SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

SENSORY EVALUATION AND ACCEPTABILITY OF CORN-BASED NUTRI-SNACK FOR JUNIOR HIGH SCHOOL

Czarina Mae S. Danzalan[1*], Martina Delos Reyes-Peñalber, Ed.D.[2]
[1]Central Graduate School, Isabela State University, Echague Campus, Philippines
[2]College of Education, Isabela State University, Echague Campus, Philippines

[*]Corresponding Author

Article DOI: https://doi.org/10.36713/epra17536
DOI No: 10.36713/epra17536

ABSTRACT

The purpose of the study delves on innovating Corn-Based Sagip Nutri-Snack. It generally aims to innovate supplementary snack for school-based feeding program and contribute to attainment of Sustainable Development Goals. The study has been conducted for sensory evaluation, acceptability, nutritive value, return on investment and market analysis. This study was conducted within January- May 2024 at Jones Rural School. The research design was experimental study. The five treatments are sensory evaluated according to color/appearance, taste/flavor, odor/aroma, and general acceptability by fifty individuals thirty-three female and twenty-two male who were randomly selected junior high school students. Results of sensory evaluation were statistically analyzed using one-way classification of the Analysis of Variance. F test, mean, and descriptive statistics were used to determine if there is significant difference among the treatments. In terms of degree of acceptability, the study reveals that respondents prefer treatment 2. The acceptability consumer index for Treatment 1 achieved the highest followed closely by Treatment 2 with only 0.04 difference. As regards to nutritive value, Treatment 1 has the lowest energy while other treatments have higher energy. This suggests that treatments with Nutri-Pack is more viable option. The Market Analysis of product showed that Treatment 2 is more favorable than Treatment 1. In terms of ROI treatment 2 have comparable ROI to treatment 1. The positive result of the innovation must be disseminated to schools and other agencies to maximize the viability of the product.

KEYWORDS – *Acceptability Consumer Index, Economic Growth, Nutri-Snack, Sagip, Sensory Evaluation, Zero hunger*

INTRODUCTION

Malnutrition is one of the pressing problems in the world especially in the Philippines. Physical health issues bring with them a slew of other problems for a child–isolation, cognitive and behavioral problems, and poor educational outcomes. Improved nutrition is one of the keys to improve a learner's behavior, academic performance, and overall health.

According to the UNICEF-WHO-The World Bank 2023 Report on the joint Child Malnutrition Estimates (JME) — Levels and Trends, child malnutrition estimates for the indicators stunting, wasting, overweight and underweight describe the magnitude and patterns of malnutrition aligned with the Sustainable Development Goal (SDG) Target 2.2.

Malnutrition, with its 2 constituents of protein–energy malnutrition and micronutrient deficiencies, continues to be a major health burden in developing countries. It is globally the most important risk factor for illness and death, with hundreds of millions of pregnant women and young children particularly affected. Apart from marasmus and kwashiorkor (the 2 forms of protein– energy malnutrition), deficiencies in iron, iodine, vitamin A, and zinc are the main manifestations of malnutrition in developing countries. (Müller & Krawinkel 2005)

Eating a balanced diet that contains the recommended number of fruits, vegetables, grains, and protein-rich foods is the best way to prevent malnutrition. Receiving a supplement and the addition of micronutrients or fortified foods into diets can also help prevent malnutrition. (Ahmed et al.,2022)

In recent years, several legislations have been enacted by the Philippine Congress to support healthier diets and nutrition of Filipinos. The Department of Education has also issued policies on sale of healthy foods and beverages in schools, as well as the conduct of school feeding program. According to Lawson (2012), school feeding program as a social safety net has been popular in developing countries as an instrument for achieving the Millennium Development Goals.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

DepEd Order No.23, s.2020 known as School-Based Feeding Program (SBFP) aims to address hunger and encourage learners to enroll, contribute to the improvement of their nutritional status, provide nourishment for their growth and development, help boost their immune system, and enhance and improve their health and nutrition values.

In the implementation of SBFP, the preparation of food supply map of food commodities available in the region as reference in developing a localized cycle menu. The cycle menu can be by school clusters/ schools' district/municipality/schools' division-wide. It shall be composed of but not limited to a combination of hot meals, enhanced Nutri-bun/Milky Bun from PCC / Fortified/ Enriched breads, local fruits and fortified blended food and Nutri-Packs.

