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PRODUCT FORMULATION, ANALYSIS, AND SHELF-LIFE OF BANANA PSEUDO-STEM WITH PURPLE SWEET POTATO TOPS, CITRUS, AND ORGANIC HONEY DRINK

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Abstract: Nature provides goodness and nourishment for man. There are many useful plants around that could be a source of food and wellness, but are seldom left untapped, like the banana pseudo-stem and the sweet purple potato. Hence, this study was conducted to determine the acceptability of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink. The study used the Experimental-Developmental method of research using a Completely Randomized Design (CRD). The sensory qualities were evaluated by ten (10) semi-trained panelists and the acceptability of the products was evaluated by one hundred (100) consumers. Scorecards with the Nine (9) Points Hedonic Scale was used to obtain the data. The mean and Analysis of variance (ANOVA) were used to analyze the data set at a 0.01 level of significance. The findings of the study revealed that sensory qualities of banana pseudo-stem juice with purple sweet potato tops and organic honey were generally positively evaluated by the semi-trained panelists as revealed by their respective ratings in terms of their appearance, aroma, taste, and texture. The banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink was generally liked extremely by the consumers. Of the three treatments, Treatment C (with lemon) was the most preferred. There was a significant difference in the sensory qualities of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey in terms of appearance, aroma, taste, and consistency in favor of Treatment C (Lemon Flavor). Likewise, there was a significant difference in the general acceptability of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink in terms of appearance, aroma, taste, and consistency in favor of Treatment C (Lemon Flavor). Furthermore, the product could last for at least 30 days when chilled and at least 7 days when left at room temperature. Likewise, the product has a pH of 5 which indicates it was slightly acidic due to its citrus fruit content and was safe for human consumption as the results of microbial analysis of the product and based on the BFAD standard for microorganism test for products belonging to the ready-to-drink beverages. Hence, it was suggested that considering the appeal of the product to the probable target market. There is a huge possibility of mass production of the formulated product of the banana pseudo-stem with purple sweet potato tops, organic honey, and citrus for commercialization.

Keywords: Banana Pseudo-Stem, Sweet Potato Tops, Citrus, and Organic Honey

I. INTRODUCTION

Bananas are native to Southeast Asia and among the world's most popular fruits containing a protective impact on health. It comes in different types and sizes. The color varies from green to yellow; some varieties appear in red. The preferable appearance is yellow. One medium-sized banana contains 422mg of potassium. Potassium is an essential mineral needed by all tissues in the body. It is often referred to as an electrolyte because it carries a small electrical charge that activates various cell and nerve functions. Its major role in the body is to help maintain normal fluid levels inside our cells. Potassium does not only help muscles to contract and supports normal blood pressure, but it may also reduce the risk of kidney stones.

Considering not only its potassium content, many health benefits are associated with this curvy fruit. It can be a source of magnesium, fiber, vitamin B6, vitamin C, and various antioxidants and phytonutrients. Like the banana, sweet potato is a staple food in the Philippines since it is a popular ingredient used in local delicacies. It can be grown at any time of year. It has many product forms: the leaves, tops, and roots, are largely utilized as either food or feeds. Its leaves are used

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as vegetables; flesh (edible root) with white purple, brown, or red skin color is utilized mainly as food - even as a staple food in Northern Mindanao and numerous other countries (Reynoso, 2011). When considered for an agricultural enterprise, raising sweet potatoes is a profitable commodity with an ROI of 206%.

With these abundant food sources, one could come up with many ways to develop new and enticing food options. Hence, this developmental study aimed to discover the banana pseudo-stem juice extract with purple sweet potato tops and honey organic drink.

II. STATEMENT OF THE PROBLEM & LITERATURE REVIEW

This study aimed to determine the acceptability of banana pseudo-stem juice with purple sweet potato tops and organic honey drink with seven (7) problem statements.

These are determining the sensory qualities of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink in terms of its appearance, aroma, taste, and consistency in three treatments; the general acceptability of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink in terms of its appearance, aroma, taste, and consistency in three treatments; the significant difference in the sensory qualities of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink in terms of its appearance, aroma, taste, and consistency in three treatments; the significant difference in the acceptability of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink in terms of its appearance, aroma, taste, and consistency in three treatments; the shelf-life of the product at room and chilling temperature; the pH-level of the product; and the microbial and proximate analysis of the best treatment of the product.

Hence, this study contained two (2) hypotheses:

1. There is no significant difference in the sensory qualities of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink due to appearance, aroma, taste, and consistency in the three treatments.

2. There is no significant difference in the acceptability of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink due to appearance, aroma, taste, and consistency in the three treatments.

According to Lakshman (2015), the inside portion of the central core part of the pseudo-stem is edible. In many parts of India, the pith or the tender core of the banana pseudo-stem has been used as food after boiling and the addition of spices. Banana central core is rich in fibre and aids in weight loss. It helps to relieve constipation. Research also found that it is rich in potassium and vitamin B6. It helps to detoxify the body by being a diuretic. Further, it is used in the treatment of kidney stones.

In addition, Ho (2015) stated: “Banana pseudo-stem is a by-product of plant and has potential for providing profitable products such as food source for human consumption. Banana pseudo-stem flour (BPF) has a good amount of several important macro minerals potassium (K), sodium (Na), calcium (Ca), magnesium (Mg), and phosphorus (P) which are important to maintain body health. BPF exhibits high fiber content.”

Likewise, Bornare & Sumaiya (2015) explored the banana pseudo-stem juice and papaya juice in the present study was initially characterized by a few important physiochemical parameters.

The storage studies for both the beverages i.e. control RTS and selected RTS were carried out for 90 days at storage of refrigerated temperature. Thus, the records claimed that the moisture content of the selected RTS [87.2%] was greater than the control RTS [85.2%] on the initial day thus gradual increases in moisture content had been seen but in small variation. The Ash content of both the RTS beverages shows 0.1% in the control sample and 0.17% in the selected sample on the initial day. It was observed that Ash content in selected RTS was increased in very minute quantity.

From 13°Bx the TSS of both the sample had increased to 16°Bx. Total soluble solids increased gradually during storage. An increase in TSS during storage might be attributed to the conversion of polysaccharides and other constituents of juice into sugar. It was observed that in both samples there was a gradual increase in pH thereby decreasing the acidity of both the sample (Bornare & Sumaiya, 2015).

