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Development and Assessment of Social Acceptability, Market Potential, and Profitability of Various Banana Pseudo-Stem Beverages

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RESEARCH ARTICLE INFORMATION

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ABSTRACT

The study aimed to utilize banana pseudo-stem (BPS) to develop juice, shakes, and tea, and assess their acceptability and market potential. Natural ingredients were used. The developed products contain extract from the inner sheath and tender core of BPS. Untrained panelists showed different preferences when grouped according to age and marital status. Younger, single people preferred shakes and juice; older, married people preferred tea. There was a general dearth of knowledge about the physiological and nutritional advantages of BPS, which emphasizes the necessity of consumer education. Different levels of palatability were found in the beverages based on sensory ratings. The juice was evaluated as moderately acceptable with no discernible bitterness, whereas shakes were rated extremely good because of their balanced sweetness and absence of sourness or bitterness. The tea faced challenges due to its slight bitterness and less favorable aftertaste. The shakes have the most favorable potential, highlighting how flavor influences consumer preferences. The low frequency of consumption was found, with beverages being perceived as supplemental rather than everyday needs. On average, the projected weekly consumption is 188 ml of juice, 258 ml of shakes, and 74 ml of tea. Profitability evaluations highlighted the economic feasibility of all beverages, with T1 formulations showing cost-effectiveness across all products. While not for tea, sociodemographic characteristics like age, household size, and income source may substantially impact juice and shake consumption trends. The results highlight the urgency of innovative marketing, better flavor compositions, and consumer education promotional programs to increase the appeal and consumption of BPS beverages.

Keywords: *banana pseudo-stem, natural beverages, development, social acceptability, market potential*

Introduction

One of the most valuable and well-known plants worldwide is the banana. This plant may be utilized in almost any way, including the fruit, leaves, flower bud, trunk, and pseudo-stem (Subagyo & Chafidz, 2020). The banana pseudo-stem is commonly wasted after fruit harvesting (Acevedo et al., 2021; Castillo et al., 2023). However, several

studies have reported that this part of the banana plant has economic opportunities (Pillai et al., 2024), considering its properties that provide health benefits to consumers (Dayod & Abat, 2016).

Botanically, the banana stem is a member of the Musa genus and is a flower stalker of a large, herbaceous plant in the Musaceae family. In Asia, the stems are utilized for a variety of culinary purposes, even though the fruits are the portion of the plant that is most frequently consumed (Ramakrishna, 2022). In South Indian cooking, banana stems are frequently used and valued for their mild flavor, crisp texture, high nutritional content, and ability to blend well with a variety of spices (Farmizen, n.d.). Moreover, bananas are mostly consumed domestically, giving over 400 million people substantial nutrition and food security (Voora et al., 2023). They are a staple food for millions and are regarded as the world's preferred fruit (Fairtrade, n.d.). They also provide an affordable energy source, vitamins, and potassium (Harvard, n.d.).

Through product development research, BPS has been used to develop food and non-food products such as all-purpose flour, facial masks, beverages, and other products.

In a 2015 study conducted by Go et al. (2021), all-purpose flour (APF) was mixed with banana pseudo-stem (BPS) flour in five different treatments - T0 (100% APF), T1 (15%), T2 (30%), T3 (45%), and T4 (60%) on the cooked brownies' chemical and sensory characteristics. The results showed that the banana-like taste was marginally perceptible in all BPS flour treatments.

Additionally, Aguilar et al. (2021) determined whether or not it is practical and biodegradable to create facial masks from BPS fiber, polypropylene, thread, and elastic by removing the fibers and using them to create fabric sheets that can be used to create two different sets of masks with varying numbers of filter layers. According to the results, employing layers of banana fiber as filters revealed a high rate of water absorbency and a low rate of particle penetration in terms of water repellency; in terms of breathability, air permeability was higher than the baseline, indicating its effectiveness.

Other researchers explored the potential of the BPS in beverage making. It is made palatable by blending it with different fruit extracts or concentrates. Buvaneshwari et al. (2020) conducted a specifically related study aimed at creating and preparing a ready-to-drink BPS beverage using the delicate core of a banana: KMS (70 ppm) as a preservative, 2% citric acid as an anti-browning agent, CMC (0.1%) as a stabilizer, and natural flavoring extracts (lemon, mint). Adding KMS improved juice quality while causing minimal changes in chemical properties during storage. According to the sensory evaluation, lemon-flavored stem beverages were more popular with consumers than mint-flavored beverages.

