

# Acceptability of Sweet Potato (*Ipomoea batatas*) flour and Toasted Rice (*Oryza sativa*) Powder as Base Ingredients in Making Polvoron



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**Abstract** Sweet potatoes and rice are common food staples among Filipinos. Deterioration of these food commodities significantly affect their marketability which leads to create innovations for consumption and profitability. This study aimed to develop a polvoron made from sweet potato flour and toasted rice powder as base ingredients. This descriptive study utilizes mean to determine the level of acceptability of the respondents to the product. Each sensory quality of the sweet potato and toasted rice polvoron was rated on a Likert scale of 1 to 5. There were 150 respondents who were conveniently selected which composed of 25 households and 25 vendors from Sta. Cruz, Davao del Sur, 25 households and 25 vendors from Sulop, Davao del Sur, and 25 students and 25 faculty/staff from UM Digos College. The respondents' assessment in terms of palatability obtained a mean score of 4.63 (SD = 0.688), considered the most acceptable. Texture obtained a mean score of 3.87 (SD = 0.665), which was described as more acceptable. Aroma obtained a mean score of 4.72 (SD = 0.490), considered the most acceptable. Color obtained a mean score of 4.68 (SD = 0.489), considered the most acceptable, and appearance obtained a mean score of 4.80 (SD = 0.451), considered the most acceptable. The overall average rating of the product obtained a mean score of 4.54 (SD = 0.40). Moreover, the product described to be highly acceptable in terms of palatability, texture, aroma, color, and appearance. The data revealed that sweet potato and toasted rice powder can be base ingredients of polvoron. Thus, it is recommended that the texture shall be more refined. The product can be a good input for starting up a small business.

**Keywords:** palatability, texture, aroma, color, appearance, Philippines

## 1. Introduction

Food innovation is a significant way to reinvent or discover healthier and marketable delicacies. Polvoron is identified as one of the easiest and simplest pastry foods that can be produced instantly by local entrepreneurs and become a source of income, especially for unemployed citizens and Filipino households. It will also help improve farmers' interest by engaging in the extensive production of native crops (Gunnawa 2021). Polvoron contains high cholesterol and glucose content because of its tremendous amount of sugar (Soriano 2020). There are different versions of polvoron, but the Filipino version uses a large amount of flour, powdered milk, hydrogenated fats, and shortenings such as margarine or butter as a substitute for lard (Quimbo 2019). Sweet potato and rice are abundant in Davao del Sur and the Philippines. Blended pure powdered polvoron made of sweet potatoes and toasted rice powder has yet to be produced. Therefore, the researchers will produce an innovative mixture of polvoron using these great locally available products. Hence, the researchers conducted the study and focused on developing these available food crops in the locality and processing sweet potato and rice into powder to produce healthy and locally available polvoron.

Many countries, including the Philippines, are blessed with indigenous food crops which can be processed and sold to financially help families by selling the by-products to some business industries (Padilla et al 2016). Filipinos enjoy travel and are fond of eating unique delicacies. They even buy some as gifts or "Pasalubong" for their friends and families. Most delicacies are sweet but lack nutrients, resulting in health problems for some Filipinos who are very conscious about their health (Doblon-Merilles 2019). Improving the processing of delicacy into a salable commodity as a new choice of food product is prompted by the popularity of food crops. One of these crops is sweet potato (Llamera 2018).

Sweet potato is used substantially in Asia and South East Asian countries, the fact that processed products are usual in countries like Vietnam, Indonesia, Thailand, Malaysia, and the Philippines (Padmaja 2012). The leaves and roots of the sweet potato contain a variety of nutrients, including bioactive carbohydrates, proteins, carotenoids, flavonoids, anthocyanins, phenolic acids, and minerals, antioxidant, cardioprotective, anti-inflammatory, anti-cancer, anti-diabetic, antibacterial, anti-



obesity and prevention of vitamin A deficiency are only a few of the health advantages (Alam 2021). Sweet potato is one of the most preeminent economic crops in many countries in yearly production. It is the fifth most important food crop in the tropics and the seventh in the world's food production, next to wheat, potato, barley, cassava, rice, and maize (FAO 2016). Sweet potato placed a significant role in food production globally, all of which have underlying implications for succeeding in the food requirements, lessening poverty, and increasing food security (El-Sheikha and Ray 2017).

In Asia, rice production benefited from the Green Revolution and has become one of the world's essential food production systems (Chivenge 2019). Rice is a primary food crop worldwide, and a significant amount of rice bran is produced as a by-product of rice milling (Wang 2021). Rice is rich in vitamins, especially thiamine, riboflavin, niacin, and dietary fibers, but unfortunately, rice does not supply the essential minerals sufficiently. Indeed, it is the most significant cereal providing 21% of global human per capita energy and 15% of per capita protein (Breeding and RI 2020).

