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PROXIMATE COMPOSITION AND ACCEPTABILITY OF EGGPLANT (*Solanum melongena)* NUTRI-CHIPS

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Abstract

This study focused on the development and evaluation of eggplant (*Solanum melongena*) Nutri-chips using varying proportions of cornstarch, flour, and corn-based Sagip Nutri-Pack. A Completely Randomized Design (CRD) with three treatments was used to assess differences in sensory attributes and nutritional composition. The production process involved standardized preparation, cooking, and sensory evaluation procedures. Forty (40) BTLED students from Isabela State University-Echague Campus participated in the sensory evaluation, rating the products based on appearance, aroma, flavor, texture, and general acceptability using a 9-point Hedonic Scale.

Results from ANOVA indicated that there was a significant difference in appearance acceptability ($p < 0.01$), with Treatment 2 receiving the highest mean score. However, no significant differences were observed among treatments in terms of aroma, flavor, texture, and overall acceptability, although numerical variations in mean scores were noted. Nutritional analysis revealed that all treatments met acceptable ranges for crude protein, crude fiber, crude fat, moisture, and ash content based on standard values. Treatment 3 had the highest fat and moisture content, while Treatment 1 had the highest protein content. Cost analysis further confirmed the economic feasibility of the product. Overall, the study suggests that eggplant Nutri-chips are a nutritionally acceptable and market-viable snack product. Treatment 2 was the most preferred in terms of appearance, but all treatments were deemed generally acceptable. The study recommends further analysis of the product's vitamin, mineral content and shelf life to ensure nutritional value and stability.

INTRODUCTION

The study on Eggplant (*Solanum melongena*) chips belongs to the food industry aligned with SDG No. 9 (Industry, Innovation and Infrastructure), specifically in snacks. The business offers healthy snacks made from eggplant, which is rich in vitamin A (Thiamine), Vitamin C (Ascorbic acid), fiber, and potassium. Eggplants are also used in a wide variety of

food products, such as toppings and ingredients. Because of the numerous health advantages, eggplant demand is expected to increase during the projection period (Link, 2017)

This study aligns with several Sustainable Development Goals (SDGs). This study supports SDG No. 3 (Good Health and Well-Being). Although experimenting with food might be exciting, its effects on consumer desire and health outcomes are still mostly unanticipated. It is essential to comprehend how food experimentation affects dietary decisions, nutritional intake, and general well-being.

Eggplants have long been recognized for their high nutritional value. According to Kaur and Kapoor (2001), eggplant contains significant amounts of antioxidants, including phenolic compounds, which help combat oxidative stress. Similarly, Mishra et al. (2015) emphasized that eggplant consumption contributes to the prevention of cardiovascular diseases due to its bioactive compounds. Furthermore, Naseri et al. (2017) reported that eggplant's Nasunin content has neuroprotective effects, protecting brain cells from oxidative damage.

The acceptability of eggplants (*Solanum melongena*) as chips is investigated in this study. This meal can be served as an appetizer or snack and has a unique taste profile derived from the mild and creamy texture of eggplant. Gaining knowledge about this dish's history will help appreciate its origins, cultural value, and possible health benefits.

Even while chips are mostly manufactured from potatoes, corn, and other grains and starches from different edible plants, which everyone loves to eat, eggplant (*Solanum melongena*) is usually prepared and eaten as one of the major elements in various vegetable dishes and cuisine. The purpose of this study was to ascertain whether or not eggplant chips are a healthier ingredient than raw eggplant. Consequently, the primary goals of this study are to ascertain the acceptance of eggplant chips in terms of texture, taste, look, and aroma, as well as the benefits of eating them for persons other than children.

The increasing popularity of functional foods has led to research on alternative snack products. According to Slavin (2013), fiber-rich foods such as eggplant contribute to gastrointestinal health and lower cholesterol levels. Likewise, Mozaffarian et al. (2011) suggest that increasing fruit and vegetable consumption can help prevent long-term weight gain. The WHO (2020) also emphasizes the importance of promoting healthy diets that reduce the risks of non-communicable diseases.