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III. MATERIAL SELECTION AND EXPERIMENTAL WORK

Experimental-developmental method of research made the conduct of this study. An experimental method was referred to as the process undertaken to demonstrate that particular events or outcomes are likely to occur due to the specifiable conditions that are controlled and manipulated (Myers & Hansen, 2012). Hence, in this study, the developmental method involved situations in which the product-development process is analyzed and described, and the final product has been evaluated. In this study, the developmental phase involved the creation of banana pseudo-stem extract with purple sweet potato tops and organic honey drink in three different treatments.

Developmental research is defined as the systematic study of designing, developing, and evaluating instructional programs, processes, and products that must meet criteria of internal consistency and effectiveness. The most common types of developmental research involve situations in which the product-development process is analyzed and described, and the final product is evaluated (Jagunap,2019). In this research design, the researcher intended to produce a desirable result, wherein the banana pseudo stem extract with purple sweet potato tops and organic honey drink would be acceptable as an appetizer among experts and prospective consumers.

Completely Randomized Design (CRD) was used in the study. This is a type of experimental design where treatments are assigned to experimental units at random for studying the effects of one primary factor without the need to take other nuisance variables into account. The experiment compared the values of a response variable based on the different levels of that primary factor.

Tools and Equipment

The materials, tools, and equipment used in formulating the banana pseudo-stem with purple sweet potato tops, citrus, and raw honey were: one (1) piece chef knife; one (1) piece chopping board; one (1) set measuring cups; one (1) piece measuring glass; one (1) piece ladle; one (1) piece strainer; four (4) pieces utility bowls; four (4) pieces spoons; four (4) pieces utility tray; several plates; two (2) pieces cheese cloth; one (1) piece medium size casserole; one (1) unit digital weighing scale and one (1) unit gas stove.

Experimental Treatments

Three treatments were designed to formulate this product. In this study, the researcher employed the experimental proportion using the three different treatments, all having the same amount but varied in the ingredients. Treatment A with Orange Flavor, Treatment B with Calamansi Flavor, and Treatment C with Lemon Flavor.

The following ingredients used in preparing the banana pseudo-stem juice was shown in table 1.

Ingredients	Quantity (across 3 treatments)
Banana Pseudo-stem (fresh)	1000g
Distilled Water	2880mL

Table 1. Ingredients of Pseudo-Stem Juice

Likewise, the ingredients in making the purple sweet potato tops juice was shown in table 2.

Ingredients	Quantity (across 3 treatments)
Purple sweet potato (fresh leaves)	200g
Distilled Water	500mL

Table 2. Ingredients used in the study for concoction of purple sweet potato tops juice.

Table 3 shows the proportion of ingredients in making the banana pseudo stem with purple sweet potato tops, citrus, and organic honey drink in three treatments in varying flavors of citrus fruits.

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Ingredients	Treatments		
	A (Orange)	B (Calamansi)	C (Lemon)
Banana Pseudo-stem juice	1,000ml (saba)	1,000ml (saba)	1,000ml (saba)
Purple Sweet Potato Juice	360 ml	360 ml	360 ml
Raw Honey	360 ml	360 ml	360 ml
Brown Sugar	200 g	200 g	200 g
Water (Distilled)	2,500 ml	2,500 ml	2,500 ml
Citrus	360 ml	360 ml	360 ml

Table 3. Ingredients in making the banana pseudo stem with purple sweet potato tops, citrus, and organic honey drink.

The experiments utilized three different treatments and product formulation. Treatment A used Orange fruit juice, Treatment B used Calamansi fruit juice; while Treatment C used lemon fruit juice.

The treatments of the study vary on the citrus flavor added to the banana pseudo stem juice and the other ingredients were of the same amount. The formulation of the treatments was based on the three trials in order to come up with best formulation.

Experimental Procedures

The experiment was carried out in the preparation of raw materials such as the pseudo-stem juice, purple sweet potato top juice, and citrus sugar syrup, and the procedure in making the banana pseudo stem with purple sweet potato tops, citrus, and organic honey drink.

Step 1. Preparation of Raw Materials

A. **Pseudo Stem Juice**

Quality pseudo stems were selected and sorted. They were washed with running water. The pseudo stems were chopped into small pieces and using a blender it was turned into a puree texture. Then, the puree of the blended pseudo stems was simmered for 15 minutes until the impurities disappeared. The pseudo-stems were drained and the juice separated afterwards. Set aside for later use.

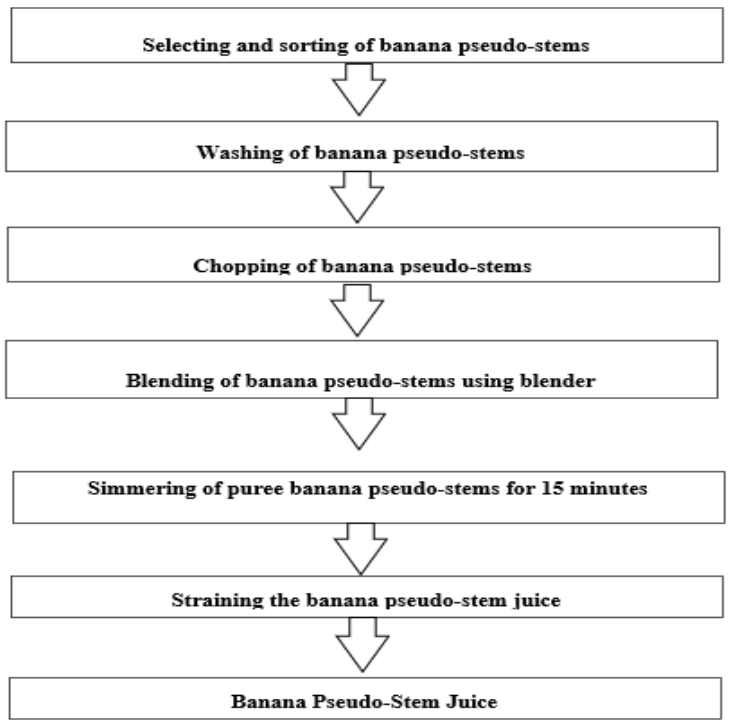

Figure 1. Preparation of Pseudo Stem Juice.