The researchers conducted the study to utilize the available food crops in the locality and process sweet potato and toasted rice into powder to produce polvoron. Since there is a need for more studies regarding the product, the study focused on developing these crops as raw materials for making polvoron. The developed product might be a good input for a start-up business or a suitable proposal as a livelihood program of a specific banner project of any industry that continuously helps partner communities through extension activities. Generally, this study aimed to develop a polvoron made from sweet potato and toasted rice powder as based ingredients. Afterward, this research determined the acceptability level of the product as perceived by the respondents.

## 2. Materials and Methods

*Respondents.* One hundred fifty (150) respondents were conveniently selected, composed of household keepers, vendors, students, and teachers who participated in the sensory evaluation. Respondents were randomly selected using the following criteria: respondents must be 18 years old and above, household keepers and vendors must be bonafide residents of Santa Cruz and Sulop, Davao del Sur, and students and teachers must be from UM Digos College.

*Instruments and Materials.* A survey questionnaire was used to obtain the information required for this study. The study focuses on the palatability, texture, aroma, color, and appearance of sweet potato and toasted rice polvoron. Each sensory quality of the sweet potato and rice coffee polvoron was rated on a Likert scale of 1 to 5. The researchers have secured approval and confirmation from Sherwin Jumao-as, the author of the study entitled "Level of Acceptability of Chili Garlic Sauce Enhanced With Lemongrass", to adapt and utilize the survey form used in his study. Listed are the scoring guidelines, which are classified into five scales (see [Supplementary Material](#)).

The abundance of sweet potato and rice made the researchers to process powder and derived to a formulation of a typical polvoron recipe instead of using wheat flour as a base ingredient.

**Table 1** Ingredients of sweet potato and toasted rice polvoron.

Unit	Description
144g	Sweet potato powder
224g	Rice coffee powder
185g	Skimmed milk
300g	Butter/Margarine
195g	Sugar
30ml	Vegetable oil

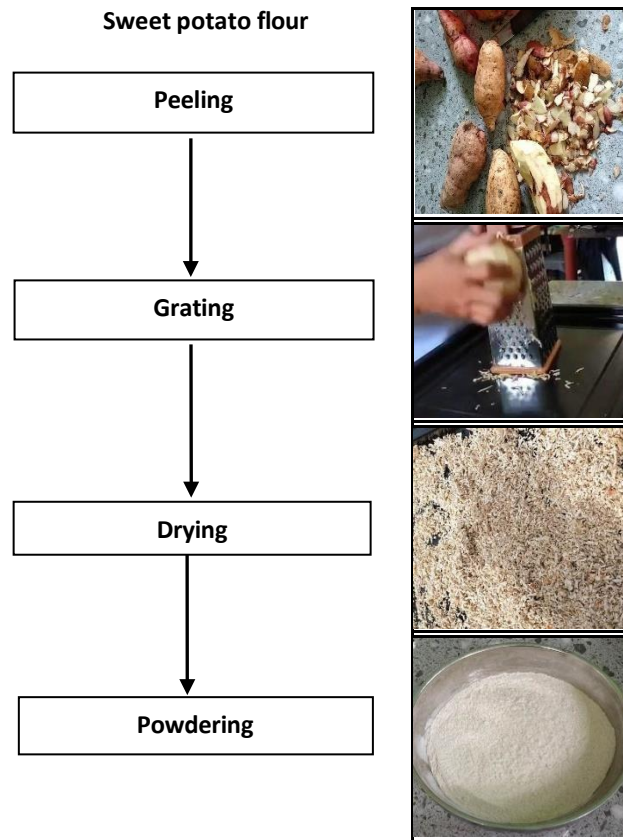
### 2.1. Design and Procedure

An experimental and descriptive research design was utilized to describe the acceptability level of the respondents toward the product produced.