However, based on the general knowledge of proximate composition and acceptability studies, a study on the proximate composition and acceptability of eggplant chips would likely involve analyzing the nutritional content of the chips, including protein, fat, carbohydrates, fiber, and other nutrients. This study would also assess the sensory attributes of the chips, such as taste, texture, aroma, and overall acceptability, through sensory evaluation methods.

According to Nielsen (2010), proximate analysis is crucial in determining the nutritional composition of newly developed food products, ensuring they meet nutritional standards. AOAC (2019) provides the standardized methods used in determining proximate composition globally.

A simple and quick snack to prepare and share with loved ones is these eggplant chips. A fantastic provider of vitamins and minerals is eggplant. Compared to conventional potato

chips, which are extremely heavy in fat and have little health advantages, raw eggplants are higher in carbohydrates, fiber, protein, and vitamins (Link, 2017). Because they are high in fiber, which benefits our gastrointestinal systems, eggplants help facilitate better digestion (Diamond, 2018).

The development of eggplant chips can also serve as a way to minimize postharvest losses in eggplant production. The Philippine Statistics Authority (2021) reported that eggplant remains one of the top vegetable crops in the country, providing opportunities for value-added products such as chips. Palupi et al. (2019) argued that vegetable-based chips could improve economic opportunities while promoting healthier diets.

Additionally, the study also focuses on evaluating the acceptability of eggplant (*Solanum melongena*) chips among consumers. Consumer acceptability is crucial for the success of any food product in the market. By conducting sensory evaluations and surveys, researchers aim to understand consumers' preferences, taste, texture, and overall liking for eggplant chips. According to Stone and Sidel (2004), sensory evaluation is an essential method to ensure consumer satisfaction during food product development. Lawless and Heymann (2010) further support that sensory evaluation plays a crucial role in predicting market success.

Moreover, processing methods like vacuum frying help preserve nutritional quality while reducing oil content, as Santos et al. (2020) noted. Rahman et al. (2018) demonstrated that drying methods can maintain significant antioxidant properties in eggplant chips, making them suitable as functional snacks.

Statement of the Problem

This study aimed to determine the consumers' acceptability of Eggplant (*Solanum melongena*) Nutri-chips. Specially, it aimed to answer the following questions:

Specially, this study aimed to answer the following questions:

1. What is the level of consumers' acceptability of Eggplant (*Solanum melongena*) Chips in terms of:
    a. color /appearance;
    b. odor/aroma;
    c. taste/flavor;
    d. texture; and
    e. general acceptability?
2. What is the nutritional composition value of eggplant Nutri-chips in terms of:
    a. moisture;
    b. protein;
    c. fat;
    d. fiber and;
    e. Ash Vitamins
3. What is the return on investment (ROI) obtained from producing the different treatments of eggplant (*Solanum melongena*) Nutri-chips based on the cost analysis conducted?

METHODS

Research Design

This study utilized an experimental research design to determine the proximate composition and sensory acceptability of eggplant-based Nutri chips.

The preparation of Nutri-chips followed a standardized process, after which samples were analyzed for their moisture, protein, fat, fiber, and ash vitamins using standard laboratory procedures. To assess consumer acceptability, a sensory evaluation was conducted, where selected panelists rated the product based on color, odor, taste, texture, and general acceptability.

Materials

1. Ingredients

Table 1 shows the ingredients and quality of each used in producing Eggplant (*Solanum melongena*) Chips.

A Completely Randomized Design (CRD) was utilized in this study. Three (3) treatments were used, as shown in Table 1.

Among the ingredients, only the cornstarch, flour, and corn-based Sagip Nutri-Pack were varied. The rest of the ingredients were consistent in terms of content among the treatments.