Some researchers further reported that the pseudo-stem core is used for urological conditions such as urolithiasis treatment by making use of a healthy and tasty pseudo-stem juice with papaya pulp. A therapeutic ready-to-serve beverage with varying ratios of pseudo stem juice and papaya pulp has been created. Diener et al. (2014) claimed that a liquid fraction taken from pseudo stems has a potential application based on its physicochemical makeup. Sugar, protein, fat, solids, sodium, potassium, calcium, magnesium, chloride, tannin, polyphenol oxidase and peroxidase activity, microbiology, and pesticides were tested. Because it contains potassium and sodium, creating a sports drink seemed appropriate.

In the Philippines, banana is one of the top priority commodities. The fruit is the most utilized and consumed in various forms of banana parts. Other parts, such as pseudo-stem and leaves, are ignored as they are commonly treated as biodegradable waste after harvesting. However, in several types of research, as discussed above, the banana pseudo stem has been reported as edible. It is also a popular treatment for stomach issues like gas, diarrhea, dysentery, and urinary disorders (Thorat & Bobade, 2018). Despite this, the utilization of BPS for developing functional products in the country is minimal. It may be attributed to most Filipinos' ignorance of the edibility and various advantageous uses of BPS that may contribute to maintaining or improving consumers' health and economic condition.

Scientifically developed beverages based on literature use additional preservatives, stabilizers, and anti-browning agents. Thus, this research aimed to utilize BPS in producing natural beverages, such as juice, shakes, and tea, with no additives, and determine its economic/market potential. Specifically, it intended to assess the perception of consumers on the edibility of BPS; determine the potential of the developed beverages in terms of its degree of social acceptability as to sensorial attributes; analyze its marketability in terms of consumers' willingness to buy at a given price, consumer demand; determine the promotional strategies that influence the consumers buying decision; analyze the viability of developing banana-pseudo stem juice, tea, and shake; and determine the relationship between respondents' socio-demographics and products' acceptability and marketability.

Methods

The research design combines experimental and descriptive methods. Three treatments were made for each beverage. The descriptive research design allowed the researchers to describe the developed products' social acceptability and market potential.

Product Development

The pseudo-stems used in developing juice, shake, and tea were acquired from the nearest area where the material was available. The BPS material used in developing the three beverage products was from banana trees that have already borne fruit or those wasted eight to ten months after fruit harvesting. Other ingredients were taken from the public market.

Product Formulation and Processing/Production

Juice, shakes, and tea products were developed to explore and fully harness the banana pseudo-stem's potential. The juice product was developed following the formulation indicated in Table 1. The schematic diagram of producing the product is shown in Figure 1. The procedures are as follows:

1. With precision, remove the outer leaf sheath of the banana pseudo-stem, slice it into thin circles, and delicately take out the fiber between each round. Cut the rounds into small cubes. Add water to extract the juice from the banana pseudo-stem using a blender.
2. Pasteurize the juice extract at a low temperature for approximately thirty minutes and let it cool
3. Filter it through cheesecloth. And then put it in a jar.
4. Measure, then add honey.
5. Put in a refrigerator.
6. Fill it into a bottle and get ready to drink.

Table 1. Formulation of Banana Pseudo-Stem Juice

Ingredients	T1	T2	T3
BPS (inner part and core) Extract	1 kg (0.8 L)	2 kg (1.3 L)	3 kg (1.6 L)
Honey	100 ml	100 ml	100 ml
Water	200 ml	200 ml	200 ml

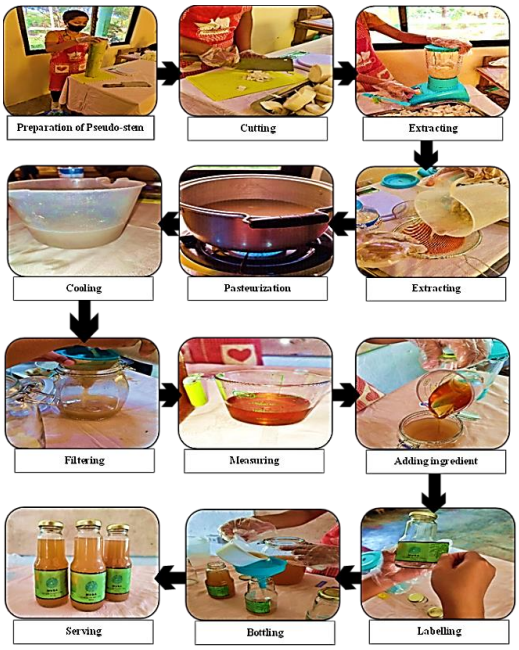

Figure 1. *Schematic Diagram of BSP Juice*

The shake product was developed following the formulation indicated in Table 2. The schematic diagram of producing the product is shown in Figure 2. The procedures are as follows:

1. Remove the outer leaf sheath of the banana pseudo-stem, slice it into thin circles, and take out the fiber between each round. Cut them into small cubes.
2. Measure all the ingredients.
3. Blend the banana pseudo-stem and banana fruit. Add milk, sugar, flavor, and ice.
4. Transfer into a glass.
5. Serve.