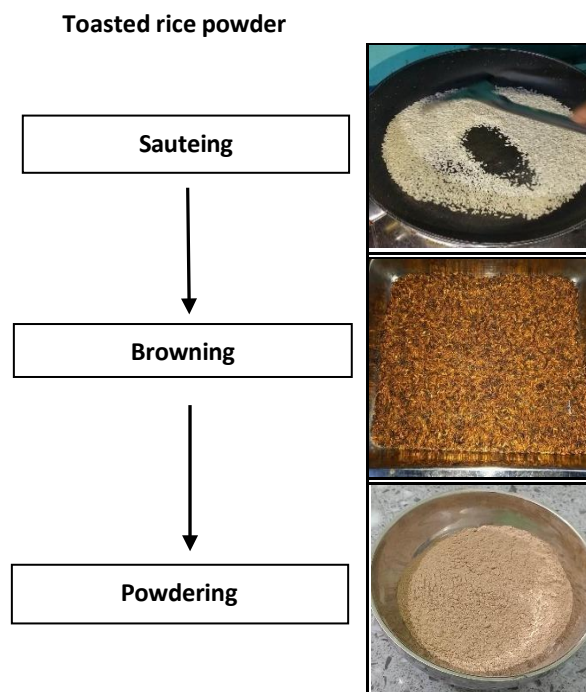
*Drying and powdering process.* The sweet potato flour and toasted rice powder underwent a series of procedures as specified in figures 1 and 2.

### 2.2. Ethical Declaration

The researchers observed full ethical standards in the conduct of the study following the study protocol assessments and standardized criteria by the institution. The following steps were taken to gather the responses needed in the study, the researchers coordinated and secure approval and authorization from the UM Digos College Vice-President for Branch Operations, the College Dean, and the Barangay Captains of Barangay Zone 3, Santa Cruz and Barangay Poblacion, Sulop, Davao del Sur to conduct the study. Following the approval from the authorities, the researchers conducted the study with the respondents following ethical considerations such as voluntary participation, informed consent process, permission from the organization, and without biohazard and conflict of interest issues in collecting the data for the study and archiving with confidentiality. A validated questionnaire was utilized in evaluating the acceptability of sweet potato and toasted rice polvoron.



**Figure 1** Drying and powdering process of sweet potato flour.



**Figure 2** Drying and powdering process of toasted rice powder.

*Methods of cooking sweet potato and toasted rice polvoron.* The following procedures were observed by the researchers in preparing sweet potato and toasted rice polvoron (Figures 3 and 4):

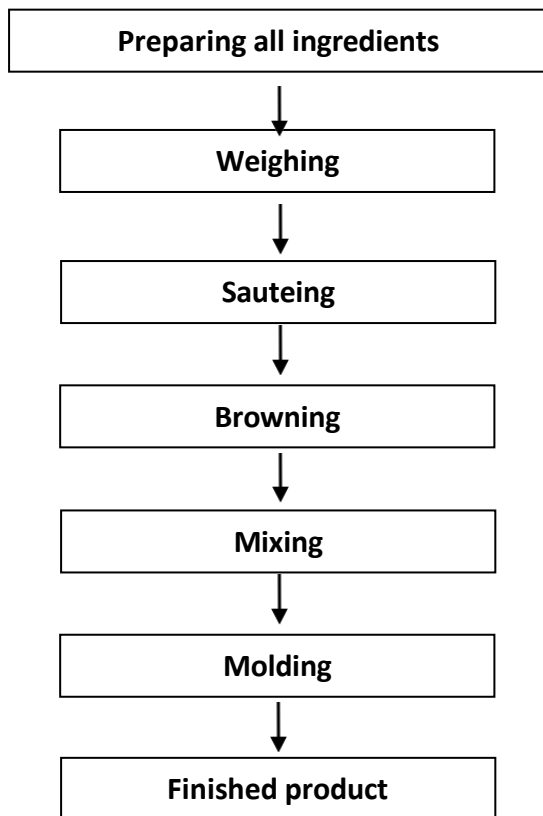


Figure 3 Drying and powdering process of toasted rice powder.



Figure 4 Finished product.

### 3. Results and Discussion

#### 3.1 Characteristics of the Respondents

This study determined the profile of households and vendors from Santa Cruz and Sulop, Davao del Sur, and students and faculty from UM Digos College with an equal number of participants. Presented in Table 2 was the distribution of the participants. The first column showed the profile, the second column indicated the frequency, and the third determined the percentage.

*Location/Type.* The distribution of the participants in terms of the location revealed an equal population between Santa Cruz, Sulop, and UM Digos College participants, with the same percentage of 16.7.

*Age.* A frequency of 49 with a percentage of 32.67 is under the ages of 18 to 27. A frequency of 29 with a percentage of 19.33 is under the ages of 28 to 37. A frequency of 25 with a percentage of 16.67 is under the ages of 38 to 47. A frequency of 41 with a percentage of 27.33 is under the age of 48 and above. A frequency of 6 with a percentage of 4.0 is under the unidentified ages. It implies that 18 to 27 years old had the more significant number among all participants.