Table 1. Ingredients used in Producing Eggplant Chips

Ingredients	T1	T2	T3
Eggplant	1000g	1000g	1000g
Cornstarch	400g	300g	200g
Flour	350g	250g	150g
Corn-Based Sagip Nutri-Pack	250g	450g	650g
Garlic Powder	3g	3g	3g
Salt	5g	5g	5g
Oil	280g	280g	280g
Black Pepper Ground	5g	5g	5g

2. Equipment, Tools, and Utensils

In preparing eggplant (*Solanum melongena*) chips, the measuring cup, measuring spoon, weighing scale, mixing bowls, plates, spoon, gas stove, tongs, paper towels, plastic gloves, basin, knife, and chopping board were the tools and equipment utilized.

Methods

The eggplant was washed and dried. The eggplant was sliced thinly into rounds using a sharp knife. The eggplant was placed in a large basin and soaked in cold water for 5 minutes. After 5 minutes, the eggplant was drained in a strainer. All the ingredients were combined on

a plate with the correct measurements. The eggplant was dipped in the cornstarch and then again in the breading. After dipping in the breading, the eggplant was placed and arranged on a plate before frying. The oil was heated, and when it boiled, the eggplant was added until it was cooked.

Research Flowchart

The flowchart illustrates the essential process of making eggplant (*Solanum melongena*) nutri chips and visualizes the steps needed to produce a successful output.