Table 2. Formulation of Banana Pseudo-Stem Shake

Ingredients	T1	Treatment 2	Treatment 3
1. Banana Pseudo-Stem (core) Extract	30 g	40 g	50 g
2. Banana Fruit (señorita)	50 g	50 g	50 g
3. Milk	60 mL	60 mL	60 mL
4. Sugar	1 tbsp	1 tbsp	1 tbsp
5. Vanilla	½ tbsp	½ tbsp	½ tbsp
6. Ice	1 cup	1 cup	1 cup

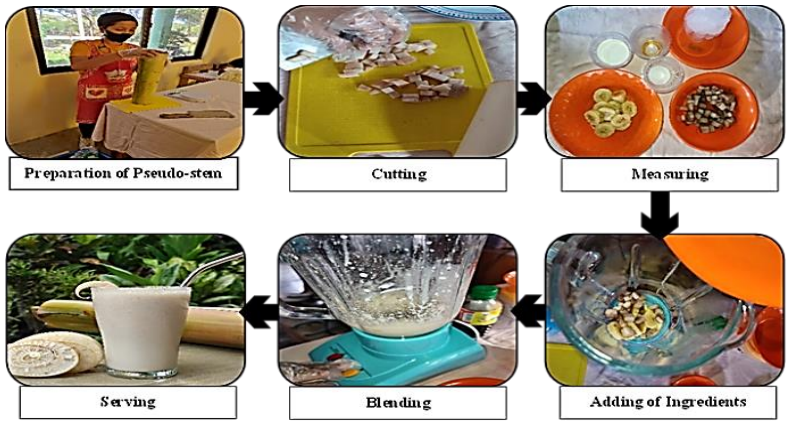

Figure 2. *Schematic Diagram of Processing/Production of Shake*

The tea product was developed following the formulation indicated in Table 3. The schematic diagram of producing the product is shown in Figure 3. The procedures are as follows:

1. Remove the outer leaf sheath of the BPS, slice it into tiny parts, and remove the tough fiber.
2. Remove the outer tough fiber of the leaf sheath.
3. Cut the soft fiber from the middle part of the leaf sheath into small cubes.
4. Dry using the different types of dehydration process.
5. Measure the weight per gram.
6. Pack and label.
7. Serve.

Table 3. Formulation of Banana Pseudo-Stem Tea

Ingredients	T1	T2	T3
Banana pseudo-stem (inner part and core)	Oven dry	Air fry	Sun dry

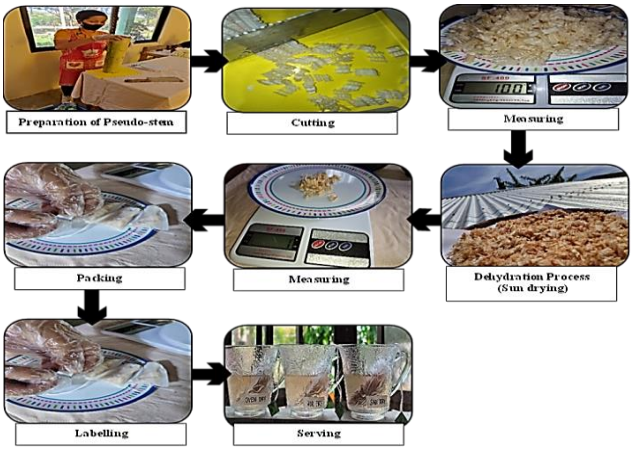

Figure 3. *Schematic Diagram of Processing/Production of Tea*

Social Acceptability and Market Potential Assessment

A pivotal product taste test was meticulously conducted in San Manuel, Isabela, which is crucial in evaluating the developed products' social acceptability.