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B. **Purple Sweet Potato Tops Juice**

Quality sweet potato tops were selected and sorted. Then, it was washed with running water. The sweet potato tops were simmer for 5 minutes. Drained the sweet potato tops and separate the juice. Set aside for later use.

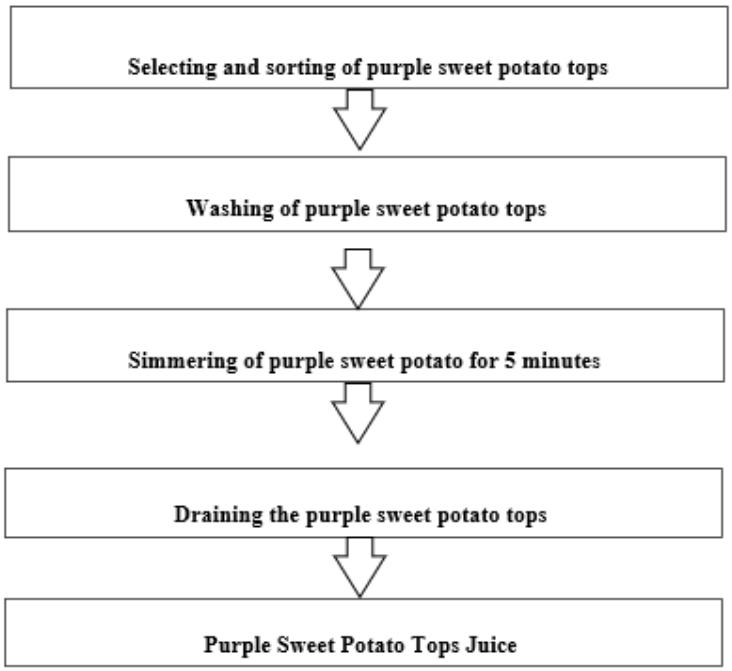

Figure 2. Preparation of Purple Sweet Potato Tops Juice.

C. Citrus Syrup

Squeezed the citrus fruits to extract the juice. Then, measured the citrus juice and sweet potato tops juice and combined them. Add the sugar and bring it to a simmer without stirring until the desired syrup consistency was achieved. Removed the syrup from the fire and add the organic honey. Set aside for later use.

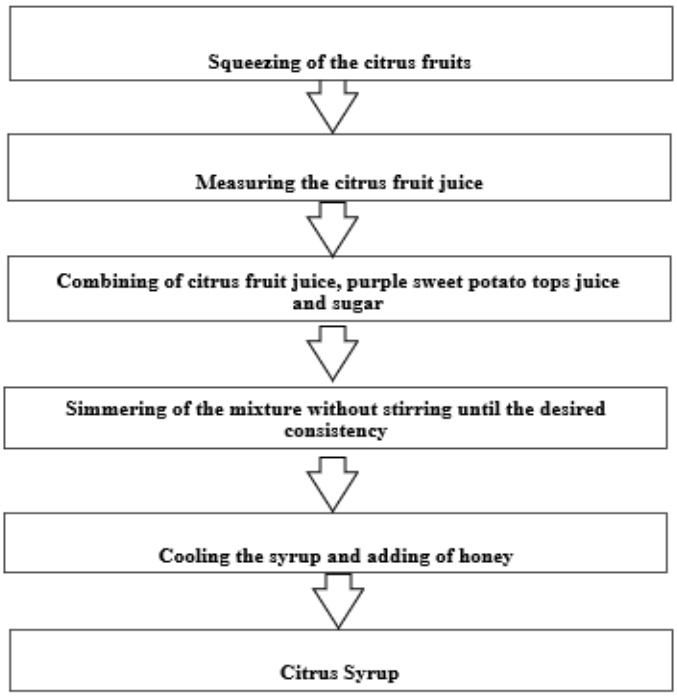

Figure 3. Preparation of Citrus Syrup.

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Step 2. Procedure in Making of Banana Pseudo Stem with Purple Sweet Potato Tops, Citrus and Organic Honey Drink

In a big jar container, the pseudo stem juice, and citrus syrup were mixed together until the consistency of the juice was achieved. Then, the juice was poured into clean and sterilized glass bottles. And the bottled juice was pasteurized for 10 minutes. The pasteurized juice bottle was completely sealed and placed at room temperature.

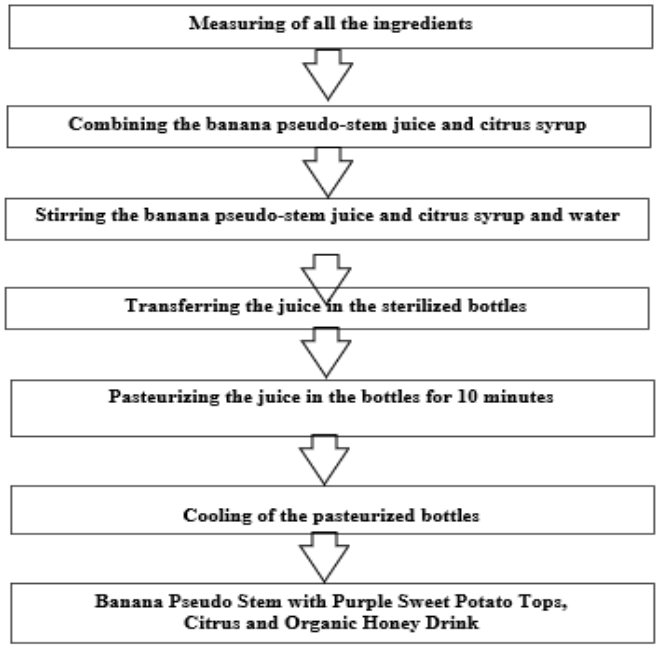

Figure 4. Flow chart showing the procedures in the preparation of banana pseudo stem with purple sweet potato tops, citrus and organic honey drink.

To ensure the safety of consumers the product remains in optimum condition, the bottles and caps were sterilized and pasteurized.

Sterilizing the bottles and caps

The researcher boiled 3 liters of water for 3 to 5 minutes in a high fire (timer starts when water is boiling). Then, turned the fire into low and soaked the bottles and caps in boiling water for about 1 minute. Next, removed the bottles from the water and put them in a clean basket in reverse position to air dry. The bottles were finally ready to use when dried.