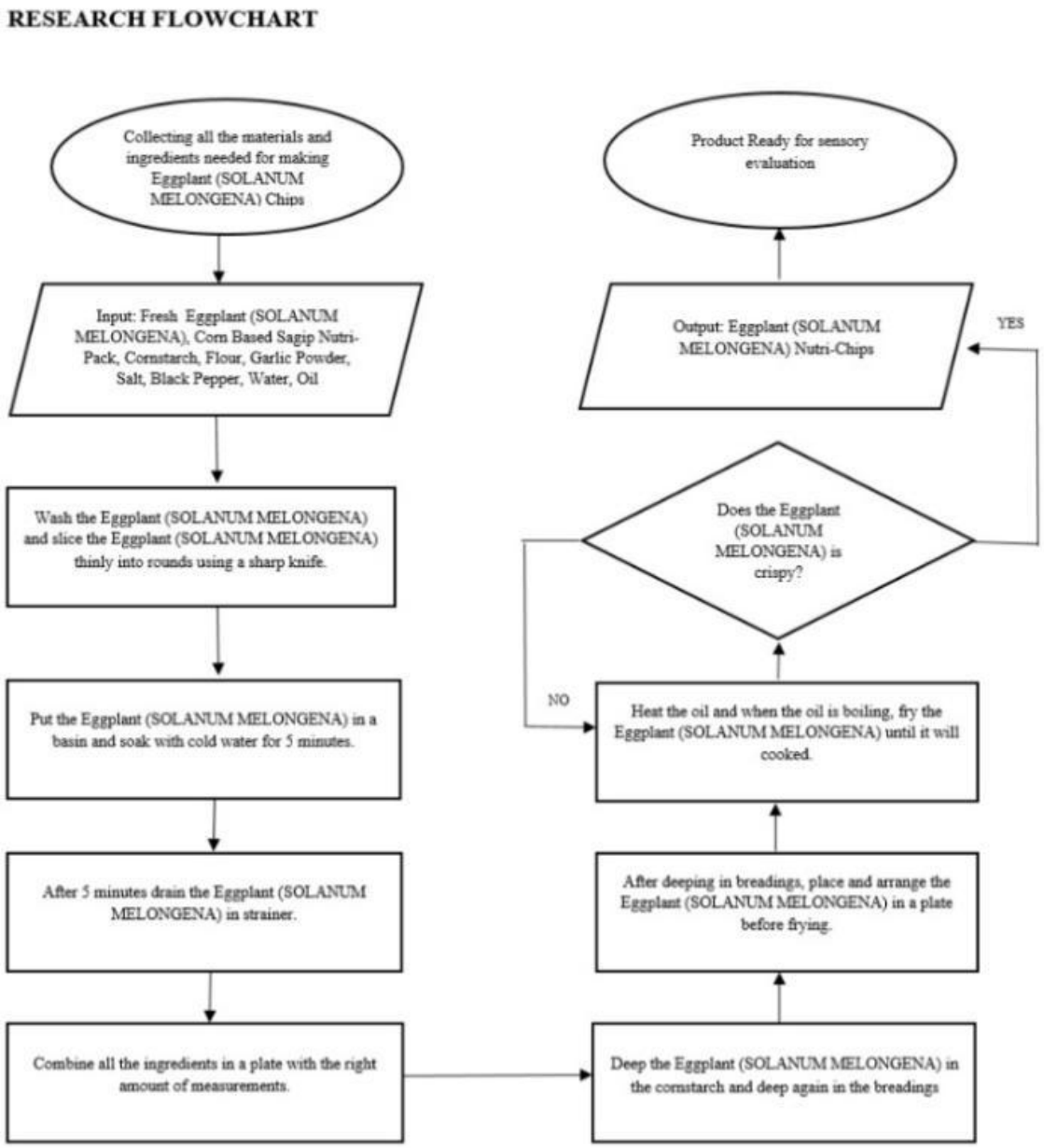

Figure 1. Flowchart of the General Procedure

Data Collection

A sensory evaluation was conducted to determine the acceptability of eggplant (*Solanum melongena*) chips in terms of taste, texture, appearance, aroma, and general acceptability. The product was evaluated by a group of 40 students. The selected respondents were 40 students of the Bachelor of Technology and Livelihood Education (BTLED) program at San Fabian, Echague, Isabela, whose ages ranged from 18 to 30 years old.

The instrument for data gathering was a score sheet using the 9-point Hedonic Scale. It was used because of its suitability in measuring product acceptance, with 9 as excellent or like extremely, 5 as neither like nor dislike, and 1 as very poor or dislike extremely. Numbers 1–9 were interpreted as follows.

9	Like extremely	4	Dislike slightly
8	Like Very Much	3	Dislike moderately
7	Like Moderately	2	Dislike very much
6	Like Slightly	1	Dislike extremely
5	Neither Like nor dislike		

Cost and Return Analysis

Cost analysis was carried out to determine the economic acceptability of the product if it were to be sold in the market. This was done by listing all the costs incurred in producing the different proportions of eggplant Nutri-chips and computing the unit cost and the return on investment (ROI) per treatment.

Statistical Data Analysis

The results of the sensory evaluation were statistically analyzed using one-way classification analysis. F-test, mean, and other statistics were used to determine if there was a significant difference among the treatments in terms of color/appearance, taste/flavor, odor/aroma, texture, and general acceptability.

RESULTS AND DISCUSSION

Level of Sensory Qualities of Eggplant (*Solanum melongena*) Nutri-Chips

A. Appearance/Color

The Analysis of Variance (ANOVA) in Table 2 revealed a significant difference in the acceptability of eggplant nutri-chips in terms of appearance ($p < 0.01$). Treatment 2 obtained the highest mean score of 7.00, which is interpreted as "Liked Moderately," and was statistically more acceptable in appearance than Treatment 3, which received the lowest mean score of 6.05 or "Liked Slightly."

However, Treatment 1, with a mean score of 6.47 ("Liked Slightly"), was not significantly different from either Treatment 2 or Treatment 3, suggesting an intermediate level of acceptability. These findings indicated that Treatment 2 was the most visually pleasing and preferred by the respondents. In contrast, Treatment 3 may have required further refinement to improve its visual appeal.