Anent to this, several efforts have been made by the DepEd schools to localized the menu for SBFP. Innovations in food preparation are encouraged to the school implementers depending on the available resources within their locality. The Municipality of Jones, where the Jones Rural School is located, is primarily an agricultural municipality best suited for the intensive production of rice and corn as evidence by its topographic map which shows that 73% of the agricultural area of 16,848 hectares. (Department of Agriculture-Jones, 2023)

Due to massive availability of corn and malunggay, this can be utilized as an alternative in making fortified Nutri-Packs. Maize flour can be fortified with malunggay powder as this contains vitamins and minerals to combat the malnutrition of the SBFP recipients (Pachon, 2018). Malunggay, also known as Moringa, is a highly nutritious plant that is rich in vitamins, minerals, and antioxidants (Braganza, 2023).

A research paper titled "Development of Malunggay-Based Products for Health and Nutrition Program" by Valera and Ancheta (2021) showed that snacks with moringa leaves as the primary ingredient to supplement the nutritional needs of Filipino children were found to be generally acceptable by home economics teachers and grade school children.

An action research program funded by the UN Food and Agriculture Organization (FAO) and the National Science and Technology Authority (NSTA) of the University of the Philippines Los Banos (UPLB) which is the Barangay Integrated Development Approach for Nutrition Improvement (BIDANI) a comprehensive nutrition-in-development strategy emphasizing the need to mainstream improving the nutrition of Filipinos towards achieving sustainable development.

BIDANI as a network program composed of various state colleges and universities (SUCs) across the Philippines was established and the ISABELA State University Echague Campus was one of it. In addressing this, Isabela State University Echague Campus particularly the College of Education developed a "SAGIP NUTRI-PACK" a food supplement which contains corn, mung bean, sesame fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder.
Combining these mixtures available local products can be an alternative ingredient in the productions of Buchi. Buchi is a popular, delicious and satisfying snack that is perfect for any time of day. It is a great source of carbohydrates and protein, which can help provide energy especially for school children.

With this, the proposed research delved on innovating food product locally known as "Buchi". The proposed study is entitled "Sensory Evaluation and acceptability of Corn (*Zea mays*)-Based Nutri-Snack for Junior High School" to determine its acceptability, nutritive value, return on investment and market analysis. This undertaking generally aimed to innovate a supplementary snack for school-based feeding program and contribute on the attainment of the Sustainable Development Goals specifically on SDG 1 No Poverty, SDG 2 Zero Hunger, SDG 3 Good Health and Well-being, SDG 4 Quality Education, SDG 8 Decent Work and Economic Growth and SDG 12 Responsible Consumption and Production.

OBJECTIVE/ STATEMENT OF THE PROBLEM

Generally, the study aimed to determine the acceptability and nutritive value of Sensory Evaluation and Acceptability of Corn-Based Nutri-Snack for Junior High School.

Specifically, it aimed to answer the following:

1. Which among the five treatments is more acceptable in terms of color/appearance, odor/aroma, taste/flavor, texture, and general acceptability?
2. What is the Acceptability Consumer Index (ACI) of the different treatments?
3. What is the nutritive value of the Corn-Based Nutri-Snack?
4. What is the Return-on-Investment (ROI) computed for the different treatments?
5. Which among the five treatments is more marketable for Junior High School students?

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

METHODOLOGY

Collection and Preparation of Materials

The Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder was obtained at ISU CED Cafeteria, Echague, Isabela. The buchi is prepared using the proportion of Corn-Based Nutri-Snack with the ratio 250g, 500g, 750g and 1000g for the treatment samples. The flowchart for making buchi is shown in Figure 2.

In a mixing bowl, sift and combine the flour and other dry ingredients. Put the water then mix well. Separate the dough into individual pieces and roll each individual piece of dough until a spherical (round) shape is formed. Press the center of the spherical dough until the shape becomes concave put the cube size cheese then seal the dough and roll it once more until the shape is spherical. Place the sesame seeds in a bowl then roll the sphere-shaped dough over it.

Heat the pan and pour-in the cooking oil. When the cooking oil is very hot, deep fry the dough until the sesame seed's color turns golden brown. Remove the cooked buchi from the pan and drain excess oil.
Allow the Buchi balls to cool completely before packaging. Place them in small, clear plastic box. Seal the packaging securely to keep the Buchi fresh.

The same procedure was done to the experimental products in using separate cooking utensils as to eliminate contaminations which will affect the organoleptic characteristics of the product.