Pasteurization

The casserole was pasteurized over boiling water in a casserole. The water level in a casserole was made sure to be ¼ of the height of the battle container. Then placed the bottles of juice over boiling water. Placed the cap on it but did not tighten (timer started when it started to boil again). Then let the bottle stay in boiling water for 10 minutes. Next, removed the bottles of juice in the boiling and totally close tighten the cap. The bottles were set aside to cool before they were placed in the chiller and before being used to serve the drink.

Collection of Data

An evaluation scorecard was used by the semi-trained panelists in evaluating the sensory quality attributes of the product in terms of appearance, aroma, taste, and consistency.

Ten (10) semi-trained panelists from Capiz State University who was Food Technology professors composed the evaluators for sensory quality attributes. The 100 evaluators of the study for the general acceptability were composed of 25 food establishment owners; 25 food technology students of Capiz State University; 25 housewives; and 25 consumers. After the evaluation, the evaluation sheets were gathered, tallied, summarized and prepared for statistical computation. Mean was used to determine the level of acceptability of banana pseudo-stem juice with purple sweet potato tops and organic honey drink in three treatments. Likewise, the mean was also used to determine the general acceptability of the product as a whole.

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To further determine whether significant differences existed among the three treatments, One-way Analysis of Variance (ANOVA) was used and the level of significance was set at 0.01.

The product was a cold juice drink and each evaluator was given an individual disposable plastic cup for every treatment, bottled mineral water was also given to neutralize their taste buds before tasting each treatment of the product to have a valid and honest result.

Detailed processes on how the data were gathered followed a series of procedures. In order to obtain the data in the experimental-developmental research, product formulation was the first step established by the researcher.
After several trial and error discoveries, one final product was established. As soon as it is established, the formulation of treatments 1, 2, and 3 was also established.

Scoring of Variables

In scoring the variables, the researcher used the Hedonic Nine-Point Rating Scale in the evaluation of the product. To better understand the collected data and its results, the researcher also provided the equivalent interpretation for each scale that corresponds to the Nine (9)-Point Hedonic Rating Scale. In this study, the different sensory qualities, such as appearance, aroma, color, taste, and texture of the banana pseudo-stem juice with purple sweet potato tops and organic honey drink were scored, given weight, and categorized. In terms of sensory qualities, each quality was assigned with adjectival description. However, the qualitative description was used for the general acceptability of the product.
The variables were categorized as follows:

1. Appearance of the product

Score	Mean Score	Adjectival Description
9	8.12 – 9.00	Extremely Appealing
8	7.23 – 8.11	Very Much Appealing
7	6.34 – 7.22	Moderately Appealing
6	5.45 – 6.33	Slightly Appealing
5	4.56 – 5.44	Neither appealing nor unappealing
4	3.67 – 4.55	Less Unappealing
3	2.78 – 3.66	Moderately unappealing
2	1.89 - 1.88	Very Much Unappealing
1	1.00 – 1.88	Extremely Unappealing

2. Aroma of the product

Score	Mean Score	Adjectival Description
9	8.12 – 9.00	Extremely Pleasant
8	7.23 – 8.11	Very Much Pleasant
7	6.34 – 7.22	Moderately Pleasant
6	5.45 – 6.33	Slightly Pleasant
5	4.56 – 5.44	Neither pleasant nor unpleasant
4	3.67 – 4.55	Less Unpleasant
3	2.78 – 3.66	Moderately Unpleasant
2	1.89 – 2.77	Very Much Unpleasant
1	1.00 – 1.88	Extremely Unpleasant

3. Taste of the product

Score	Mean Score	Adjectival Description
9	8.12 – 9.00	Extremely Delicious
8	7.23 – 8.11	Very Much Delicious
7	6.34 – 7.22	Moderately Delicious
6	5.45 – 6.33	Slightly Delicious
5	4.56 – 5.44	Neither Delicious nor Not Delicious
4	3.67 – 4.55	Slightly Not Delicious
3	2.78 – 3.66	Moderately Not Delicious
2	1.89 – 2.77	Very Much Not Delicious
1	1.00 – 1.88	Extremely Not Delicious

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4. Consistency of the product

Score	Mean Score	Adjectival Description
9	8.12 – 9.00	Extremely Concentrated
8	7.23 – 8.11	Very Much Concentrated
7	6.34 – 7.22	Moderately Concentrated
6	5.45 – 6.33	Slightly Concentrated
5	4.56 – 5.44	Neither Concentrated nor Not Concentrated
4	3.67 – 4.55	Slightly Not Concentrated
3	2.78 – 3.66	Moderately Not Concentrated
2	1.89 – 2.77	Very Much Not Concentrated
1	1.00 – 1.88	Extremely Not Concentrated

5. Experts and Consumers' Summary of General Acceptability

Score	Mean Score	Adjectival Description
9	8.12 – 9.00	Liked Extremely
8	7.23 – 8.11	Liked Very Much
7	6.34 – 7.22	Liked Moderately
6	5.45 – 6.33	Liked Slightly
5	4.56 – 5.44	Neither Liked nor Disliked
4	3.67 – 4.55	Disliked Slightly
3	2.78 – 3.66	Disliked Moderately
2	1.89 – 2.77	Disliked Very Much
1	1.00 – 1.88	Disliked Extremely

Statistical Tools and Analysis

The data were collected and statistically analyzed using the Arithmetic Mean and the Analysis of Variance (ANOVA) using the SPSS, a statistical tool used for data processing and analysis. The Analysis of variance (ANOVA) was used to determine the significant difference among the three treatments A, B, C and, D. The ANOVA is set at 0.01 alpha level and used to determine the significant difference on the appearance, aroma, taste and texture.

Cost Analysis

The table shows the cost of all the materials used in the creation of every treatment in this developmental study of banana pseudo-stem juice with purple sweet potato tops and organic honey drink. Hence, if the 40% of the calculated labor was added to the cost of materials, the product cost was shown in table 4:

Qty.	Unit	Description	Value (₱)	Remarks
1,000	grams	Banana pseudo stem	50.00	Purchased
360	ml.	Organic Honey	250.00	Purchased
360	ml.	Citrus (Lemon)	80.00	Purchased
200	grams	Wash sugar	25.00	Purchased
2,500	ml	Distilled Water	60.00	Purchased
1,000	grams.	Ice tube	15.00	Purchased
4	pcs	Bottle (1000 mL)	300.00	Purchased
1	pc	Bottle (500 mL)	35.00	Purchased
		TOTAL	**₱ 815.00**	

Table 4. Product cost of banana pseudo-stem juice with purple sweet potato tops and organic honey drink.