Table 2. Difference in the Acceptability of Eggplant Nutri-Chips in Terms of Appearance

Treatments	Mean	Description
Treatment 1	6.47 ab	Like Slightly
Treatment 2	7.00 a	Like Moderately
Treatment 3	6.05 b	Like slightly
ANOVA Result	**	Significant
C.V (%)	21.17	
LSD Value	1.97	

Odor/Aroma

Table 3. Difference in the Acceptability of Eggplant Nutri-Chips in Terms of Aroma

Treatments	Mean	Description
Treatment 1	6.53	Like Moderately
Treatment 2	6.70	Like Moderately
Treatment 3	6.50	Like slightly
ANOVA Result	ns	Not Significant
C.V (%)	20.14	

Table 3 revealed that all four treatments did not differ significantly in aroma acceptability based on the ANOVA analysis ($p = 0.7820$). The treatments were statistically similar in the respondents' preference for aroma. The mean aroma scores among the treatments ranged from 6.50 to 6.70, with Treatment 2 having the highest mean. Meanwhile, the lowest was recorded for Treatment 3.

Texture

Table 4. Difference in the Acceptability of Eggplant Nutri-Chips in Terms of Texture

Treatments	Mean	Description
Treatment 1	6.68	Like Moderately
Treatment 2	7.08	Like Moderately
Treatment 3	6.28	Like Moderately
ANOVA Result	ns	Not Significant
C.V (%)	19.65	

The ANOVA results in Table 4 showed that the treatments did not have a significant impact on texture acceptability at the 0.05 significance level ($p = 0.0554$). However, the p-value was close to the threshold, indicating a marginal difference in texture preferences among the treatments. The mean scores in Table 4 revealed that Treatment 2 had the highest texture rating, or "Liked Moderately," while Treatment 3 had the lowest, "Liked Slightly." These results suggest that although the differences were not statistically significant, there may have been a slight preference for Treatment 2 in terms of texture.

Flavor/Taste

The ANOVA in Table 5 demonstrated no significant differences in the acceptability of the eggplant chips among the three treatments ($p = 0.1931$) in terms of flavor. The sensory evaluation results for taste were comparable across treatments. As indicated, Treatment 2 was assessed by the participants as having the highest mean score, while Treatment 1 had the lowest. Despite these numerical differences, the lack of statistical significance suggested that taste was perceived similarly across all treatments.

Table 5. Difference in the Acceptability of Eggplant Nutri-Chips in Terms of Flavor

Treatments	Mean	Description
Treatment 1	6.23	Like Slightly
Treatment 2	6.93	Like Moderately
Treatment 3	6.43	Like slightly
ANOVA Result	ns	Not Significant
C.V (%)	23.00	

General Acceptability of Eggplant Chips

The results of the analysis of variance (ANOVA) are presented in Table 6, showing that the differences in the mean scores for the general acceptability of the treatments were not significant at the 0.05 level.

Table 6. Difference in the Acceptability of Eggplant Nutri-Chips in Terms of Flavor

Treatments	Mean	Description
Treatment 1	6.23	Like Slightly
Treatment 2	6.93	Like Moderately
Treatment 3	6.43	Like slightly
ANOVA Result	ns	Not Significant
C.V (%)	23.00	

The table shows the mean scores for each treatment. Treatments 3 and 1 were rated as the most acceptable, with mean scores of 6.82 and 6.80, respectively; both were rated as "Liked Moderately." On the other hand, Treatment 4 had the lowest mean score of $\mu = 6.50$. However, due to the low level of significance achieved in the ANOVA test, the differences between these values are considered small and do not indicate real differences in the acceptability of the treatments by the respondents.

In general, this means that all treatments were deemed equally acceptable by the respondents. The close approximation of the mean scores indicates that acceptability was fairly consistent across all treatments, and no particular treatment was evaluated as significantly more or less acceptable. This consistency may suggest that the treatments were relatively equal in terms of quality, effectiveness, or preference.