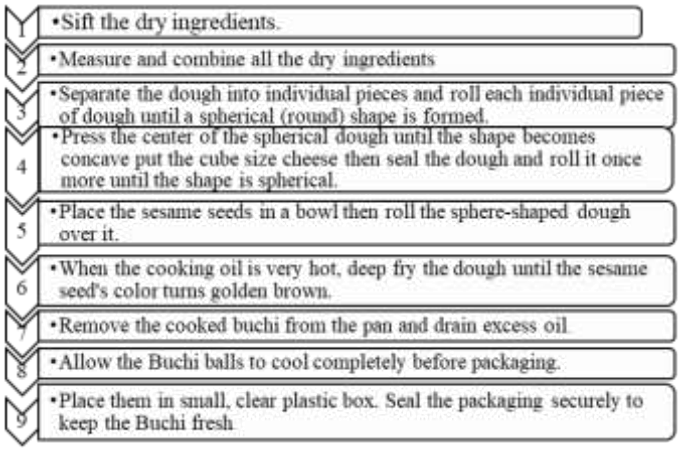


Fig. 2 Flow Chart in Cooking Buchi Corn-Based Nutri-Snack

Treatment of the Study

The proportions of ingredients of Buchi Corn-Based Nutri-Snack for in this study were the same except for the main ingredient which is the glutinous flour. Different ratio of Buchi Corn-Based Nutri-Snack was used as the main ingredients in making buchi. The treatment of this study are as follows:

T1 = Commercial Glutinous Flour
T2 = 25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder (250g), 75%Glutinous Flour (750g)
T3= 50%Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder (500g), 50%Glutinous Flour (500g)
T4 = 75% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder (750g), 25%Glutinous Flour (250g)
T5 = 100% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder (1000g), Glutinous Flour (0g)

Nutrient Analysis

Treatments was subjected to nutrient analysis conducted at the Regional Food Technology Development and Incubation Center, Integrated Laboratory Division of the Department of Agriculture Regional Government Center, Carig Sur, Tuguegarao City, Cagayan. The nutrients that were analyzed were Crude Protein, Crude Fiber, Crude fat, Moisture and Ash.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

Sensory Evaluation

Sensory Evaluation was conducted at the Food Processing Laboratory Room, Jones Rural School, Jones, Isabela to determine the acceptability of the experimental product in terms of color/appearance, odor/aroma, taste/flavor, texture, and general acceptability of Buchi Corn-Based Nutri-Snack. The instrument for data gathering made use of score sheet using the 9-Point Hedonic Scale.
The range of scale is interpreted as follows:

9	8.50 – 9.00	Like Extremely
8	7.50 – 8.49	Like Very Much
7	6.50 – 7.00	Like Moderately
6	5.50 – 6.49	Like Slightly
5	4.50 – 5.49	Neither Like nor Dislike
4	3.50 – 4.49	Dislike Slightly
3	2.50 – 3.49	Dislike Moderately
2	1.50 – 2.49	Dislike Very Much
1	1.00 – 1.49	Dislike Extremely

A sensory panel were composed of fifty (50) individuals. The qualification of the panelists in terms of age should be 12-16 years old. They will be also screened to be non-smokers, not liquor drinkers, and in good health during the sensory evaluation.

The treatment samples of serving of Buchi Corn-Based Nutri-Snack, were subjected to sensory evaluation by the panelists. The panelists were requested to sensory evaluate keenly and rate the treatment samples as t its color/appearance, odor/aroma, taste/flavor, texture and general acceptability following the Hedonic scale ratings. The respondents were required to rinse their mouth before tasting each sample. This was strictly observed as a standard procedure to ensure the credibility and validity of the result of the study.

Cost and Return Analysis

Cost analysis was performed to determine the economic feasibility of the product if it will be sold in the school canteen/market. This will be done by listing down all the cost incurred in producing the different proportion of Buchi Corn-Based Nutri-Snack and computing the unit cost and the return on investment (ROI) per treatment.

Market Analysis

Market Analysis was conducted at the Jones Rural School Canteen, Junior High School, Jones, Isabela to determine the marketability of the Buchi Corn-Based Nutri-Snack among Junior High School students. The instrument for data gathering made use of score sheet using the 5-Point Hedonic Scale.
The range of scale is interpreted as follows:

5	4.50 – 5.00	Extremely Desirable
4	3.50 – 4.49	Very Desirable
3	2.50 – 3.49	Moderately Desirable
2	1.50 – 2.49	Slightly Desirable
1	1.00 – 1.49	Not Desirable

A market analysis was composed of two hundred (200) individuals consisting of 40 panelists per treatment thru quota sampling. The qualification of the panelists in terms of age should be 12-16 years old.

The panelists were requested to evaluate the market analysis tool following the Hedonic scale ratings stated above.

