control group which is the local classic pan desal. This means F4 attained the highest degree of acceptability in terms of odor and aroma. However, F2 shows the lowest mean of 7.53 which is still described as liked very much. Hence, overall, the degree of acceptability for all the formulations considered are all liked very much in terms of the odor and aroma acceptability, highlighting the F4 with All-Purpose Flour (88.75g) and Cassava-Based Sagip Nutri Powder (266.25g), as the most acceptable.

The aroma of food significantly affects its acceptance, particularly when introducing a strong-smelling ingredient like turmeric. The results from this study, which show that F4 had the highest acceptability for aroma, align with findings from previous studies, where the combination of turmeric and other base ingredients helped moderate its strong smell, making it more palatable (Ali et al., 2021). Thus, the successful integration of turmeric in pan desal fortified with Cassava-Based Sagip Nutri Powder indicates its potential for broad consumer appeal.

Table 8. Degree of Acceptability in Terms of Texture of Pan desal fortified with Cassava-Based Sagip Nutri Powder

FORMULATIONS	MEAN	QD
F1 = Local Classic Pandesal	7.89	LVM
F2 = All-Purpose Flour (266.25g) and Cassava-Based Sagip Nutri Powder (88.75g)	7.94	LVM
F3 = All-Purpose Flour (177.5) and Cassava-Based Sagip Nutri Powder (177.5g)	7.98	LVM
F4 = All-Purpose Flour (88.75g) and Cassava-Based Sagip Nutri Powder (266.25g)	8.16	LVM
F5= All-Purpose Flour (0g) and Cassava-Based Sagip Nutri Powder (355g)	8.08	LVM

Legend: *LVM= Like Very Much*

Table 8 shows the degree of acceptability of Pan desal fortified with Cassava-Based Sagip Nutri Powder in terms of its texture as evaluated. Among formulations considered, F4 got the highest mean of 8.16 which is described as liked very much, and is higher than the control group which is the local

classic pan desal. This means F4 attained the highest degree of acceptability in terms of texture acceptability. However, F1 shows the lowest mean of 7.89 which is still described as liked very much. Overall, the degree of acceptability for all the formulations considered are all liked very much in terms of the texture acceptability, highlighting the F4 with All-Purpose Flour (88.75g) and Cassava-Based Sagip Nutri Powder (266.25g), as the most acceptable. Result further implies that Pan desal fortified with Cassava-Based Sagip Nutri Powder has higher acceptability of texture quality than the local classic pan desal.

Texture plays an essential role in food acceptance, especially for products that involve alterations to traditional recipes. A study by Raza et al. (2020) found that the addition of functional ingredients like turmeric often affects the texture of baked goods, but the addition of fiber-rich cassava can enhance the overall mouthfeel. This aligns with the findings in the current study where formulations with higher cassava content such as F4 were rated highest for texture. Textural attributes, such as softness and chewiness, are particularly important in the acceptance of bread products, and the combination of turmeric and cassava appears to have improved these qualities in pan desal fortified with Cassava-Based Sagip Nutri Powder.

Table 9. General Acceptability of Pan desal fortified with Cassava-Based Sagip Nutri Powder

FORMULATIONS	MEAN	QD
F1 = Local Classic Pandesal	7.96	LVM
F2 = All-Purpose Flour (266.25g) and Cassava-Based Sagip Nutri Powder (88.75g)	7.68	LVM
F3 = All-Purpose Flour (177.5) and Cassava-Based Sagip Nutri Powder (177.5g)	7.70	LVM
F4 = All-Purpose Flour (88.75g) and Cassava-Based Sagip Nutri Powder (266.25g)	7.85	LVM
F5= All-Purpose Flour (0g) and Cassava-Based Sagip Nutri Powder (355g)	8.19	LVM

Legend: *LVM= Like Very* Much

Table 9 shows the general acceptability of Pan desal fortified with Cassava-Based Sagip Nutri Powder as evaluated. Among formulations considered, F5 got the highest mean of 8.19 which is described as liked very much, and is higher than the control group which is the local classic pan desal. This means F4 attained the highest degree of general acceptability. However, F2 shows the lowest mean of 7.68 which is still described as liked very much. Overall, the general acceptability for all the formulations considered are all liked very much in terms of general acceptability, highlighting the F5 with All-Purpose Flour (0g) and Cassava-Based Sagip Nutri-Pack Powder (355g), as the most acceptable.