A. Labor

Labor is equal to 40% of the cost of materials

Labor = Php 815.00 (cost of materials)

= .40 x Php 815.00

= 326.00

If the labor consists of 40% of the cost of materials, the total product cost of Treatment C therefore was:

Labor = Php 326.00

Cost of Materials = 815.00

Product Cost = 1,141.00

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B. Summary of Expenses of Treatment C.

The above data shows the cost of all the materials used in making Treatment C. Hence, if the 40% was labor and it was added to the cost of materials for treatment C and the product cost of the product therefore was:

Labor = 326.00
Cost of Materials = 815.00
Product Cost = 1,141/ 4 bottles/1Liter
Cost bottle/liter = 285.25/liter

IV. DISCUSSION OF THE RESULTS

Sensory Qualities of Banana Pseudo-Stem with Purple Sweet Potato Tops and Organic Honey Drink evaluated by Semi-Trained Panelist

Table 5 reflects the sensory qualities of the product as evaluated by ten (10) semi-trained panelists in terms of appearance, aroma, taste and consistency. In terms of its appearance, results revealed that the Lemon Flavor were found "Extremely Appealing" with mean of 8.73, respectively. The Calamansi Flavor and Orange Flavor were found to be "Very Much Appealing" as shown by the mean score ranges to7.80-7.90. The findings on the changes in the appearance of the product could be attributed to the different varieties of citrus fruit applied to the juice.

As to its aroma, the Lemon Flavor and Calamansi Flavor were found to be "Extremely Pleasant" as revealed by the means of 8.50 respectively. The findings of the study suggest that as to its aroma, Lemon Flavor and Calamansi Flavor appeared to be highly accepted by semi-trained panelists. Between the two, though, it was the lemon flavor that had the higher rating, hence, more preferred by the evaluators.

The taste of the product was revealed in the same table. Data showed that the Lemon Flavor was found "Extremely Delicious" since it reflected mean result of 9.00. The Calamansi Flavor and Orange Flavor were similarly interpreted as "Very Much Delicious" with the mean ranges to 7.40 -8.10. As to the consistency of the product, participants found the Lemon Flavor and Calamansi Flavor were "Extremely Concentrated" reflecting the mean rating of 8.90 and 8.20 respectively.

It was observed that among the three treatments, it was the lemon flavor that was most preferred. While orange, calamansi, and lemon are closely related and have a lot of overlap in nutritional values, however, according to WebMD (2022), lemons are more preferred as an ingredient to enhance the flavor of meat, fish, or vegetables, or you can use it to flavor beverages (like lemonade) or pastries and desserts.

SENSORY QUALITY	Mean TA Orange	AD	TB Calamansi	AD	TC Lemon	AD
Appearance	7.80	VMA	7.90	VMA	9.00	EA
Aroma	7.50	VMP	8.50	EP	8.50	EP
Taste	7.40	VMD	8.10	VMD	9.00	ED
Consistency	7.50	VMC	8.20	EC	8.90	EC

Table 5. Sensory Qualities of Banana Pseudo-Stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink by Semi-Trained Panelist.

Legend:

AD –Adjectival Description
EA - Extremely Appealing
VMA- Very Much Appealing
EP- Extremely Pleasant
VMP- Very Much Pleasant
ED-Extremely Delicious
VMD- Very Much Delicious
VC – Very Much Concentrated
EC – Extremely Concentrated

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Findings of this study are supported by Dawn (2016) stated that: "Pseudo-stem of Banana normally goes as waste though it could be used in pulp and paper industries due to its cellulosic content. It is also consumed as juice in fresh form. The banana central core finds use in south Indian cuisine. Banana stem is a rich source of fibre and helps to control obesity. It also aids to detoxify the body. In southern India, it is consumed as fresh juice to prevent kidney stones."

Juice was found to have TSS of 12°Brix and pH. Comparable to TSS of 10.50°Brix and pH 4.22 data given and Banana Pseudo-stem juice recorded to have less TSS of 4°Brix and pH. A higher value of Turbidity was estimated in Banana pseudo-stem juice 600 NTU, whereas that of papaya juice was found to be 440 NTU. Acidity of papaya juice and Banana pseudo-stem juice was result to have [0.15], [0.2]. The result recorded for Brix: Acid ratio of papaya juice 120 and that of Banana pseudo-stem was 53.3. Moisture and ash content of pseudostem was 94.85 and 0.11 and of papaya 86.0 and 0.25 respectively (Bornare & Sumaiya, 2015).

General Acceptability of Banana Pseudo-Stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink

Table 6 shows the preferences of the 100 consumers such as teachers, students, and potential consumers (housewives, vendors, and food enthusiasts) on the Banana Pseudo-Stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink in terms of its appearance, aroma, taste and consistency.

SENSORY QUALITY	Mean TA Orange	QD	TB Calamansi	QD	TC Lemon	QD
Appearance	7.62	LVM	8.45	LE	8.73	LE
Aroma	7.79	LVM	8.70	LE	8.50	LE
Taste	7.84	LVM	8.65	LE	8.72	LE
Consistency	7.85	LVM	8.65	LE	8.66	LE
General Acceptability	**7.76**	**LMV**	**8.61**	**LE**	**8.65**	**LE**

Table 6. General Acceptability of Banana Pseudo-Stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink by Consumers.

Legend:

Scale of Means	Qualitative Description
8.12 – 9.00	Liked Extremely
7.23 – 8.11	Liked Very Much
6.34 – 7.22	Liked Moderately

Generally, Lemon Flavor and Calamansi Flavor were "Liked Extremely" and potential product for development as shown by the grand mean ratings of 8.65 and 8.61, respectively. The Orange flavor was just shown to be "Liked Very Much" indicating a mean of 7.76. However, the consumers of the product have generally preferred the Lemon Flavor among other variants when preparing banana pseudo-stem juice product.

The general acceptability of banana pseudo-stem juice is already given considering that other products made using this ingredient have been received positively by consumers. Banana pseudo-stem has been known as potential cellulose source. The centre core of banana is edible and used to prepare dish in the southern states of India. It is also used to prepare candies and pickles (Dawn et al., 2016).