Nutritional Composition Values of all Eggplant Nutri-Chips Treatments through Proximate Analysis

Treatment 1

- Crude Protein (g/250g): The sample contained 7.52 g of crude protein per 250 g of sample. The method used was the Semi-Automatic Kjeldahl Method. The standard content range for crude protein is 15%.
- Crude Fiber (g/250g): The sample contained 3.16 g of crude fiber per 250 g of sample. The ANKOM Filter Bag Technique was used. The standard content range is 2% to 8%.
- Crude Fat (g/250g): The sample contained 30.79 g of crude fat per 250 g of sample. The ANKOM Filter Bag Technique was used. The standard content range is 20% to 40%.
- Moisture (g/250g): The sample contained 8.71 g of moisture per 250 g of sample. The Gravimetric Method was employed. The standard content range is 8%.
- Ash (g/250g): The ash content was 2.80 g per 250 g, measured using the Gravimetric Method. The standard content is 2%, indicating that the ash content is very close to the standard value.

Treatment 2

- Crude Protein (g/250g): The sample contained 6.98 g of crude protein per 250 g of sample. The Semi-Automatic Kjeldahl Method was used. The standard content range is 15%.
- Crude Fiber (g/250g): The sample contained 3.53 g of crude fiber per 250 g of sample. The ANKOM Filter Bag Technique was used. The standard content range is 2% to 8%.
- Crude Fat (g/250g): The sample contained 37.48 g of crude fat per 250 g of sample. The ANKOM Filter Bag Technique was used. The standard content range is 20% to 40%.
- Moisture (g/250g): The sample contained 11.61 g of moisture per 250 g of sample. The Gravimetric Method was used. The standard content range is 8%.
- Ash (g/250g): The sample contained 1.61 g of ash per 250 g of sample. The Gravimetric Method was used. The standard content range is 2%.

Treatment 3

- Crude Protein (g/250g): The sample contained 6.61 g of crude protein per 250 g of sample. The Semi-Automatic Kjeldahl Method was used. The standard content range is 15%.
- Crude Fiber (g/250g): The sample contained 3.62 g of crude fiber per 250 g of sample. The ANKOM Filter Bag Technique was used. The standard content range is 2% to 8%.
- Crude Fat (g/250g): The sample contained 39.88 g of crude fat per 250 g of sample. The ANKOM Filter Bag Technique was used. The standard content range is 20% to 40%.
- Moisture (g/250g): The sample contained 13.30 g of moisture per 250 g of sample. The Gravimetric Method was used. The standard content range is 8%.
- Ash (g/250g): The sample contained 1.55 g of ash per 250 g of sample. The Gravimetric Method was used. The standard content range is 2%.

Table 7. Nutritional Composition Values of all Eggplant Nutri-Chip Treatments

Sample Description	Parameter	Results	Methods	Standard content of each parameter
Treatment 1	Crude Protein (g/250g)	7.52	Semi-Automatic Kjeldahl Method	15%
	Crude Fiber (g/250)	3.16	ANKOM Filter Bag Technique	2 to 8%
	Crude Fat (g/250g)	30.79	ANKOM Filter Bag Technique	20 to 40%
	Moisture (g/250g)	8.71	Gravimetric Method	8%
	Ash (g/250g)	2.80	Gravimetric Method	2%
Treatment 2	Crude Protein (g/250g)	6.98	Semi-Automatic Kjeldahl Method	15%
	Crude Fiber (g/250)	3.53	ANKOM Filter Bag Technique	2 to 8%
	Crude Fat (g/250g)	37.48	ANKOM Filter Bag Technique	20 to 40%
	Moisture (g/250g)	11.61	Gravimetric Method	8%
	Ash (g/250g)	1.61	Gravimetric Method	2%
Treatment 3	Crude Protein (g/250g)	6.61	Semi-Automatic Kjeldahl Method	15%
	Crude Fiber (g/250)	3.62	ANKOM Filter Bag Technique	2 to 8%
	Crude Fat (g/250g)	39.88	ANKOM Filter Bag Technique	20 to 40%
	Moisture (g/250g)	13.30	Gravimetric Method	8%
	Ash (g/250g)	1.55	Gravimetric Method	2%

