Sensory Evaluation and Acceptability of *Bambusa blumeana* as Bamboo Shoot Polvoron

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**Abstract.** The Bamboo shoots of the grassy Poaceae family have fibre, potassium and lignans, which are believed to hold anti-cancer, antibacterial, anti-fungal and anti-viral properties, according to agsys.wsu.edu. There is already a legion of studies, pertaining to the use of bamboo shoots as the main ingredients in baked goods. An example is the Polvoron. This is one of the popular Filipino desserts, especially among young ones. This study presents a new polvoron flavor derived from the bamboo shoot (bayog) powder. The product also underwent nutritional analysis which was conducted by the Food and Nutrition Research Institute Service Laboratory. This study aimed to develop processed bamboo shoot into polvoron along with its sensory evaluation and acceptability among consumers. The researchers used an experimental design for the four treatments with different proportion of bamboo shoot powder for every treatment employed during the evaluation. There were 50 untrained respondents. Respondents were able to select and evaluate the products using the Semantic scale for the colour, taste, texture and odour and hedonic scale and facial hedonic scale for the general acceptability of the product. Results showed that Treatment 3 had the most acceptable treatment with a mean value of 7.95, interpreted as Like Very Much with light brown, pronounced bamboo shoot flavour, moderately smooth texture and moderately detected bamboo odour. Hence the incorporation of powdered bamboo shoots into polvoron is widely acceptable among its consumers.

**Keyword:** bamboo shoot, polvoron, colour, texture, odour and taste.

1. Introduction

Polvorón (from *polvo*, the Spanish word for powder), is a type of heavy, soft, and very crumbly Spanish shortbread made of flour, sugar, milk, and nuts (especially almonds). Polvorones are popular holiday delicacies in all of Spain as well as its former colonies in Latin America and the Philippines[1].

Bamboo, the tallest grass in the world belonging to the family of Poaceae, grows in tropical countries like the Philippines [2]. The shoots can grow without any fertilizer or any chemical that can affect the given nutrients on the shoots. Thus, it makes the shoots free from a residual toxin [3].

Moreover, the bamboo shoot has sufficient vitamins and minerals such as Vitamin B6, riboflavin, thiamine, niacin, calcium, folate and pantothenic acid. The bamboo shoot also contains a nominal amount of carbohydrates, calories and sugar. It keeps you full for a long time; thus, it helps you lose weight. It can also reduce cholesterol because of its phytonutrients and phytosterols which helps lessen the harmful cholesterol in the body. Furthermore, bamboo shoot is a medicinal plant because it can treat cancer, aid wound cleaning and prevent stomach disorder; it can also lower blood pressure [3].

Thus, the development of polvoron made of bamboo shoot helps in the implementation of National Government Program on food fortification as one way of eradicating malnutrition in the Philippines.

DOST Region 02 has identified ISU Cauayan as the beneficiary of assistance for the project entitled “Strengthening Bamboo Industry for Community Development in Cauayan City, Isabela” in support of the SMARTER Cauayan City project. Cauayan City plans to revive the bamboo as part of its One Town One Product (OTOP). With this, the production of bamboo food products will strengthen tourism industry and provide additional job opportunities in the municipality.

1.1 Objectives of the study

The study was conducted to achieve the following:

1. Describe the acceptability of the sensory quality of the developed bamboo shoot regarding:
   a. Colour;
   b. Texture;
   c. Taste; and
   d. Odour
2. Determine the most acceptable polvoron at different proportions of bamboo shoot powder; and
3. Determine the quality of bamboo shoot polvoron regarding the Nutritional components.

2. Materials and Methods

2.1 Preparation of Bamboo shoot

The Bamboo shoot (bayog) variety was bought at Angandanan, Isabela. Peel off the bamboo shoot, wash and shred. Add salt and boil the shredded bamboo shoots for one hour. Drain and squeeze shredded bamboo shoot to remove excess water. Set aside.

2.2 Preparation of Bamboo shoot extract

Liquefy shredded bamboo shoot and strain. Place extract into sterilized containers. Set aside.

2.3 Preparation of Bamboo shoot powder

Use spray dryer to process bamboo shoot extract into powder.