Statistical Data Analysis

The data gathered were tallied, tabulated, organized and analyzed with the following statistical treatments:

1. Frequency and Tally Percent. These statistical measures were used to tabulate the acceptability and marketability of the product.
2. Arithmetic and Weighted Mean. This measure was used to get the average of the acceptability and marketability of the product

RESULTS

I. Degree of Acceptability

Color/Appearance. Table 4 shows the degree of acceptability of Corn-Based Nutri-Snack in terms of color or appearance by the respondents.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

Table 4. Degree of Acceptability in terms of Color or Appearance of Corn-Based Nutri- Snack

TREATMENT	MEAN	QD
T_1 – Commercial Glutinous Flour	7.68	Like very much
T_2 – 25% Corn-Based Sagip Nutri-pack, 75% Glutinous flour	7.58	Like very much
T_3 – 50% Corn-Based Sagip Nutri-pack, 50% Glutinous flour	6.96	Like moderately
T_4 – 75% Corn-Based Sagip Nutri-pack, 25% Glutinous flour	6.96	Like moderately
T_5 – 100% Corn-Based Sagip Nutri-pack	6.48	Like moderately
SD	0.49	
CV (%)	6.96	

(t = 32.13, P 0.00)

The degree of acceptability in terms of color or appearance of Corn-Based Nutri-Snack as alternate to commercial flour in the production of Buchi Corn-Based Nutri-Snack significantly improved the color or appearance of the product with approximately by 0.49 units. There is strong evidence (t = 32.13, P 0.00) that Corn-Based Sagip Nutri-Pack affected the color of the product thus influenced its acceptability.

In terms of color or appearance, Treatment 1 (Commercial Buchi) obtained the highest degree of acceptability with a mean of 7.68 followed by Treatment 2(25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) with a mean of 7.58 which were described as" Like Very Much".

Based on the result, it can be gleaned that Treatment 1 (Commercial) and Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) lies on the same qualitative description of "like very much" which indicates that they are comparable in terms of color/appearance.

Moreover, Treatment 3 (50% Corn-based Sagip Nutri-pack) with a mean of 6.96, Treatment 4 (75% Corn-based Sagip Nutri-pack) gained a mean 6.96, and lastly, Treatment 5 (100% Corn-based Sagip Nutri-pack) acquired a mean of 6.48. These three treatments were labelled as "Like moderately".

Taste/Flavor. Table 5 presents the degree of acceptability in terms of taste or flavor of Corn-Based Nutri-Snack by the respondents.

Table 5. Degree of Acceptability in terms of Taste or Flavor of Corn-Based Nutri-Snack.

TREATMENT	MEAN	QD
T_1 – Commercial Glutinous Flour	8.00	Like very much
T_2 – 25% Corn-Based Sagip Nutri-Pack, 75% Glutinous flour	8.02	Like very much
T_3 – 50% Corn-Based Sagip Nutri-Pack, 50% Glutinous flour	7.60	Like very much
T_4 – 75% Corn-Based Sagip Nutri-Pack, 25% Glutinous flour	6.70	Like moderately
T_5 – 100% Corn-Based Sagip Nutri-Pack	5.72	Like slightly
SD	0.44	
CV (%)	13.72	

(t = 16.29, P 0.00)

The degree of acceptability in terms of taste or flavor of Corn-Based Nutri-Snack as alternate to commercial flour in the production of Buchi Corn-Based Nutri-Snack significantly improved the color or appearance of the product with approximately by 0.44.

It can be seen that Treatment 1 (Commercial Glutinous Flour), Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder), and Treatment 3 (50% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) have the same description, "Like very much" with means 8.00, 8.02 and 7.60, respectively.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

Moreover, Treatment 4 (75% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) obtained a mean of 6.70 which described as "Like moderately, and lastly Treatment 5 (100% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) obtained a mean of 5.72.was described as "Like Slightly".

In terms of Flavor/Taste, Treatment 2 obtained the highest mean which indicate that respondents prefer this treatment over the other treatments. The components of the Nutri-Snack might be a factor influencing their preference as it contains mixtures of corn, turmeric, malunggay, mung beans, sesame seeds and Cacao pod husk powder.

Odor/Aroma. Table 6 shows the degree of acceptability in terms of odor or aroma of Corn-Based Nutri-Snack.

Table 6. Degree of Acceptability in terms of Odor or Aroma of Corn-Based Nutri-Snack.

TREATMENT	MEAN	QD
T_1 – Commercial Glutinous Flour	8.10	Like very much
T_2 – 25% Corn-Based Sagip Nutri-Pack, 75% Glutinous flour	8.06	Like very much
T_3 – 50% Corn-Based Sagip Nutri-Pack, 50% Glutinous flour	7.12	Like moderately
T_4 – 75% Corn-Based Sagip Nutri-Pack, 25% Glutinous flour	6.70	Like moderately
T_5 – 100% Corn-Based Sagip Nutri-Pack	6.12	Like slightly
SD	0.39	
CV (%)	11.94	

(t = 18.73, P 0.00)

The degree of acceptability in terms of odor or aroma of Corn-Based Nutri-Snack as alternate to commercial flour in the production of Buchi Corn-Based Nutri-Snack significantly improved the color or appearance of the product with approximately by 0.39 units. There is strong evidence (t = 18.73, P 0.00) that Corn-Based Sagip Nutri-Pack affected the odor or aroma of the product thus influenced its acceptability.