Difference in the Sensory Qualities of Banana Pseudo-Stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink

Table 7 revealed that there was a significant difference in the appearance of the product in varying treatments as rated by semi-trained panelist (F–value=.47.880, p-value=.000<.01) in favor of Lemon Flavor. Therefore, the null hypothesis of the study that no significant difference exists in the appearance of the three flavor variants was not accepted. This implies that the product appearance was not remained the same due to the variation of citrus fruit used as acid colorant for purple sweet potato tops.

The juice product prepared in different flavor variants differ in their aroma (F-value=12.000, p-value=.000<.01) in favor of Lemon and Calamansi Flavor. Result therefore, accepts the existence of a significant difference among treatments of

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banana pseudo-stem juice products. This indicates that the flavor variants used in preparing the juice, the aromatic quality of the three treatments appeared to be not the same.

As to its taste, the different preparations of banana pseudo-stem juice vary based on the flavor variants (F-value=23.795, p-value=.000<.01) in favor of Lemon Flavor. Therefore, the result rejects the null hypothesis of the study. Hence, the taste qualities of the three variants of juice product were significantly different from each other. This explains the idea that the three variants of flavor when preparing the juice could have different taste or flavor for the evaluators.

The consistency of the three flavors of the product was significantly different (F-value=14.700, p-value=.000<.01) in favor of Lemon Flavor. Therefore, the existence of a significant difference in the texture of the three flavors was accepted. Findings of this study were supported by Chandrasekaran (2012) which stated that: "Banana stem is a rich source of fibre and helps in weight loss."

In addition, Bhaskar (2011) added: "Pseudo-stem have low glycemic index and have a high content of dietary fiber and antioxidant which is good for diabetes."

Furthermore, Truong (2018) stated: "Sweet potatoes have potential nutritional value depending on the content of its bioactive compounds which are correlate to the flesh color." Based on the study of Dusuki (2020), The proximate analysis was revealed that purple sweet potatoes from West Java cultivar has higher percentage of total fat and carbohydrate as well as the energy from fat. Whereas the percentage of water and protein content was higher in Central Java cultivar.

SOURCES OF VARIANCE	SUM OF SQUARE	df	MEAN SQUARE	F-VALUE	P-VALUE	REMARKS
Appearance	8.867	2	4.433	47.880	.000	s.
	2.500	27	.093			
	11.367	29				
Aroma	6.667	2	3.333	12.000	.000	s.
	7.500	27	.278			
	14.167	29				
Taste	12.867	2	6.433	23.795	.000	s.
	7.300	27	.270			
	20.167	29				
Consistency	9.800	2	4.900	14.700	.000	s.
	9.000	27	.333			
	18.800	29				

Table 7. Difference in the sensory qualities of the Banana Pseudo-Stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink.

P-value > .01 alpha

In addition, the study of Bornare & Sumaiya (2015) found that the sensory quality revealed that banana pseudo-stem juice could be successfully incorporated with Papaya juice in development of blended therapeutic RTS with improved sensorial quality profile of 50% Banana pseudo-stem juice and 50% Papaya juice. However, unlike this study, the one experimented by Bornare & Sumaiya (2015) used preservatives to prolong the shelf life of the product.

Based on the Post Hoc Test, the product in terms of appearance there was a significant difference between treatment A and C in favor of C (Lemon), while treatment B and C in favor of C (Lemon) also. Likewise, in terms of aroma there was a significant difference between treatment A and B in favor of B (calamansi), while between treatment C and A in favor of C (Lemon) but between treatment B and C there was no significant difference found. Moreover, there was a significant difference between treatment C and A in favor of C (Lemon) but between treatment B and C there was no significant difference likewise also with treatment A and B. Further, there a significant difference in terms of consistency between treatment A and B in favor of B (calamansi), while between treatment C and A in favor of C (Lemon) but between treatment B and C there was no significant difference found.

Difference in the General Acceptability of Banana Pseudo-Stem with Purple Sweet Potato Tops, Citrus and Organic Honey Drink

Table 8 shows the test of difference in the consumers' general acceptability of the three variants of Banana Pseudo-Stem Juice with Purple Sweet Potato Tops, Citrus, and Organic Honey.

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Data revealed that consumers' acceptability of the appearance of the product significantly differs (F-value=95.145, p-value=.000<.01) among consumers. This result implies that consumers have not the same preferences with regards to the appearance of the three flavor variants of banana pseudo-stem juice.

SOURCES OF VARIANCE		SUM OF SQUARE	df	MEAN SQUARE	F-VALUE	P-VALUE	REMARKS
Appearance	Between Groups	66.647	2	33.323	95.145	.000	s.
	Within Groups	104.020	297	.350			
	Total	170.667	299				
Aroma	Between Groups	45.740	2	22.870	64.943	.000	s.
	Within Groups	104.590	297	.352			
	Total	150.330	299				
Taste	Between Groups	47.847	2	23.923	76.938	.000	s.
	Within Groups	92.350	297	.311			
	Total	140.197	299				
Texture	Between Groups	43.207	2	21.603	64.200	.000	s.
	Within Groups	99.940	297	.336			
	Total	143.147	299				
Acceptability	Between Groups	46.621	2	23.311	119.060	.000	s.
	Within Groups	58.149	297	.196			
	Total	104.771	299				

Table 8. Difference in the General Acceptability of Banana Pseudo Stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink.

This result rejects the null hypothesis that consumers' acceptability of the appearance of the product tended to be not the same in favor of Lemon Flavor. Results likewise showed that consumers' acceptability of the aroma of the product significantly differed (F-value=64.943, p-value=.000<.01) among consumers. Thus, the null hypothesis that consumers' acceptability of the aroma of the product differ therefore it was accepted in favor of Calamansi Flavor.

Moreover, consumers' acceptability of the taste of the product significantly differed as shown by the result (F-value=76.938, p-value=.000<.01). This outcome rejects the null hypothesis that consumers' acceptability of the taste of banana pseudo-stem with three flavor variants significantly differ. This implies that consumers' acceptability of the product was not similar to one another in favor of Lemon Flavor.