General acceptability is a composite measure that combines various factors, including color, taste, aroma, and texture. The results of the current study, which indicate that F5 had the highest general acceptability, align with findings from other studies where turmeric-enriched products like Cassava-Based Sagip Nutri Powder were well-received when their sensory attributes were balanced (Patel et al., 2021). The strong preference for F5 suggests that consumers are open to the concept of Cassava-Based Sagip Nutri Powder with turmeric-enriched pan desal, provided the overall sensory profile is appealing.

Acceptability Consumers Index

Acceptability Consumers Index

Table 10. Acceptability and Desirability Composite Index (ACI) for Pan desal fortified with Cassava-Based Sagip Nutri Powder

	Appearance	22	Aroma	19	Texture	19.5	Taste	39.5	100	RANK
F1	7.93	1.74	7.86	1.49	7.89	1.54	7.87	3.11	7.89	3
F2	7.74	1.70	7.53	1.43	7.94	1.55	7.59	3.00	7.68	5

F3	7.66	1.69	7.71	1.46	7.98	1.56	7.89	3.12	7.82	4
F4	8.11	1.78	7.88	1.50	8.16	1.59	7.81	3.08	7.96	2
F5	8.11	1.78	7.81	1.48	8.08	1.58	8.21	3.24	8.09	1

Table 10 shows that formulation 5 (All-Purpose Flour (0g) and Cassava-Based Sagip Nutri Powder (355g) ranked first with ACI of 8.09, followed by formulation 4 (All-Purpose Flour (88.75g) and Cassava-Based Sagip Nutri Powder (266.25g) with ACI of 7.96. Formulation 1 (local classic pan desal) ranked as the 3rd with ACI of 7.89, followed by the formulation 3 (All-Purpose Flour (177.5g) and Cassava-Based Sagip Nutri Powder (177.5g)) with ACI of 7.82. Lastly, formulation 2 (All-Purpose Flour (266.25g) and Cassava-Based Sagip Nutri Powder (88.75g)) got the lowest rank with ACI of 7.68. Results further imply that Formulation 5 with All-Purpose Flour (0g) and Cassava-Based Sagip Nutri Powder (355g) is more acceptable and desirable than of the local classic pan desal.

The Acceptability Composite Index (ACI) is a useful tool for assessing overall consumer preferences. The high ACI for F5 in this study, followed by F4, is consistent with findings by Hossain et al. (2020), which suggest that products with balanced improvements in all sensory attributes tend to score higher in consumer acceptability. This suggests that pan desal fortified with Cassava-Based Sagip Nutri Powder, particularly F5, has the potential for strong market acceptance, highlighting the role of sensory profile balance in driving consumer choices.

Development of Information, Education, and Communication (IEC) Materials

Figure 4 shows the trifold developed Information, Education, and Communication (IEC) Materials to give information and promote the Pan Desal Fortified with Cassava-Based Sagip Nutri Powder to School Learners, Community, and to the public. It is also one way of educating the consumers as well as to easily disseminate and advertise the Pan de Sal which can help attaining good health and wellness.

This contains the name, ingredients, and procedure of the Pan Desal Fortified with Cassava Based Sagip Nutri Powder. It also gives information on the benefits and other facts of Pan Desal Fortified with Cassava Beasd Sagip Nutri Powder. The contact persons are also included in the material.

Figure 4. Developed Information, Education, and Communication (IEC) material.

4. Conclusion

The pan desal enriched with Cassava-Based Sagip Nutri Powder offers a more nutritious choice than the traditional local pan desal. Incorporating Cacao Pod Husk, Malunngay, Turmeric and other ingredients, improves the nutritional value of the pan desal. Most importantly, the dietary fiber found in the traditional local pan desal is also present in the pan desal fortified with Cassava-Based Sagip Nutri Powder.