2.4 Preparation of Bamboo shoot Polvoron

Measure the dry ingredients. In a medium-sized bowl, mix all purpose flour and bamboo shoot powder. Heat pan and roast all purpose flour and bamboo shoot powder until light brown. Cool. Add powdered milk. Mix well. Add sugar and melted margarine. Mix well. Mould the polvoron mixture to the desired size. Wrap in cellophane. Pack and label.

2.5 Research Design

The Completely Randomized Design (CRD) was utilized in this study. Four treatments were used as follows: Treatment 1 (59.15 g Bamboo shoot powder and 177.45 g All Purpose Flour), Treatment 2 (118.30 g Bamboo shoot powder and 118.30 g All purpose flour), Treatment 3 (177.45 g Bamboo shoot powder and 59.15 g All Purpose flour) and Treatment 4 (236.59 g All Purpose Flour).

2.6 Instruments used

To determine the sensory evaluation of the bamboo shoot polvoron as well as the acceptability of the product, the following options and verbal interpretation was used:

| SEMANTIC SCALE |
|----------------|
| RANGE | SCALE | DESCRIPTION | ABBREVIATION |
|-------|-------|--------------|---------------|
| COLOR |
| 4.20-5.00 | 5 | Golden Brown | PB |
| 3.40-4.19 | 4 | Dark Brown | LB |
| 2.60-3.39 | 3 | Brown | B |
| 1.80-2.59 | 2 | Light Brown | BB |
| 1.00-1.79 | 1 | Pale Brown | DB |
| TEXTURE |
| 4.50-5.00 | 5 | Smooth | S |
| 3.50-4.49 | 4 | Moderately Smooth | MS |
| 2.50-3.49 | 3 | Neither Smooth nor Rough | NSR |
| 1.50-2.29 | 2 | Moderately Rough | MR |
| 1.00-1.49 | 1 | Rough | R |
| TASTE |
| 4.50-5.00 | 5 | Very pronounced bamboo shoot Flavor | VPLF |
| 3.50-4.49 | 4 | Pronounced bamboo shoot Flavor | PLF |
| 2.50-3.49 | 3 | Moderately pronounced bamboo shoot Flavor | MPLF |
HEDONIC SCALE

| RANGE     | SCALE | DESCRIPTION            | ABBREVIATION |
|-----------|-------|------------------------|--------------|
| 1.00-1.49 | 1     | Absence of bamboo shoot flavor | ALF |
| 1.50-2.29 | 2     | Slightly pronounced bamboo shoot flavor | SPLF |
| 2.50-3.49 | 3     | Moderately pronounced bamboo shoot odour | MPLF |
| 3.50-4.49 | 4     | Pronounced bamboo shoot odour | PLF |
| 4.50-5.00 | 5     | Very pronounced bamboo shoot odour | VPLF |
| 5.50-6.49 | 6     | Like Slightly            | LS |
| 6.5-7.49  | 7     | Like Moderately          | LM |
| 7.5-8.49  | 8     | Like Very Much           | LVM |
| 8.5-9.00  | 9     | Like Extremely           | LE |

2.7 Sensory Evaluation

A sensory evaluation was used to determine the general acceptability and quality of bamboo shoot polvoron regarding colour, texture, taste and odour. It was done by a panel composed of 50 untrained judges. Selected judges were faculty members, staff, students and vendors of Isabela State University- Cauayan Campus, High School students and Elementary pupils whose ages ranged from 8 years old to 45 years old. The procedures and precautions involved in proper sensory evaluation as suggested by Gatchalian [4] and Mabesa [5] were followed in the study. An equal amount of samples from each treatment were coded with 3-digit random numbers. The coded samples were presented to each panel of evaluators in a randomized order. Score cards were used in the evaluation. The Hedonic scale and the Facial Hedonic scale or “smiley” rating scale was used to determine the general acceptability of the finished products. Furthermore, the Semantic Scale was used to evaluate the quality of the products.

2.8 Statistical Analysis

Results of the sensory evaluation were statistically analyzed using the two-way classification of the analysis of Variance (ANOVA). F–test, mean and Descriptive Statistics were used to determine if there is a significant difference among the treatment samples in terms of colour, texture, taste and odour of the bamboo shoot polvoron and its acceptability as well.