However, the consumers' acceptability in terms of consistency of the product significantly differed as shown by the result (F-value=64.200, p-value=.000<.01). This means that the null hypothesis was rejected and the alternative hypothesis was accepted that there was a significant difference in the texture of banana pseudo-stem juice in favor of Lemon Flavor. This implies that Lemon Flavor has a good consistency compared to Calamansi and Orange. Furthermore, when it comes to the over-all results of the consumers' acceptability, the three variety of rice were found acceptable in making banana pseudo-stem juice. This implies that the banana pseudo-stem found in the local market has a potential as a value-added product for the marketability and livelihood of the people.

According to Ajibola (2012), Honey is a luxuriously rich, sweet, sticky, golden fluid made from the nectar of flowers. Its natural sweetness endowed with health benefits makes it an adept substitute for white sugar. Nectar, often referred to as 'the drink of the gods', is collected by hymenop-teran honeybees and is gathered, modified and stored in the honeycomb to be used as food.

p-value > .01 alpha, not significant, p-value<.01, significant

Based on the Post Hoc Test, the product in terms of appearance there was a significant difference between treatment A and B in favor of B (calamansi), while treatment B and C in favor of C (Lemon), and between treatment C and A in favor of C (Lemon) also. Meanwhile, in terms of aroma, there was a significant difference between treatment A and B in favor of B (calamansi), while between treatment C and A in favor of C (Lemon) but between treatment B and C there was no significant difference found. Moreover, there was a significant difference between treatment A and B in favor of B (calamansi), while between treatment C and A in favor of C (Lemon) but between treatment B and C there was no significant difference found. Further, there a significant difference in terms of consistency between treatment A and B in

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favor of B (calamansi), while between treatment C and A in favor of C (Lemon) but between treatment B and C there was no significant difference found. Besides, there a significant difference in the over-all acceptability of the product between treatment A and B in favor of B (calamansi), while between treatment C and A in favor of C (Lemon) but between treatment B and C there was no significant difference found.

Furthermore, Kaškonienė (2009) stated that: "Biochemical studies indicate the presence of about 400 compounds in honey, namely mixed sugars (glu-cose 31%, fructose 38%, and less than 5% sucrose), not more than 20% water, and 0.08% of certain acids with 0.18% of other minerals and numerous enzymes, phenolic acids, amino acids flavonods, various proteins, etc. The composition of honey differs based on varia-tions in pollen content weather conditions, micro- and macroclimate and honey processing methods."

In addition, Bogdanov (2008) added: "Disparity in its appearance and possibly taste is attributed to different biological origin of honey, how-ever, the basic components imperative to its nutritional value, as glucose, fructose and 25 other oligosaccha-rides, largely remains unaltered. In spite of being rich in carbohydrates, its glycemic index ranges from 32 to 85, varying upon its source and hence 50-80 grams can be safely consumed per intake."

Shelf Life of Banana Pseudo-Stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink at Room and Chilling Temperature

Table 9 shows the shelf-life of the banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink at room and chilling temperature based on the observation of the researcher, chilled banana pseudo-stem juice with purple sweet potato tops, citrus, and honey could last up to 30 days without a change in the appearance, aroma, taste, and texture.

Likewise, the researcher observed no noticeable change in the appearance, aroma, taste, and texture of the product for 5 days when stored at room temperature. On the sixth day, white residue started to surface, indicating a chemical change has already occurred on the product.

Variant	**One to Ten days** No Changes	**Eleven to Twenty days** No Changes	**Twenty-one to Thirty days** No Residual Formation on the surface
Treatment A (Orange Flavor)	0	0	0
Treatment B (Calamansi Flavor)	0	0	0
Treatment C (Lemon Flavor)	0	0	0

Table 9. Observed the Shelf-life of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink at Room Temperature.

Findings of this study are also correlated to that of Bornare & Sumaiya (2015), which revealed that blended therapeutic RTS made from Banana waste [pseudo-stem] with Papaya juice could be successfully stored for the period of 90 days with significant change in chemical and sensory qualities (Bornare & Sumaiya, 2015).

However, the latter's product used preservatives to prolong the shelf life, whereas in the banana pseudo stem with purple sweet potato tops, citrus, and organic honey drink developed by the researcher utilized honey and citrus, which are considered as natural preservatives. Hence, in the perspectives of niche consumers who are looking for drinks that are naturally-processed, this product could be a better option.

Aside from the fact that chilling the product contributes to prolonging the product's shelf life, the presence of honey also contributes, particularly to the product which was stored at room temperature. The potentiality of honey in increasing the shelf life of food was checked by substituting honey for sucrose in cashew apple juice (Silva, et. al., 2008). Post 180 days of storage at a temperature of 28±2°C, the products (different concentrations of juice and honey) were evaluated based on their sensory perception and were found to maintain good taste.

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Variant	**One to Two days** No Changes	**Three to Five days** No Changes	**Six days** Present of Residual Formation on the surface
Treatment A (Orange Flavor)	0	0	+
Treatment B (Calamansi Flavor)	0	0	+
Treatment C (Lemon Flavor)	0	0	+

Table 9.1. Observed the Shelf-life of banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink at Chilling Temperature.

Apart from this, the product also had superior satisfactoriness, good color, flavor, microbiological quality, and physicochemical stability. This could be a healthier option for the fruit drink market (Silva, et. al., 2008).

pH-level of the Banana Pseudo-Stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink

The banana pseudo-stem with purple sweet potato tops, citrus, and organic honey drink has a pH level of 5 using a pH paper which indicates that the juice was in the range of slightly acidic due to the 5-8% citric acid content of the citrus fruits which means that the juice was safe for human consumption.

This research investigated the efficacy of gaseous ozone on the inactivation of Escherichia coli ATCC 25922 and NCTC 12900 strains in apple juice of a range of pH levels, using an ozone bubble column. The pH levels investigated were 3.0, 3.5, 4.0, 4.5 and 5.0. Apple juice inoculated with E. coli strains (106 CFU/mL) was treated with ozone gas at a flow rate of 0.12 L/min and ozone concentration of 0.048 mg/min/mL for up to 18 min.

Results show that inactivation kinetics of E. coli by ozone were affected by pH of the juice. The ozone treatment duration required for achieving a 5-log reduction was faster (4 min) at the lowest pH than at the highest pH (18 min) studied. The relationship between time required to achieve 5 log reduction (t5d) and pH for both strains was described mathematically by two exponential equations. Ozone treatment appears to be an effective process for reducing bacteria in apple juice and the required applied treatment for producing a safe apple juice is dependant on its acidity level (Patil et al., 2010).