Cost and Return Analysis

The cost analysis in Table 8 reveals a progressive increase in the production cost across the three treatments of eggplant nutri-chips. Treatment 1 incurred the lowest total cost at ₱338.00, followed by Treatment 2 at ₱408.00, while Treatment 3 had the highest production cost at ₱488.00. The increase in cost is mainly attributed to the varying amount of Corn-Based Sagip Nutri-Pack, which increased from 100g in Treatment 1 to 300g in Treatment 3, as well as the reduction in cheaper ingredients like cornstarch and flour. Despite these changes, the quantity of other components like eggplant, oil, salt, and seasonings remained constant. This analysis provides critical insight for cost-efficient production planning, helping determine which treatment yields the best balance between cost and consumer acceptability.

Table 8. Cost Breakdown of Ingredients Used in the Production of Eggplant Nutri-Chips

Ingredients	Treatment		
	T1	T2	T3
Eggplant	100.00	100.00	100.00
Cornstarch	50.00	30.00	20.00
Flour	30.00	20.00	10.00
Corn-Based Sagip Nutri-Pack	100.00	200.00	300.00
Garlic Powder	10.00	10.00	10.00
Salt	5.00	5.00	5.00
Oil	30.00	30.00	30.00
Black Pepper Ground	3.00	3.00	3.00
Disposable paper saucer	10.00	10.00	10.00
Total Cost (Php)	338.00	408.00	488.00

Computation of Return on Investment (ROI)

The Return on Investment per production of Eggplant (*Solanum melongena*) Nutri-chips was computed, summarized, and shown in Table 9. The table showed that Treatment 1 had a Return-on-Investment of 49.42%, while Treatment 2 had 50%, and Treatment 3 had 50%.

Table 9. Return on Investment

Ingredients	Treatments		
	T1	T2	T3
Total Production Cost (Php)	338	408	488
Unit Cost = Total Production / No. of Packs	16.9	20.4	24.4
Selling Price Unit Cost x 50% + Unit Cost	25.35	30.6	36.6
Total Sale Selling Price x No. of Packs	507	612	732
Income = Total Sales – Total Production	169	204	244
ROI = Income x 100 / Total Production Cost	49.42%	50%	50%

CONCLUSION AND FUTURE WORKS

Based on the results of the study, the researcher concluded that Eggplant (*Solanum melongena*) Nutri-Chips were accepted by the consumer.

As for appearance, aroma, texture, taste, and general acceptability, there was a significant difference among the treatments. Treatment 2 (Eggplant 1000g, Cornstarch 300g, Flour 250g, Corn Based Sagip 450g, Garlic Powder 3g, Salt 5g, Vegetable Oil 280g, Black Pepper 5g) were the best treatments in terms of taste, texture, appearance, and aroma among the other treatments.

In terms of profit, the production of Eggplant nutri-chips, the treatment 2 (Eggplant 1000g, Cornstarch 300g, Flour 250g, Corn Based Sagip 450g, Garlic Powder 3g, Salt 5g, Vegetable Oil 280g, Black Pepper 5g) was more profitable for the business venture.

This study was successful in developing Nutri-Chips from Eggplant (*Solanum melongena*) with a thorough process that involved specific preparation, breading, and frying techniques. Consumer acceptability of texture, aroma, color, and general appeal of the Nutri-Chip products was assessed to determine the most preferred treatment from the tested variations. In addition to this, through proximate analysis, the treatments were found to contain the most accepted nutritional composition, with the economic value of the products evaluated through the return on investment analysis. The study recommends further analysis of the product's vitamin, mineral content and shelf life to ensure nutritional value and stability. It also suggests improving taste, texture, packaging, and promotion to enhance the acceptability and marketability of the Eggplant Nutri-Chips.

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