The research was designed to be inclusive, recognizing that different age groups have different preferences for beverage consumption. Children consume milk-based and sweetened beverages, such as shakes and juice (Grimes et al., 2017). Females consume more fruit juices than males (Mai & Khue, 2016). At the same time, tea consumption was discovered to provide women with greater protection than men (He et al., 2024). With this in mind, the research adopted a randomly selected group of respondents, dominated by women. The juice and shake beverages have three groups of respondents—the childhood, adolescence, and adulthood groups. For the tea, only the adults were taken as respondents. Each product has 30 respondents: males, and females, with no medical restrictions on beverage consumption and no allergies to the product ingredients.

Moreover, the consumer preference for beverages was also considered when assigning each panelist to the product to be evaluated. A brief orientation on the evaluation procedures was performed. The samples were coded with random letters to minimize bias and served in transparent testing cups in a randomized presentation.

Prior to the final assessment, a rigorous pre-assessment of sensory attributes was conducted at San Manuel, Isabela, and ISU-Roxas Campus. This step was crucial in standardizing the formula and development procedures, ensuring the accuracy and reliability of the final assessment. The data from this stage was analyzed using descriptive statistics. Following the product sensory evaluation, the panelists responded to the market potential assessment of the three beverage products. At this point, minimum viable products (prototypes) were provided. The respondents were asked to carefully consider the intrinsic and extrinsic sensory factors to judge whether they would consume the product, how much they think they could consume, and how often. The perceived quantity and frequency of consumption declared by the respondents may have been influenced by their level of acceptability of the three products.

Method of Data Analysis

Descriptive statistics, such as central tendency and frequency distribution, weighted mean, and percentages, were used to examine the data. Correlational analysis, using Statistical Package for the Science (SPSS), was a key part of the study. This analysis determined the relationship between socio-demographics, acceptability, and market potential. A Cost and Return Analysis (CRA) was also conducted to assess the viability of the developed products.

Ethical Considerations

The researchers strictly followed the health protocols against COVID, taking every necessary precaution to ensure the safety of all involved. All raw materials, tools, equipment, and packaging materials used in the development of the beverage products were cleaned and sanitized to ensure clean and safe products before subjecting to taste-testing to assess social acceptability. Before conducting the product taste tests, the researchers secured approval from

the office of the Municipal Mayor and the office of the Barangay Captain where the activity took place. The respondents/untrained panelists were limited to respondents with no medical restrictions on consuming beverages such as juice, shakes, and tea. A short briefing was performed to inform the randomly selected untrained panelists about the research goals. They signed an agreement form before the product taste tests proceeded.

Results and Discussion

Socio-Demographic Profile of the Respondents

The panelists of BPS beverages (juice, shake, and tea) were primarily low-income individuals aged 7-71, with females dominating the number of respondents. The appeal of juice and shake was strongest among younger, single individuals (mean ages = 25.13 and 23.13), while tea was more prevalent among older, married respondents (mean age = 41.17). The average household size of four to six members was a notable trend, with agriculture being the primary income source. Educational backgrounds varied, with juice and shake consumers mainly at the primary level, while tea panelists showed a mix of primary graduates and tertiary education. This consumer profile is in line with the analysis of consumer preferences for tea beverages by Hong et al. (2024).

Table 4. Socio-Demographic Profile of Panelists

Profile	Juice		Shake		Tea	
	F (n=30)	Percent (%)	F (n=30)	Percent (%)	F (n=30)	Percent (%)
Age						
7-19	20	66.67	20	66.67	-	-
20-32	3	10	3	10	13	43.33
33-45	-	-	1	3.33	4	13.33
46-58	3	10	4	13.33	8	26.67
59-71	4	13.33	2	6.67	5	16.67
Mean	25.13		23.13		41.17	
Sex						
Male	9	30	9	30	13	43.33
Female	21	70	21	70	17	56.67
Civil Status						
Single	23	76.67	23	76.67	9	30
Married	7	23.33	7	23.33	19	63.33
Widowed	-	-	-	-	2	6.67
Household size						
1-3	6	20	6	20	10	33.33
4-6	19	63.33	19	63.33	15	50
7-9	5	16.67	5	16.67	5	16.67
Mean	5		5		5	
Household Income						
1-10,957 PHP	28	93.33	28	93.33	28	93.33
10,958 -21,914 PHP	2	6.67	2	6.67	2	6.67
Mean	6,209 PHP		6,209 PHP		6,209 PHP	
Educational Background						
Primary (ng)	15	50	14	46.67	3	10
Primary (g)	2	6.67	4	13.33	7	23.33
Secondary (ng)	8	26.67	8	26.67	3	10
Secondary (g)	2	6.67	1	3.33	6	20
Tertiary (ng)	3	10	3	10	7	23.33
Tertiary (g)	-	-	-	-	4	13.33
Source of Income						
Agriculture Crops	16	53.33	14	46.67	14	46.67
Self-Employed (Small Business)	5	16.67	6	20	6	20
Private Sector Salary	9	30	10	33.33	10	33.33