**Table 2** Characteristics of the Respondents (n=150).

Profile	f	%
<b>Location/Type</b>		
Sta. Cruz Household	25	16.7
Sta. Cruz Vendor	25	16.7
Sulop Household	25	16.7
Sulop Vendor	25	16.7
UMDC Faculty	25	16.7
UMDC Student	25	16.7
<b>Age</b>		
18 – 27	49	32.67
28 – 37	29	19.33
38 – 47	25	16.67
48 and above	41	27.33
Unidentified	6	4.0
<b>Total</b>	<b>150</b>	<b>100.0</b>

### 3.2 Level of Acceptability

**Palatability.** The product's average rating based on the respondents' assessment obtained a mean score of 4.63 (SD = 0.688), considered the most acceptable. It signifies that the product is flavorful, creamy, and sweet. The delicious, naturally sweet crop is mixed with the slightly bitter toasted rice, combined with other essential ingredients to make it even tastier, and has an excellent result of sweet potato and toasted rice polvoron. Palatability plays an important role in food production. It was related to the assertion of Schiffman and Graham (2020) that the choice of a dish may be affected by palatability, which is comparable to the level of satisfaction a person derives from consuming food. Unlike how it tastes, food's palatability varies depending on the individual (Lowe 2007).

**Texture.** The product's average rating based on the respondents' assessment obtained a mean score of 3.87 (SD = 0.665), which was considered more acceptable. It means that the texture is slightly sandy and soggy. Since the sweet potato flour and the toasted rice powder are manually processed, as expected, the texture of the product is slightly sandy compared to other powders that are processed using a machine which results in a very fine texture. According to the study by Chen and Rosenthal (2015) that the texture of the food plays a crucial role in influencing consumers' preference for a food product. According to Foegeding et al (2011), when food structure is processed into a bolus by a difficult series of oral maneuvers, such as ingestion, processing, and swallowing. The texture of the food can be perceived.

**Aroma.** The product's average rating based on the respondents' assessment obtained a mean score of 4.72 (SD = 0.490), considered the most acceptable. It implies that the smell of the product is very strong and aromatic. As for aroma, the respondents rated it as the most acceptable because the respondents like how the product smells. Since, toasted rice is one of the base ingredients of the product, the aroma is a more coffee-like smell. The results show that respondents like the aroma of the product. It was thoroughly explained by Splenger (2009) that aroma is an essential quality of food that affect food choice behavior. It is well known that aromas can be appetizers.

**Color.** The product's average rating based on the respondents' assessment obtained a mean score of 4.68 (SD = 0.489), considered the most acceptable. It implies that the color of the product is coffee brown. The results reveal that the sweet potato and toasted rice polvoron obtained the highest ratings from the respondents for color. Toasted sweet potato flour has light brown color compared to toasted rice powder which has a darker brown color. The color of the toasted rice powder is more dominant than the color of sweet potato flour which resulted in a coffee brown color. Vanderbilt (2015) stated that food color affects how consumers become conscious of the flavor of the food before it is even tasted.

**Appearance.** The product's average rating based on the respondents' assessment obtained a mean score of 4.80 (SD = 0.451), considered the most acceptable. It signifies that the product is very appealing. The packaging or the outward look of the product is yet presentable and it is one of the big factors that affect the interest of the respondents. The findings reveal that the respondents valued the outward form of sweet potato and toasted rice polvoron. In your observations, Berčík et al (2021) rigorously explained that the food presentation sets particular expectations for the balance of flavor, delicacy, and overall quality, which in turn influences not only the actual consumption but also a variety of other aspects of the consumer's behavior.

Based on the respondents' assessment, the product's overall average rating for palatability, texture, aroma, color, and appearance acquired a mean score of 4.54 (SD = 0.400), which described the product as being most acceptable to the respondents (Figure 3, Table 3). It shows no significant difference in the acceptability of sweet potato and toasted rice polvoron among respondents.





Figure 3 Finished product.

Table 3 Level of Acceptability (n=150).

Indicator	Mean	SD
Palatability	4.63	0.688
Texture	3.87	0.665
Aroma	4.72	0.490
Color	4.68	0.489
Appearance	4.80	0.451
Overall	4.54	0.400

### 3.3 Levels of Acceptability Across Ages

Based on the assessment of respondents aged 18 to 27, palatability obtained a mean score of 4.59, considered the most acceptable (Table 4). It signifies that sweet potato and toasted rice polvoron are flavorful, creamy, and sweet. Texture obtained a 3.92 of the mean score, which is considered more acceptable. It implies that the product’s texture is slightly sandy and soggy. Aroma obtained a mean score of 4.90, considered the most acceptable. It implies that the smell of the product is very strong and aromatic. The color obtained a mean score of 4.65, considered as the most acceptable. It implies that the color of the product is coffee brown. The appearance obtained a mean score of 4.78, considered the most acceptable. It signifies that the product is very appealing. Based on the assessment of respondents aged 18 to 27 years old, the overall average rating of the product attained a mean score of 4.57, considered the most acceptable, which signifies that the respondents were content with the output of this study.