3. Results and Discussion

| Treatment | Color Preference |
|-----------|------------------|
|           |                  |

Table 1. Color Preference of Bamboo Shoot Polvoron
As shown in Table 1, the most preferred colour of bamboo shoot polvoron was Treatment 3 with a mean value of 2.58 and a descriptive interpretation of light brown. On the other hand, Treatment 1 and treatment 2 got a mean score of 1.88 and 2.37 respectively and interpreted as light brown. Lastly, Treatment 4 got a mean score of 1.39 and interpreted as pale brown.

The colour of the food has a large impact on our perception of it. It can enhance the food quality by its colour.[6]

| Treatment | Texture Preference |
|-----------|--------------------|
| Mean      | Description        |
| T1-59.15g bamboo shoot powder | 4.00 | Moderately smooth |
| T2-118.30g bamboo shoot powder | 4.04 | Moderately smooth |
| T3-177.45g bamboo shoot powder | 4.20 | Moderately smooth |
| T4- Control | 4.24 | Moderately smooth |

As to the texture preference of the evaluators, Treatment 1,2,3 and 4 have a mean value of 4.00, 4.04,4.20 and 4.24 respectively and were interpreted as moderately smooth.

Texture can influence flavor and appearance of the food. It is assessed in many different ways such as chewing, springiness and its fracturability.

Table 2. Analysis of Variance on Color Preference of Bamboo Shoot Polvoron

| Source of Variation | SS   | F   | p-value |
|---------------------|------|-----|---------|
| Between Groups      | 4.12 | 1.69| 0.153   |
| Within Groups       | 118.60|     |         |

Table 2 shows that there is no significance difference on the colour preference of the bamboo shoot polvoron between and within groups of the Treatments with an F computed value of 1.69 at the p-value of 0.153. It implies that there is no significant difference on the evaluators color preference of bamboo shoot polvoron.

Table 3. Texture Preference of Bamboo Shoot Polvoron

Table 4. Analysis of Variance on Texture Preference of Bamboo Shoot Polvoron

| Source of Variation | SS   | F   | p-value |
|---------------------|------|-----|---------|
| Between Groups      | 2.42 | 1.01| 0.391   |
| Within Groups       | 134.94|    |         |

Table 4 shows that there is no significance difference in the texture preference of bamboo shoot polvoron between and within groups of the treatments with F computed value of 1.01 at p-value of 0.391. This means that there is no significant difference on the evaluators texture preference of the product bamboo shoot polvoron.

Table 5. Taste Preference of Bamboo Shoot Polvoron

| Treatment | Taste Preference |
|-----------|------------------|
| Mean      | Description      |
| T1-59.15g bamboo shoot powder | 2.56 | Moderately Pronounced Bamboo shoot flavour |
| T2-118.30g bamboo shoot powder | 3.28 | Moderately Pronounced Bamboo shoot flavour |
| T3-177.45g bamboo shoot powder | 4.47 | Pronounced Bamboo shoot flavour |
Regarding taste preference, Treatment 3 has a mean value of 4.47 which is interpreted as pronounced bamboo shoot flavour while Treatment 1 and Treatment 2 were interpreted as moderately pronounced bamboo shoot flavour with a mean value of 2.56 and 3.28 respectively. Lastly, Treatment 4 got a mean value of 1.38 and interpreted as absence of bamboo shoot flavour.

It has been supported by the study of Ogawa [7] that the sense of taste is important as it allows for assessment of nutritional value, safety and quality of food for enjoyment and quality.

**Table 6.** Analysis of Variance on Taste Preference of Bamboo Shoot Polvoron

| Source of Variation | SS    | F      | p-value |
|---------------------|-------|--------|---------|
| Between Groups      | 158.31| 37.90  | 3.34E-19|
| Within Groups       | 261.77|        |         |

Table 6 shows that there is a significant difference in the taste preference of bamboo shoot polvoron between and within groups of the treatments with an F computed value of 37.90 at p-value of 3.34 E - 19.