As shown in the table, Treatment 1 obtained the mean of 8.10 and followed by Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) with a mean of 8.06. Both treatments are categorized under the "Like Very Much" qualitative description which signifies comparable odor or aroma.

Moreover, Treatments 3 and 4 described as "Like moderately" with their means 7.12 and 6.70. Lastly Treatment 5 obtained a mean 6.12which described as "Like slightly".

Texture. Table 7 shows the degree of acceptability in terms of texture of Corn-Based Nutri-Snack.

Table 7. Degree of acceptability in terms of Texture of Corn-Based Nutri-Snack.

TREATMENT	MEAN	QD
T_1 – Commercial Glutinous Flour	8.04	Like very much
T_2 – 25% Corn-Based Sagip Nutri-Pack, 75% Glutinous flour	7.94	Like very much
T_3 – 50% Corn-Based Sagip Nutri-Pack, 50% Glutinous flour	7.18	Like moderately
T_4 – 75% Corn-Based Sagip Nutri-Pack, 75% Glutinous flour	6.66	Like moderately
T_5 – 100% Corn-Based Sagip Nutri-Pack	6.00	Like slightly
SD	0.39	
CV (%)	12.05	

(t = 18.56, P 0.00)

The degree of acceptability in terms of texture of Corn-Based Nutri-Snack as alternate to commercial flour in the production of Buchi Corn-Based Nutri-Snack significantly improved the color or appearance of the product with approximately by 0.39 units.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

There is strong evidence (t = 18.56, P 0.00) that Corn-Based Sagip Nutri-Pack affected the texture of the product thus influenced its acceptability.

As shown in the table, Treatment 1 obtained the highest mean of 8.04 and followed by Treatment 2 (25% Corn-based Sagip Nutri-Pack) with a mean of 7.94. Both treatments were described as "Like Very Much", making the two treatments comparable to each other.

Furthermore, Treatment 3 (50% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) with a mean 7.18, Treatment 4 (75% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) which obtained 6.66. These treatments were described as "Like moderately".

Lastly, Treatment 5 (100% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) described as "Like slightly". This result is due to the fact that the contents of Corn-Based Sagip Nutri-Pack were gluten free causing the product not to form on its desired shape. With this, it is not recommended to utilize 100% Corn-Based Sagip Nutri-Pack for the production of Buchi.

General Acceptability. Table 8 shows the degree of General Acceptability of Corn-Based Nutri-Snack by the respondents.

Table 8. Degree of General Acceptability of Corn-Based Nutri-Snack.

TREATMENT	MEAN	QD
T_1 – Commercial Glutinous Flour	8.12	Like very much
T_2 – 25% Corn-Based Sagip Nutri-Pack, 75% Glutinous flour	8.24	Like extremely
T_3 – 50% Corn-Based Sagip Nutri-Pack, 50% Glutinous flour	7.60	Like very much
T_4 – 75% Corn-Based Sagip Nutri-Pack, 25% Glutinous flour	7.00	Like moderately
T_5 – 100% Corn-Based Sagip Nutri-Pack	6.12	Like slightly
SD	0.39	
CV (%)	11.80	

(t = 18.95, P 0.00)

The degree of general acceptability of Corn-Based Nutri-Snack as alternate to commercial flour in the production of Buchi Corn-Based Nutri-Snack significantly improved the color or appearance of the product with approximately by 0.39 units. There is strong evidence (t = 18.95, P 0.00) that Corn-Based Sagip Nutri-Pack affected the general acceptability of the product thus, influenced its acceptability.

It can be seen in the table that Treatment 2 obtained the highest mean of 8.12 which described as "Like extremely". This finding shows that respondents prefer this treatment that contains 25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder. The uniqueness of the color/appearance, odor/aroma, flavor/taste and texture contribute to the degree of general acceptability of the product. The result is a good indication that the Nutri-Snack has a potential market value.

Treatment 1 with a mean 8.12 and Treatment 3 (50% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) gained a mean 7.60 were described as "Like very much", respectively. Moreover, Treatment 4 with a mean 7.00 was described as "Like moderately" and Treatment 5 obtained mean 6.12 which described as "Like slightly".

II. ACCEPTABILITY CONSUMER INDEX

Acceptability Consumer Index (ACI). Table 9 shows the acceptability consumer index (ACI) of Corn-Based Nutri-Snack.

Table 9. Acceptability Consumer Index (ACI) of Corn-Based Nutri-Snack.