Level of Consumers' Awareness of the Edibility of BPS

It was revealed in the descriptive analysis that the respondents generally have no knowledge that BPS can be processed and eaten (M=1.54), may be consumed in various forms from liquid to powder (M=1.30), is an abundance of certain nutrients that are beneficial to the body (M=1.08), may reduce the rate at which sugar and fats held in body cells are released (M=1.07), benefit anyone following a weight-loss regimen (M=1.07), support the balance of bodily fluids (M=1.07), help alleviate urinary tract infections (UTIs) and stop kidney stones from forming (M=1.08), can help regulate the acidic levels in one's body (M=1.07), and can ease heartburn, discomfort, and burning in the stomach (M=1.07). The results show that respondents were significantly unaware (GWM=1.04) of the several health advantages and possible applications of banana pseudo-stem (BPS). The low mean scores across the many things measured indicate that respondents were mainly unaware of the uses and benefits of BPS despite being a nutrient-rich and adaptable component. Its adaptability opens up a world of potential uses, inspiring further research and exploration.

Table 5. Level of Consumers' Awareness of the Edibility of BPS

Statements	WM	DM
BPS can be processed and eaten.	1.54	Not at all aware
BPS may be consumed in various forms, from liquid to powder.	1.30	Not at all aware
BPS is an abundance of certain nutrients that benefit the body.	1.08	Not at all aware
It may reduce the rate at which sugar and fats held in body cells are released.	1.07	Not at all aware
It can benefit anyone following a weight-loss regimen.	1.07	Not at all aware
It can support the balance of bodily fluids.	1.07	Not at all aware
It can contribute to alleviating urinary tract infections (UTIs) and stop kidney stones from forming.	1.08	Not at all aware
It can help regulate the acidic levels in one's body.	1.07	Not at all aware
It can relieve heartburn, discomfort, and burning in the stomach.	1.07	Not at all aware
GWM	**1.04**	**Not at all aware**

Note*: WM is Weighted Mean; DM is Descriptive Meaning; GWM is General Weighted Mean*

Social Acceptability Level in Terms of Palatability of Banana Pseudo-Stem Juice, Shake, and Tea

The sensory evaluation results, obtained through a combination of taste tests and consumer surveys, show that the BPS juice, shake, and tea have different flavor profiles. These variations affect the products' acceptance and general palatability. It was determined that the sweetness of the BPS juice was moderately acceptable (Table 4), meaning that although it is acceptable, people who like a sweeter flavor would only be partially satisfied. Since the sourness was deemed neither unacceptable nor acceptable, it is unlikely to considerably improve or detract from the product. This may indicate that the flavor profile must be more balanced to increase consumer appeal. Crucially, the juice had no bitterness, a typical unfavorable taste characteristic that can make a drink less appealing.

Conversely, the BPS shake was deemed 'extremely acceptable,' with no sourness or bitterness detected. Its well-balanced flavor profile, free from any off-putting notes, makes it a highly palatable option and potentially the best of the three BPS beverages. This balance in flavor is likely to leave consumers satisfied and content with their choices.

Although a small amount of bitterness is normal in tea, particularly in herbal or plant-based teas, too much bitterness can make consumers less likely to like the beverage. To lessen the bitterness and enhance the overall sensory experience, the tea's acceptable status emphasizes the need for flavor alterations. This could be achieved by adding sweetening agents such as honey or sugar or by changing the brewing procedure, such as reducing the steeping time or adjusting the water temperature.

Though the juice and tea may be enhanced, particularly in terms of balancing sweetness, sourness, and bitterness, the BPS shake is the most successful product overall in terms of palatability. These findings demonstrate that flavor formulation is essential to functional beverages' commercial success because taste attributes greatly influence consumer preferences. For marketing professionals, this means that the BPS shake should be positioned as the flagship product, with the juice and tea marketed as complementary options. Notably, consumers would want to consume low-bitter/high-sweet beverages. Drinks' preferred flavors are positively influenced by sweetness (Gous et al., 2019).

Table 4. Social Acceptability Level in terms of General Palatability of BPS Juice, Shake, and Tea

Taste buds	Juice		Shake		Tea	
	WM	DM	WM	DM	WM	DM
Sweet	4.13	MA	4.67	EA	-	-
Sour	2.6	U/A	-	-	-	-
Bitter	-	-	-	-	2.2	SU
General Palatability	3.57	MA	4.66	EA	2.2	SU

Note: WM is weighted mean; DM is descriptive meaning; GWM is general weighted mean. EA is extremely acceptable; MA is moderately acceptable; U/A is unacceptable nor acceptable; SU is slightly unacceptable.