Ten healthy men ingested, twice daily between meals, during each of the seven-day experimental periods: (a) citric acid (as lemon juice), (b) Al(OH)3, or (c) Al(OH)3 + citric acid. Whole blood sampled after each dietary period was analyzed electrothermally after digestion with nitric acid.

Moderate, but significant, increases in mean Al concentrations as compared with pretreatment values [5 (SD 3) micrograms of Al per liter] were seen after ingestion of either citric acid or Al(OH)3: 9 (SD 4) and 12 (SD 3) micrograms/L, respectively. Ingestion of both Al(OH)3 and citric acid resulted in a more pronounced, highly significant (p less than 0.001) increase in Al concentrations, to 23 (SD 2) micrograms Al/L, probably owing to formation and absorption of Al-citrate complexes (P Slanina, W Frech, 1986).

Microbial Analysis of Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink

Table 10 showed the microbial report analysis of Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink samples conducted by the DOST Regional Standard and Testing Laboratory, Iloilo City. Test Service Request No. R6-092021-MIC-0510-0813 was submitted dated December 18, 2022, and was analyzed from December 14, 2022, to December 19, 2022, as attached in Appendix N.

The Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink with one (1) Liters were subjected to Mold and Yeast Count using Pour plate method, 25°C, 5-7 days., PCA, USFDA BAM Online (2001). As shown in the result below, the Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink has molds and yeast count it had the result of <10cfu/g sample with the BFAD criteria which was both acceptable in m and M. The result given in this report was during the time of examination and referred only to the particular sample submitted.

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Sample Description	Parameter	DOST	FDA m	M
Fruit juice 1 Liter MFD:12/11/2022 EXP: 12/19/2022)	Molds and Yeast Count	<10 cfu/ml sample (estimated)	1	—

Table 10. Microbial Analysis of Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink.

Legend: m –acceptable level of microorganism determined by a specified method:values are generally based on levels that are achievable under GMP

M – level which when exceeded in one or more samples would cause the lot to be rejected as this indicates potential health hazard or imminent spoilage.

Proximate Analysis of Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink
Table 11 shows the report of proximate analysis of Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink samples conducted by the Department of Science and Technology (DOST) Regional Standard and Testing Laboratory, Iloilo City. Test Service Request No. R6-122022-CHE-0222-0409 was submitted December 27, 2023 and was analyzed from December 27, 2022 to February 02, 2023 as attached in Appendix O.

Sample Description	Parameter	Result g/100mL
1 Liter sample in a glass bottle labeled as: **Banana Pseudo stem Drink**	Moisture	84.20
	Ash	0.24
	Crude Protein	0.28
	Total Fat	0.00
	Carbohydrate	15.28
	Energy	62 kcal

Table 11. Proximate Analysis of Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink.

The Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink with one (1) Liter sample in a glass bottle were subjected to moisture, ash, crude protein, total fat content, carbohydrate and energy. Moisture by Difference from Total Soluble Solids of Fruits and Fruit Products. Official Methods of Analysis of AOAC International (2019) 21st Ed. Official Method 932.12. For ash by gravimetric method was Official Methods of Analysis of AOAC International (2019) 21st Ed. Official Method 940.26. For crude protein by Kjeldahl Block Digestion Method and Steam Distillation. For total fat by Soxhlet Method using Petroleum Ether with Acid Hydrolysis. For carbohydrate is computed by difference (100-sum of moisture, ash, protein and fat) was Official Methods of Analysis of AOAC International (2019) 21st Ed. Official Method 986.25E. And for energy in kilocalories per 100 grams was the sum of protein, fat and carbohydrate multiplied by the general Atwater factors 4-9-4 respectively.

As shown in the result, Banana Pseudo-stem with Purple Sweet Potato Tops, Citrus, and Organic Honey Drink had the moisture content of 84.20 gram/100 ml. For ash, it got the result of 0.24 gram per 100 ml, the crude protein the result of 0.28 gram per 100 ml, the total fat content the result of 0.00 gram per 100 ml, the carbohydrate the result of 15.28 gram per 100 ml, the energy the result of 62 kcal per 100 ml.

The result given in the report were those obtained at the time of examination and referred only to the particular sample submitted.

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V. CONCLUSION AND RECOMMENDATION

Banana pseudo-stem can be made into a juice and its taste and overall appeal could be enhanced by adding sweet potato tops, organic honey, and citrus.

Banana pseudo-stem with purple sweet potato tops, organic honey, and lemon was the most preferred by the evaluators, although the two other treatments have also shown potentials for further enhancement.

The type of citrus fruit used may have caused the difference in the sensory qualities of the product.

Likewise, the type of citrus used in the three treatments might have caused the difference or variation in the general acceptability of the product.

The properties of the Banana pseudo-stem with purple sweet potato tops, organic honey, and citrus did not change because of the two ingredients, which could have served as natural preservatives: honey and citrus.
The shelf-life of the product could last for at least 30 days under chilling temperature and at least 7 days when left at room temperature.

The pH level of the juice was slightly acidic and the proximate and microbial analysis of the product was safe for human consumption based on the FDA standards and DOST.

Based on the conclusions, the following recommendations were formulated:

Banana pseudo-stem with purple sweet potato tops, organic honey, and citrus may be further developed to enhance its appeal and characteristics.

The researcher may further study what are the unique differences of each of the three treatments as an interesting selling point of the product. For example, since the product uses all-natural ingredients, the niche market for commercialization may be consumers who are health conscious and who prefer all-natural, preservative-free products.

The researcher may further study to what extent is the shelf life of the product when chilled and left in room temperature. Also, considering that honey is a natural preservative, further study may be conducted exploring how honey contributes to the shelf-life of the product. For instance, a comparative experiment on juice with and without honey may be explored. The product is also recommended for consumers to take as an alternative refreshing drink since it has a slightly acidic pH level due to Lemon as a flavoring instead of commercial juices that use artificial flavor, and sweetener, and are highly acidic.

The nutritional properties of the Banana pseudo-stem with purple sweet potato tops, organic honey, and citrus may be further explored.

Approval from the Bureau of Food and Drugs may be sought if the product is to be marketed. It may also be subject to nutritional analysis to ensure its nutrient content.

Future researches may also be done to explore the possibility of Banana pseudo-stem juice with other ingredients aside from citrus.

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