	Appearance		Aroma		Texture		Taste		ACI	RANK
T1	7.68	1.69	8.10	1.54	8.04	1.57	8.00	3.16	7.96	1
T2	7.58	1.67	8.06	1.53	7.94	1.55	8.02	3.17	7.92	2
T3	6.96	1.53	7.12	1.35	7.18	1.40	7.60	3.00	7.29	3
T4	6.96	1.53	6.70	1.27	6.66	1.30	6.70	2.65	6.75	4
T5	6.48	1.43	6.12	1.16	6.00	1.17	5.72	2.26	6.02	5

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

The ranking of treatments indicates the acceptability consumer index of Corn-Based Nutri-Snack. Treatment 1 achieved the highest ACI of 7.96 followed closely by Treatment 2 with 7.92. This finding shows that the only difference of Treatment 1 (Commercial Glutinous Flour) and Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) are only 0.04.

Furthermore, Treatment 3 obtained the third highest rank with an ACI of 7.29. Treatment 4 and 5, had lower rankings but still with ACI 6.75 and 6.01 respectively.

III. NUTRITIVE VALUE

The nutrient facts of Corn-Based Nutri-snack provided by the Regional Food Technology Development and Incubation Center can be gleaned that Treatment 1(Commercial Glutinous Flour) has lowest energy (kcal) of 78 among all other treatments. With the same serving size, Treatment 2 gained higher energy (kcal) of 89 versus Treatment 1. This result is attributed to the components of the Nutri-Snack. With the objective of improving the nutrition of the learners through the school-based feeding program, treatment 2 is a viable option among other snacks. This finding also coincides on the general acceptability of Treatment 2 gaining highest mean through sensory evaluation of the SBFP recipients.

As cited in the study of Ahmed et al.,2022 “Eating a balanced diet that contains the recommended number of fruits, vegetables, grains and protein-rich foods is the best way to prevent malnutrition. Receiving a supplement and the addition of micronutrients or fortified foods into diets can also help prevent malnutrition.”

Moreover, Treatment 3 gained the highest energy (kcal) of 93% and Treatment 4 gained a 92% energy(kcal). These treatments also gained a high energy because it contains more percentage of the Nutri-Pack.

Furthermore, in terms of total fat, total carbohydrates and total protein, all treatments contain mostly the same amounts.

Table 10. Nutrient Content of Corn-Based Nutri-Snack based on the Regional Feed Chemical Analysis Laboratory

Sample Description	Crude Protein	Crude Fiber	Crude Fat	Moisture	Ash
Commercial Buchi, T1	3.92	1.92	2.42	40.80	1.02
Buchi Corn-Based Nutri-Snack (25%), T2	4.12	1.65	5.38	36.07	1.31
Buchi Corn-Based Nutri-Snack (50%), T3	5.34	2.15	6.07	33.35	1.28
Buchi Corn-Based Nutri-Snack (75%), T4	5.18	1.88	6.91	35.14	1.60

As shown in the table, Treatment 1 (Commercial Buchi) has 3.92% of Crude Protein, 1.92% of Crude Fiber, 2.42% of Crude Fat, 40.80 % of Moisture, 1.02% of Ash ; Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) it has 4.12% of Crude Protein, 1.65% of Crude Fiber, 5.38% of Crude Fat, 36.07 % of Moisture, 1.31% of Ash ;Treatment 3 (50% of Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) it has 5.34% of Crude Protein, 2.15% of Crude Fiber, 6.07% of Crude Fat, 33.35 % of Moisture, 1.28% of Ash ; Treatment 4 (75% of Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) it has 5.18% of Crude Protein, 1.88% of Crude Fiber, 6.91% of Crude Fat, 33.14 % of Moisture, 1.60% of Ash.

Furthermore, Treatment 5 (100% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) was not tested by Regional Food Technology Development and Incubation Center because the product did not form its desired shape, and they additionally advised there is no need to test the nutritional value since the product is not commercially viable.

The result indicates that the higher ratio of Corn-Based Nutri-Snack, the higher its nutrient value.