Social Acceptability Level of Sensorial Properties/Attributes of BPS Juice, Shake, and Tea

Reflected in the overall acceptability, the BPS juice and shakes were more well-liked than tea (Table 5). Many aspects of consumer preferences and sensory attributes may have contributed to this finding. The juice and shake received high ratings for color, taste, aroma, aftertaste, and overall acceptability, indicating that their sensory profiles are pleasant and well-balanced. Given that color is frequently one of the first things buyers notice, the juice's "very good" color rating indicates that it was aesthetically pleasing, which probably helped it receive a favorable review. Based on these results, the tea may need sensory modifications to increase consumer acceptance, especially in its aftertaste and taste profile. This emphasizes how crucial it is to improve the overall flavor of functional beverages, especially given the expanding demand for health-conscious goods like those derived from banana pseudo-stems. The study by Commey and Sanful (2023) also reassures us about the high acceptance of the overall sensory attributes of banana-based beverages, indicating their potential in the market.

Table 5. Social Acceptability Level of Sensorial Properties/Attributes of BPS Juice, Shake, and Tea

	Juice		Shake		Tea	
Attributes	WM	DM	WM	DM	WM	DM
Color	4.07	VG	4.27	E	2.87	G
Taste	3.00	G	4.53	E	2.00	F
After Taste	2.63	G	4.13	VG	1.73	P
Aroma	3.20	G	3.93	VG	2.07	F
Overall acceptability	3.23	G	4.47	E	2.00	F

Market Potential of BPS Juice, Shake, and Tea in Terms of Consumer Demand

Estimated Quantity of Consumption

Results revealed that consumers take an average of 188 ml of juice every time they consume it (Table 6). For shakes, the average demand is 258 ml every time they consume it. Meanwhile, the consumers only take 74ml of tea every time they consume it. Beverage consumption, however, is frequently influenced by socio-demographic variables.

Compared to women, men consume significantly more total beverages (11.7 cups) than women (9.3 cups). With beverages accounting for about 18% of daily caloric consumption (385 calories of a 2,115-calorie diet), they play a significant role in adults' nutritional intake. Drinks account for almost half of daily added sugar intake, with sugar-sweetened beverages being the primary source. It is comforting to know that beverages contribute to a balanced diet because they do not affect the amount of fat and protein consumed. Additionally, certain beverages include important minerals, such as vitamins C and D (LaComb et al., 2011).

Table 6. Estimated Quantity of Consumption

Beverage Products	Total Quantity (ml)	Average Quantity (ml)
Juice	16, 950	188
Shakes	23, 190	258
Tea	6,650	74

Perceived Frequency of Beverage Consumption

Based on Table 7, most respondents believe that BPS juice, shakes, and tea are only seldom consumed (once a week), suggesting that these drinks are viewed as supplemental or infrequent rather than regular parts of daily routines. According to research, functional beverages—like juices, shakes, and teas—are usually used seldom and are seen as supplements rather than daily needs. This pattern is consistent with the results about consumer behavior for beverages that are intended to provide particular health benefits. Because they are marketed as niche goods aimed at health-conscious consumers rather than as alternatives to everyday beverages like milk or water, functional drinks—especially those with unusual formulas or ingredients—these are frequently drunk monthly or infrequently rather than daily (Kaur et al., 2024). Drinks containing special ingredients or bioactive substances, promoted for their particular health advantages rather than everyday hydration or nutritional requirements, are a prime example of this trend. These beverages—such as antioxidant-rich teas or juices high in fiber—are valued for their practical benefits but are less likely to be incorporated into daily routines because of their expense, taste, or perceived necessity (Mohanty, 2022). It is emphasized how crucial it is to properly position these drinks to boost usage frequency. This includes removing potential obstacles like cost and accessibility and empowering the audience.