However, in assessing respondents aged 28 to 37, palatability obtained a mean score of 4.72, considered the most acceptable. It signifies that the taste is flavorful, creamy, and sweet. Texture obtained a mean score of 3.93, which is considered more acceptable. It signifies that the texture is slightly sandy and soggy. Aroma obtained a mean score of 4.66, considered the most acceptable. It signifies that the smell of the product is very strong and aromatic. The color obtained a mean score of 4.62, considered the most acceptable. It signifies that the color of the product is coffee brown. The appearance obtained a mean score of 4.83, considered the most acceptable. It signifies that the product is very appealing. Based on the assessment of respondents 28 to 37 years old, the overall average rating of the product obtained a mean score of 4.55, considered the most acceptable, which signifies that the respondents were content with the output of this study.

Moreover, in assessing respondents aged 38 to 47, palatability obtained a mean score of 4.68, considered the most acceptable. It signifies that the taste is flavorful, creamy, and sweet. Texture obtained a mean score of 3.84, which is considered more acceptable. It implies that the texture is slightly sandy and soggy. Aroma obtained a mean score of 4.72, which is the most acceptable. It implies that the smell of the product is very strong and aromatic. The color obtained a mean score of 4.76, which is the most acceptable. It implies that the color of the product is coffee brown. The appearance obtained a mean score of 4.76, considered the most acceptable. It signifies that the product is very appealing. Based on the assessment of respondents aged 38 to 47 years old, the overall average rating of the product attained a mean score of 4.55, which is described as the most acceptable, which signifies that the respondents were content with the output of this study.

Furthermore, in assessing respondents aged 48 years old and above, palatability obtained a mean score of 4.59, considered the most acceptable. It signifies that the taste is flavorful, creamy, and sweet. Texture obtained a mean score of 3.83, which is considered more acceptable. It signifies that the texture is slightly sandy and soggy. Aroma obtained a mean score of 4.56, which is the most acceptable. It implies that the smell of the product is very strong and aromatic. The color obtained a mean score of 4.73, which is the most acceptable. It implies that the color of the product is coffee brown. The appearance obtained a mean score of 4.83, considered the most acceptable. It signifies that the product is very appealing. Based on the assessment of respondents aged 48 years old and above, the overall average rating of the product attained a mean score of 4.51, which is described as the most acceptable, which signifies that the respondents were content with the output of this study.

On the other hand, in the assessment of respondents who have unidentified ages, palatability obtained a mean score of 4.67, which is considered the most acceptable. It signifies that the taste is flavorful, creamy, and sweet. Texture obtained a mean score of 3.67, which is more acceptable. It implies that the texture is slightly sandy and soggy. Aroma obtained a mean score of 4.67, which is the most acceptable. It implies that the smell of the product is very strong and aromatic. The color obtained a mean score of 4.50, which is the most acceptable. It implies that the color of the product is coffee brown. The appearance obtained a mean score of 4.83, considered the most acceptable. It signifies that the product is very appealing. Based on the assessment of respondents who have unidentified ages, the overall average rating of the product attained a mean score of 4.47, which is considered the most acceptable, which signifies that the respondents were content with the output of this study.

As a whole, respondents from different levels of group ages rated the product as most acceptable. Sweet potato and toasted rice polvoron are said to be most acceptable due to their flavorful, creamy, and sweet taste, and they have a strong and aromatic smell that people like about the product. Aside from its excellent taste and aroma, the product is nutritious because of its based ingredients that are natural and nutritious.

**Table 4** Level of acceptability across ages (n=150).

Age groups	Mean					
	Palatability	Texture	Aroma	Color	Appearance	Overall
18 – 27	4.59	3.92	4.90	4.65	4.78	4.57
28 – 37	4.72	3.93	4.66	4.62	4.83	4.55
38 – 47	4.68	3.84	4.72	4.76	4.76	4.55
48 and above	4.59	3.83	4.56	4.73	4.83	4.51
Unidentified	4.67	3.67	4.67	4.50	4.83	4.47

#### 4. Conclusions

The data revealed that sweet potato flour and toasted rice powder could serve as base ingredients in making polvoron. Moreover, the product was described to be highly acceptable in terms of palatability, texture, aroma, color, and appearance.

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#### Conflict of Interest

The authors have declared that no competing interests exist.

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