III. COST AND RETURN ANALYSIS

Cost of Production. Table 11 shows the cost production of the five treatments of Corn-Based Nutri-Snack in terms of ingredients and operating expenses

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

Table 11. Cost of production of Corn-Based Nutri-Snack

MARKET LIST	Treatments				
	T1	T2	T3	T4	T5
A. Ingredients					
CORN-BASED NUTRI-SNACK	0.00	8.07	16.15	24.23	32.3
Glutinous Flour	6.92	5.19	3.46	1.73	0.00
Sweet Potato	2.31	2.31	2.31	2.31	2.31
Salt	0.01	0.01	0.01	0.01	0.01
White Sugar	2.7	2.7	2.7	2.7	2.7
Water	0.72	0.72	0.72	0.72	0.72
Cheese	9.26	9.26	9.26	9.26	9.26
Sesame	3.46	3.46	3.46	3.46	3.46
Subtotal	25.38	31.72	38.07	44.42	50.76
B. Operating Expenses					
Cooking Oil	5.00	5.00	5.00	5.00	5.00
Packaging Material	5.00	5.00	5.00	5.00	5.00
Label	2.00	2.00	2.00	2.00	2.00
Gas	5.00	5.00	5.00	5.00	5.00
Fare	8.00	8.00	8.00	8.00	8.00
Subtotal	25.00	25.00	25.00	25.00	25.00
Total Cost (Php)	50.38	56.72	63.07	69.42	75.76

For treatment 1, the amount spent was Php 50.38, for treatment 2 Php 56.72, treatment 3 Php 63.07, treatment 4, Php 69.42 and treatment 5, Php 75.76. The amount spent in producing 8 pieces of Buchi Corn-Based Nutri-Snack varies based on the amount of proportion of ingredients used in each treatment.

Return on Investment. Table 12 shows the return on investment among all the five treatments of Corn-Based Nutri-Snack.

Table 12. Summary Computation of Return and Investment

PARTICULARS	Treatments				
	T1	T2	T3	T4	T5
Total Production Cost (Php)	50.38	56.72	63.07	69.42	75.76
Number of Box (12 pieces Buchi Corn-Based Nutri-Snack)	3	3	3	3	3
Selling Price	28.00	28.00	28.00	28.00	28.00
Total Sales	84.00	84.00	84.00	84.00	84.00
Total Income	33.62	27.28	20.93	14.58	8.24
ROI (*Total Income//Total Production Cost*) *100	66.73%	48.10%	33.19%	21.00%	10.88%

The summary computation of return on investment shown in Table 12 indicates that treatments 2 garnered 48.10%, Treatment 3 obtained 33.19%, Treatment 4 obtained 21%, and Treatment 5 received 10.88% return on investment. This indicates that these treatments, which contain Corn-Based Sagip Nutri-Pack fortified with cacao pod husk, malunggay, and turmeric powder have a comparable return on investment to treatment 1 with 100% Commercial Glutinous flour, that gained a 66.73% ROI. This suggests that utilizing a more nutritious snack is a better option considering the percentage of the return on investment.

IV. MARKET ANALYSIS

Market Analysis. Table 13 shows the market analysis of the five treatments by consumer preferences.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

Table 13. Market Analysis of Corn-Based Nutri-Snack

TREATMENTS	N	Mean	Description
T_1 – Commercial Flour	61	4.87	Extremely desirable
T_2 – 25% corn flour, 75% Glutinous flour	95	4.53	Extremely desirable
T_3 – 50% corn flour, 50% Glutinous flour	36	3.86	Very Desirable
T_4 – 75% corn flour, 725% Glutinous flour	8	3.25	Moderately Desirable
T_5 – 100% corn flour	0	-	No taker
TOTAL	200		

As shown in the table, Treatment 1 obtained the highest mean of 4.87 with 67 consumers followed by Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) with a mean of 4.53 with 95 consumers. Both treatments were described as "Extremely Desirable". The result indicates an extreme desirability of consumers in choosing Treatment 2 as it contains nutritious ingredients.

Furthermore, Treatment 3 (50% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) garnered a mean of 3.86 with 36 consumers described as "Very Desirable", Treatment 4 (75% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) which obtained 3.25 with 8 consumers described as "Moderately Desirable". Lastly, Treatment 5 (100% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) no consumers because the finished product did not form as exactly it should be in a commercial Buchi.

SUMMARY

This study was conducted to determine the sensory evaluation and acceptability of Corn-Based Nutri-Snack for Junior High School as well its marketability of the product, conducted within the months of January - May 2024.

Sensory Evaluation was conducted at the Food Processing Laboratory Room, Jones Rural School, Jones Isabela to determine the acceptability of the experimental product, in terms of color/appearance, taste or flavor, odor/aroma, texture and general acceptability. The instrument for data gathering made use of score sheet using the 9-Point Hedonic Scale. A Sensory panel composed of 50 individuals 33 female and 17 male who were randomly selected among the students. In terms of age, the respondents belong to the youth category as indicated by the grand mean of 15 years old, and majority are females comprising 66% while males were only 34%.

Results of the sensory evaluation were statistically analyzed using the one-way classification of the Analysis of Variance (ANOVA). F test, mean, and descriptive statistics were used to determine if there is a significant difference among the treatments in terms of color/appearance, taste/flavor, odor/aroma, texture and general acceptability.