Table 7. Perceived Frequency of Consumption

Frequency of Consumption	Juice		Shakes		Tea	
	f	%	f	%	f	%
3x a day	3	10	2	6.67	3	10
2x a day	7	23.33	8	26.67	5	16.67
1x a day	5	16.67	4	13.33	8	26.67
Every other day	4	13.33	5	16.67	5	16.67
Once a week	11	36.67	11	36.67	9	30
Total	**30**	**100**	**30**	**100**	**30**	**100**

Profitability of Banana Pseudo-Stem Juice, Shake, and Tea

Juice

A clear correlation between ingredient content and production cost may be seen in the BPS juice production project. The least expensive treatment, T1, has a lower budget of ₱1,117.90 (Table 8) since it contains less banana pseudo-stem (BPS) extract. At ₱2,808.06, T3, on the other hand, costs a lot more because it includes the most BPS extract. Since the quantity and quality of ingredients affect direct costs, this pattern is consistent with economic concepts in production management (Insightivity, 2023). A 50% profit margin across all treatments demonstrates a balanced approach to profitability, following industry standards in small-scale beverage production meant to achieve market competitiveness.

Given the projected 50% return on investment (ROI), the venture has the potential to attract partners looking for modestly lucrative ventures and is financially feasible. This financial structure reflects producers' strategies for producing functional beverages, where cost-effectiveness is controlled by strategically selected ingredients, and maintaining profit margins that meet industry standards (Planet Together, 2024).

Table 8. Cost and Return Analysis for Banana Pseudo-Stem Juice

Particulars (Variable Costs)	Treatments/Variants		
	T1	T2	T3
Banana Pseudo-Stem	80	320	720
Honey	297.1	297.1	297.1
Water	10	10	10
Bottle	80	160	240
Packaging	40	80	120
Electricity	0.27	0.53	0.8
Disposable Gloves	4.8	9.6	14.4
Total Variable Cost	512.19	877.28	1,402.34
Fixed Costs			
Labor	400	800	1,200.00
Depreciation Cost	205.72	205.72	205.72
Total Fixed Cost	605.71	1,005.71	1,405.71
Total Project Cost	**1,117.90**	**1,882.99**	**2,808.06**
Unit Cost	46.58	23.54	19.5
Margin Price (50%)	23.29	11.77	9.75
Selling Price	69.87	35.31	29.25
Projected Sales	1,676.85	2,824.48	4,212.08
Net Profit	558.95	941.49	1,404.03
ROI	**50%**	**50%**	**50%**

Shake

The T1 formulation shows cost-effectiveness in shake manufacturing by lowering production costs to ₱4,519.89 (Table 9) with less banana pseudo-stem (BPS) extract. However, T3's higher BPS extract concentration drives production costs to ₱4,567.89, which explains the link between manufacturing costs and ingredient utilization.

An 80% margin is applied to all treatments to provide a consistent approach to pricing and profitability. A well-thought-out strategy for striking a balance between production costs, price, and marketability is demonstrated by the expected return of ₱0.80 for every peso spent, which makes shake production a viable choice for small-scale or niche markets due to its low-profit margin.

Additionally, long-term viability in a competitive market may be ensured by raw material procurement and formulation techniques that significantly affect cost structures and product attractiveness. Purchasing raw materials optimally is essential for the food and beverage industry to maximize output, reduce costs, and maintain competitiveness (Planet Together, 2024). This strategic approach is key to achieving and sustaining financial sustainability (SpendEdge, 2024), providing a promising outlook for the future.

Table 9. Cost and Return Analysis for Banana Pseudo-Stem Shake

Particulars (Variable Costs)	Treatments/Variants		
	T1	T2	T3
Banana Pseudo-Stem	72	96	120
Banana Fruit	420	420	420
Evaporated Milk	948.29	948.29	948.29
Sugar	262.61	262.61	262.61
Vanilla Flavor	114.07	114.07	114.07
Ice	240	240	240
Disposable Gloves	144	144	144
Cups	780	780	780
Electricity	40.4	40.4	40.4
Total Variable Cost	3021.37	3045.37	3069.37
Fixed Costs			
Labor	1200	1200	1,200.00
Depreciation Cost	298.53	298.53	298.53
Total Fixed Cost	1498.53	1498.53	1498.53
Total Project Cost	**4,519.89**	**4,543.89**	**4,567.89**
Unit Cost	18.83	18.93	19.03
Margin Price (50%)	15.07	15.15	15.23
Selling Price	33.9	34.08	34.26
Projected Sales	8,135.81	8,179.01	8,222.21
Net Profit	3,615.92	3,635.11	3,654.31
ROI	**80%**	**80%**	**80%**

Tea

The cost of production in sun drying (T3) is lowest (₱848.70) compared to the cost of production in oven drying (T1) (₱1,296.52) as shown in Table 10. The drying method significantly impacts the total cost of producing BPS tea. At least in part, the reason for this difference in cost is that while oven drying requires the application of fuel or electricity and part of the cost of owning and maintaining the equipment necessary for drying, sun drying does not. The financial benefits of sun drying are emphasized, particularly in an environment with few resources where cost and profitability are critical factors.