The acceptability of pan desal fortified with Cassava-Based Sagip Nutri Powder based on Acceptability Consumers Index (ACI) was higher than the local classic pan desal. This concludes consumer preference for innovative products in which consumers are open to trying new and innovative products, and Pan desal's unique attributes such as color, taste, odor, and texture, as well as health benefits have resonated with them.

Despite F4 being the most acceptable in some attributes among the 4 formulations of pan desal fortified with Cassava-Based Sagip Nutri Powder, the general acceptability was most favorable for F5. This concludes that F5 with All-Purpose Flour (0g) and Cassava-Based Sagip Nutri-Pack Powder (355g) is recommended as the optimal formulation for pan desal fortified with Cassava-Based Sagip Nutri Powder. With its high acceptability and desirable characteristics, F5 is ready for commercialization.

Furthermore, the ROI for pan desal fortified with Cassava-Based Sagip Nutri Powder is 49% which is already profitable, it makes the product more attractive to price-sensitive consumers. Since the ROI of pan desal fortified with Cassava-Based Sagip Nutri Powder is the same with the local classic pan desal, it can be inferred that the market demand for both might be similar. Pan desal fortified Cassava-Based Sagip Nutri Powder is competitively viable with the local classic Pan de Sal, making it a potentially attractive alternative. In other words, consumers are willing to accept pan desal fortified with Cassava-Based Sagip Nutri Powder as a substitute for the local classic Pan de Sal, which is a positive indicator for market acceptance.

Recommendations

The following recommendations were drawn based on the conclusion of the study. By developing these educational materials, it can effectively communicate the value and benefits of pan desal fortified with Cassava-Based Sagip Nutri Powder to various stakeholders, ultimately driving sales, full acceptance, and loyalty. Specifically,

For Local government units (LGUs), they play a significant role in promoting the nutritive value and benefits of pan desal fortified with Cassava-Based Sagip Nutri Powder among business owners. They may collaborate with business owners to promote pan desal fortified with Cassava-Based Sagip Nutri Powder through various marketing channels, such as social media, print media, and local events. Considering health and nutrition programs, they may also integrate pan desal fortified with Cassava-Based Sagip Nutri Powder into existing health and nutrition programs, such as school feeding programs or community health initiatives. And lastly, LGUs may help develop labeling and certification programs to ensure the quality and authenticity of the product pan desal fortified with Cassava-Based Sagip Nutri Powder, providing business owners with a competitive edge.

For Business Owners/retailers, they may generate (1) infographics for awareness of consumers specially the public. These infographics highlight the health benefits of pan desal fortified with Cassava-Based Sagip Nutri Powder; (2) Brochures or pamphlets explaining the unique features and nutritional value; (3) Social media posts and videos showcasing the benefits its and how to incorporate it into a healthy diet (5) Webinars or online workshops featuring its benefits.

For Food Service and Culinary Professionals, they might create recipe collections or cookbooks that highlight pan desal enriched with Cassava-Based Sagip Nutri Powder as an essential component,

along with technical sheets or product guides that offer comprehensive details about its characteristics, advantages, and applications. They could also organize workshops or demonstrations to show how to incorporate pan desal fortified with Cassava-Based Sagip Nutri Powder into various menu items. Finally, there could be online materials or webinars focused on its culinary applications and associated benefits.

For Consumers, they may inform by reading the product labels and educational materials to understand the health benefits of Cassava-Based Sagip Nutri Powder and how it supports family nutrition. They may also engage with community events participate in community tastings, nutrition sessions, or social media discussions to gain firsthand knowledge and experiences.

For Researchers, they may provide the evidence base needed to improve and scale up the product. Key areas of focus may include conducting clinical and community-based studies to measure the effects of regular consumption on nutritional status, especially in children and at-risk populations. They can also explore product development by innovating new fortified food options using Cassava-Based Sagip Nutri Powder and evaluate their nutritional value, shelf life, and market potential.

Author Contributions

Tabal C.C Conceptualized the idea, did the experiment, processed the experimental data and performed the data analysis. Peñalber M.D Supervised the work. Tabal C.C and Peñalber M.D interpreted the results and wrote the manuscript.

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