Results showed that in terms of color/appearance, Treatment 1 (Commercial Buchi) and Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) are both liked very much by the 50 respondents.

In terms of taste/flavor, Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) obtained the highest degree of acceptability with a mean 8.02 with a descriptive rating of Like very much.

The most like treatments in terms of odor/aroma with a descriptive rating of Like very much are both treatment 1 and 2.

In terms of texture, Treatment 1 obtained the highest mean of 8.04 and followed by Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) with a mean of 7.94. Both treatments were described as Like Very Much while Treatment 5 (100% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) with a mean 6.00 which described as "Like slightly". This result is due to the fact that the contents of Corn-Based Sagip Nutri-Pack like the Corn and Mung bean are gluten free causing the product not to form on its desired shape.

In General Acceptability of Corn-Based Nutri-Snack Treatment 2 (Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) obtained the highest mean of 8.24 described as "Like Very Much".
In the Acceptability Consumer Index of Corn-Based Nutri-Snack. Treatment 1 achieved the highest ACI of 7.96 followed closely by Treatment 2 with 7.92. The only difference of Treatment 1 (Commercial Glutinous Flour) and Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) are only 0.04.

SJIF Impact Factor (2024): 8.675| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 6 | June 2024 - Peer Reviewed Journal

As regards to the nutrient content of the product, Treatment 1(Commercial Glutinous Flour) has lowest energy (kcal) of 78 among all other treatments. Furthermore, in terms of total fat, total carbohydrates and total protein, all treatments contain mostly the same amounts except for Treatment 5 (5 (100% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) which was not tested by Regional Food Technology Development and Incubation Center because the product did not form its desired shape, and they additionally advised there is no need to test the nutritional value since the product is not commercially viable.

The Market Analysis of the product was conducted at the Jones Rual School Junior High School Canteen and Food Laboratory SOTA Building. Result showed that Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) obtained a mean of 4.53 described as Extremely desirable with 95 out of 200 consumers.

The return on investments for treatment 2 garnered 48.10%, Treatment 3 obtained 33.19%, Treatment 4 obtained 21%, and Treatment 5 received 10.88% which contain Corn-Based Sagip Nutri-Pack fortified with cacao pod husk, malunggay, and turmeric powder have a comparable return on investment to treatment 1 with 100% Commercial Glutinous flour, that gained a 66.73% ROI.

CONCLUSION

Based on the results of the study, the following conclusions were formulated:

1. In terms of degree of acceptability, the study reveals that the respondents prefer treatment 2 that contains 25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder. The uniqueness of the color/appearance, odor/aroma, flavor/taste and texture contribute to the degree of general acceptability of the product. Moreover, Treatment 5 (100% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) described as “Like slightly”. This result is due to the fact that the contents of Corn-Based Sagip Nutri-Pack were gluten free causing the product not to form on its desired shape.
2. The acceptability consumer index of Corn-Based Nutri-Snack, Treatment 1 achieved the highest ACI of 7.96 followed closely by Treatment 2 with 7.92. The only difference of Treatment 1 (Commercial Glutinous Flour) and Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) is only 0.04.
3. As regards to the nutritive value, Treatment 1 has the lowest energy while other treatments have higher energy. This result is attributed to the components of the Nutri-Snack. Furthermore, in terms of total fat, total carbohydrates, and total protein, all treatments contain mostly the same amounts.
4. The return on investments for treatment 2 which contain Corn-Based Sagip Nutri-Pack fortified with cacao pod husk, malunggay, and turmeric powder have a comparable return on investment to treatment 1 with 100% Commercial Glutinous flour.
5. In the Market Analysis of the product showed that Treatment 2 is more favorable than Treatment 1 in terms of consumer preferences.

RECOMMENDATION

Based on the results of the study, the following recommendations are given:

1. Treatment 2 (25% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) is recommended to be introduced to the market since it was rated as one of the most liked among the five treatments and that treatments with Nutri-Pack are a more viable option among other snacks.
2. Treatment 5 (100% Corn-Based Sagip Nutri-Pack Fortified with Cacao Pod Husk (CPH), Malunggay, and Turmeric Powder) is not recommended to utilize for the production of Buchi Corn-Based Nutri-Snack due to the fact that the gluten-free contents of Corn-Based Sagip Nutri-Pack.
3. The product may be introduced in the nearby locality for additional source of income of residents and local food processors.
4. The product may be utilized as a School Based Feeding to the students due to its nutrient contents.
5. The developed Information, Education and Communication material for the consumers must be utilized and distributed as a guide in the production of Corn-Based Nutri-Snack.
6. The product may subject to the application of IPOPHL for intellectual property protection.
7. Further study is recommended to arrive for a more conclusive and reliable result.