The tea is also financially sustainable, with an 80% return on investment. While it indicates a strong economic potential, it must confront market demand, competition, and external obstacles for sustainable success.

In his paper, Fuller (n.d.) stated that sun drying is frequently the most economical, especially in temperate weather areas. However, sun drying may expose goods to outside factors like rain and insects, leading to uneven product quality. Oven drying has much higher running costs, which might make it less feasible for large-scale or low-margin manufacturing, even though it offers precision and faster drying durations (Sahdev, 2014).

Table 10. Cost and Return Analysis for Banana Pseudo-Stem Tea

Particulars (Variable Cost)	Treatments/Variants		
	T1	T2	T3
Banana Pseudo-Stem	40	40	40
Tea Bag	198	144	162
Packaging	132	96	108
Disposable Gloves	2.4	2.4	2.4
Electricity	192	10	0
Total Variable Cost	564.4	292.4	312.4
Fixed Cost			
Labor	500	500	500
Depreciation Cost	232.12	234.3	36.3
Total Fixed Cost	732.12	734.3	536.3
Total Project Cost	**1296.52**	**1026.7**	**848.7**
Unit Cost	2.95	3.21	2.36
Margin Price (80%)	2.36	2.57	1.89
Selling Price	5.31	5.78	4.25
Projected Sales	2333.74	1848.06	1528
Net Profit	1037.22	821.36	678.96
ROI	**80%**	**80%**	**80%**

Relationship Between Socio-demographic Profile and Marketability in Terms of Quantity and Frequency of Consumption

The amount of BPS juice and shakes consumed was found to be significantly correlated negatively with age and civil status. BPS juice consumption is considerably lower among older and married people ($\tau b = -0.373$, $p = 0.008$). Civil status ($rpb = -0.470$, $p = 0.009$) and BPS shake consumption is similarly lower among these groups (age: $\tau b = -0.475$, $p = 0.001$; civil status: $rpb = -0.345$, $p = 0.042$). The frequency of BPS juice and shake consumption was also inversely connected with household size and source of income. Juice consumption was lower in larger households ($\tau b = -0.453$, $p = 0.005$), most likely as a result of budgetary restrictions or the need to prioritize necessities.

Additionally, because households with irregular or agricultural income may have limited discretionary expenditure, decreased consumption of shakes ($\tau b = -0.377$, $p = 0.019$) and juice ($\tau b = -0.381$, $p = 0.017$) was associated with less stable income sources. These results are consistent with other studies on consumer behavior that highlight how household dynamics and financial well-being affect habits related to non-essentials. Married families and older persons prioritize necessities and cut back on discretionary spending, especially on non-essential items like drinks. Budgetary restrictions frequently affect larger households, restricting their ability to buy such things.

Similarly, because of financial insecurity, households with erratic or agricultural revenue sources spend less on luxury or non-essential items (Lee et al., 2014). The varying amount of beverage consumption by age was also found in the study of Ozen et al. (2022).

It is worth noting that this research found no significant correlation between the quantity and frequency of tea drinking and any demographic variables. Due to its accessibility, affordability, and cultural significance, tea is one of the most popular drinks in the world, according to studies. Tea is consistently consumed in Asia regardless of income level due to its cost and historical role (Czarniecka-Skubina et al., 2022). The tea's distinctive position as a globally widely used beverage and reasonably priced staple might explain why there is no correlation between it and demographic traits.

Conclusion and Future Works

The findings of the study suggest intensive marketing mix strategy development for successful market penetration of BSP beverages. It is important to note that economic and demographic variables significantly impact

BPS juice and shake intake. Married and older adults tend to drink fewer of these drinks because they value requirements over frivolities. Reduced spending is also seen in larger households and those with erratic income sources, which reflects financial instability and budgetary restrictions. However, tea consumption is unaffected due to its cost and cultural relevance as an essential beverage. These trends are consistent with general studies on consumer and non-essential buying behaviors. Therefore, market segmentation and targeting strategies are recommended for enterprising BSP beverage companies. Production must focus on the highly favored shake with the highest potential. The urgency for change is evident in the need to improve the product attributes of BSP juice and tea, such as the taste and aftertaste, to boost its market potential. Lastly, promotional campaigns to increase awareness of BSP's benefits for human health must also be considered to encourage consumers to patronize products such as BSP beverages.

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Conflict of Interest

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