Regarding odour preference, Treatment 3 got a mean value of 3.48 which is interpreted as having a moderately detected bamboo odour while treatment 1 and treatment 2 have a mean value of 2.16 and 2.22 respectively and interpreted as slightly detected bamboo odour. Lastly, treatment 4 got a mean value of 1.48 and interpreted as absence of bamboo shoot odour.

**Table 7.** Odour Preference of Bamboo Shoot Polvoron

| Treatment | Odor Preference | Mean | Description |
|-----------|-----------------|------|-------------|
| T1 - 59.15g bamboo shoot powder | 2.16 | Slightly detected bamboo odour |
| T2 - 118.30g bamboo shoot powder | 2.22 | Slightly detected bamboo odour |
| T3 - 177.45g bamboo shoot powder | 3.48 | Moderately detected bamboo odour |
| T4- Control | 1.48 | Absence of Bamboo odour |

**Table 8.** Analysis of Variance on Odor Preference of Bamboo Shoot Polvoron

| Source of Variation | SS    | F      | p-value |
|---------------------|-------|--------|---------|
| Between Groups      | 42.2  | 95.57  | 1.02E-28|
| Within Groups       | 14.8  |        |         |

Table 8 shows that there is a significant difference in the odour preference of bamboo shoot polvoron between and within groups of the treatments with an F computed value of 95.57 at p-value of 1.02E-28.

As shown in table 9, Treatment 3 has a mean value of 7.95 and interpreted as Like Very Much. The most acceptable bamboo shoot polvoron was Treatment 3. Also, it can be gleaned that the more bamboo shoot powder added to the polvoron, the more appetizing it was due to as to its light brown colour. It is more acceptable with its moderately smooth texture, and more acceptable with its pronounced bamboo shoot flavour and moderately detected bamboo shoot odour.

**Table 9.** Panel Evaluation on the General Acceptability of Bamboo Shoot Polvoron using the Hedonic Scale

| Treatment                  | Degree of Acceptability | Mean | Description         |
|----------------------------|-------------------------|------|---------------------|
| T1 - 59.15g bamboo shoot powder | 6.55                   | Like Moderately |
| T2 - 118.30g bamboo shoot powder | 6.53                   | Like Moderately |
| T3 - 177.45g bamboo shoot powder | 7.95                   | Like Very Much  |
| T4- Control                | 6.55                   | Like Moderately |

**Table 10.** Analysis of Variance on the Hedonic Evaluation of Bamboo Shoot Polvoron

Retracted
The analysis of variance on the hedonic evaluation of bamboo shoot polvoron showed a significant difference in their acceptability for Treatment 1, 2, 3 and 4 with an F value of 1.15 and p-value of 0.329.

| Source of Variation | SS    | F     | p-value |
|---------------------|-------|-------|---------|
| Between Groups      | 5.93  | 1.15  | 0.329   |
| Within Groups       | 329.31|       |         |

Table 11. Result of Nutritional Analysis of Bamboo shoot Polvoron

| ANALYTE per 100g | RESULTS | REFERENCE METHOD |
|------------------|---------|------------------|
| Ash, g           | 2.0     | AOAC 930.30      |
| Energy, Kcal     | 500     | Computed using at water Factors |
| Total fat, g     | 23.5    | Acid Hydrolysis (Soxhlet) |
| Total Carbohydrate, g | 65.9 | Computed by difference |

| Parameters | Unit | Test Method | Test Method |
|------------|------|-------------|-------------|
| Moisture   | g/100g | Vacuum Oven Drying | 2.32 |
| Protein (N x 6.26) | g/100g | Kjeldahl | 6.32 |

4. Conclusion

The development of polvoron made of bamboo shoot helps in the implementation of National Government Program on Food fortification as one way of eradicating malnutrition in the Philippines. Having high nutritive value, it can be processed into a wide variety of nutritious products. Based on the results of the study, treatment 3 had the most acceptable treatment with a mean value of 7.95 and interpreted as Like Very Much with light brown colour, pronounced bamboo shoot flavour, moderately smooth texture and moderately detected bamboo odour.

F test revealed that there is significant difference in taste and odour and no significant difference in colour and texture.

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