

Acceptability of Cassava (*Manihot Esculenta*) in Baking Brownies

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*The focus of the study is the acceptability of cassava (*Manihot esculenta*) as the main ingredient in baking brownies. It is concerned with the acceptability or sensory attributes of cassava (*Manihot esculenta*) in baking brownies in terms of texture, aroma, appearance, color, and consumer acceptability. The pulp of the cassava was used to bake brownies that are more nutritious. This study did not undergo any laboratory tests. The respondents were the students who were available at the time of the food tasting. The survey was conducted at City College of Angeles from August to November 2019. Results show that cassava is a good ingredient in baking brownies. It is appropriate in terms of appearance, sweet in terms of taste, soft in terms of texture, brown in terms of color, and moderate in terms of aroma. It is generally accepted in terms of appearance, taste, texture, color, and aroma. Cassava brownies are generally accepted in terms of customers' preference and could be commercially produced. Based on the findings and conclusions of the study, the following recommendations are offered: the cassava may be used to other pastry products like cakes, cupcakes, cookies, etc.; various tests of the product in terms of shelf life could be conducted; another preparation could be tested using cassava; and the cassava pulp may be used as a substitute in making embutido.*

Introduction

The Philippines is a tropical country that is why agriculture plays a significant role in its economy. One of the country's advantages is that a lot of crops can live and be exposed to hot weather, making crop cultivation as its main agricultural enterprise.

One of the tropical plants that can be used as food for its nutrient is the cassava, which is staple over the world with a good proportion in the poorest tropical countries where its roots are essential energy sources (Lebot, 2009; Opeke, 1991; Axtell & Adams, 1993; Alves, 2002). Cassava is a vegetable that contains key vitamins and minerals. It is the third largest source of carbohydrates in the tropics after rice and corn. It also has numerous industrial uses including starch, flour, and bioethanol. The demand for cassava for industrial uses has substantially increased in the country.

Cassava is one of the most drought-tolerant crops, capable of growing marginally in soil and can be propagated via stem cuttings. It has a strong economic relationship with resource-constrained farmers situated in the forest margins and marginal lands. Hence, any development of cassava will have an implication on food security, poverty alleviation and protection, and consumption.

Cassava is characterized as a resilient crop that can withstand the many tropical cyclones that enter the country and even the adverse effects of climate change. It can also withstand harsh conditions such as drought, long dry spells, infertile soils, and short-time

flooding. The significance of the cassava industry in the Philippines is not surprising as it is an easy growing crop.

Cassava is a vital source of carbohydrates worldwide and used to improve food by making it healthier. A study conducted by Balagopan (2002) stated that cassava contributes significantly to the nutrition and livelihood of up to 500 million people and thousands of processors and traders around the world. It became one of the important crops in many parts of the world for being processed into industrial commodities and various human foods. The increased utilization of cassava has been a catalyst for industrial development and for creating an improvement in nutrition for various food products worldwide.

From April to June 2019, the Major Vegetables and Root Crops Quarterly Bulletin reported that the production of cassava decreased by 58.42 thousand metric tons or 7.2% of 809.88 thousand metric tons this quarter. Then again, the cassava production in the Philippines is still abundant.

The cassava industry in the Philippines is composed of three sectors representing its main uses: food, dried chips for feed, and starch. Though most of the cassava is used for food, it can also be used for starch processing which appears to be the most important in the industry, since commercial production and trading are associated with this sector (Bacusmo, 2000).

In many rural communities, root crops are eaten or sold as boiled and processed products such as fried chips, cakes, and sweets porridge. The shoots of cassava are also a favorite vegetable among Filipino Muslims.

Pastry products such as cupcakes, cakes, and cookies are also popular to Filipinos. One of these products is the brownies, a deliciously thick, fudgy, chewy, and chocolaty pastry with a perfect crinkly crust on top made of flour, eggs, cocoa powder, baking powder, salt, sugar, vanilla extract, and butter.

People tend to eat sweets than nutritional food because of the taste. This is one of the reasons why sweet products are patronized by Filipinos more than any other food products. According to Sunni and Latif (2014), the consumption of chocolate can improve heart and other health problems.

Jerome S. Bruner (1996) said "... I shall take it is self-evident that each generation must define afresh the nature, direction, and aims of education to assure such freedom and nationality as can be attained for future generations... It is in this since that education is constant process of invention."

The theoretical framework of this study is anchored on the Theory of Constructivism. The said theory describes how students apply and practice the knowledge they learned from the school to achieve observable results. In this case, the researchers developed a specific food product that may provide people a healthy food product with cassava (*Manihot esculenta*) as the main ingredient.

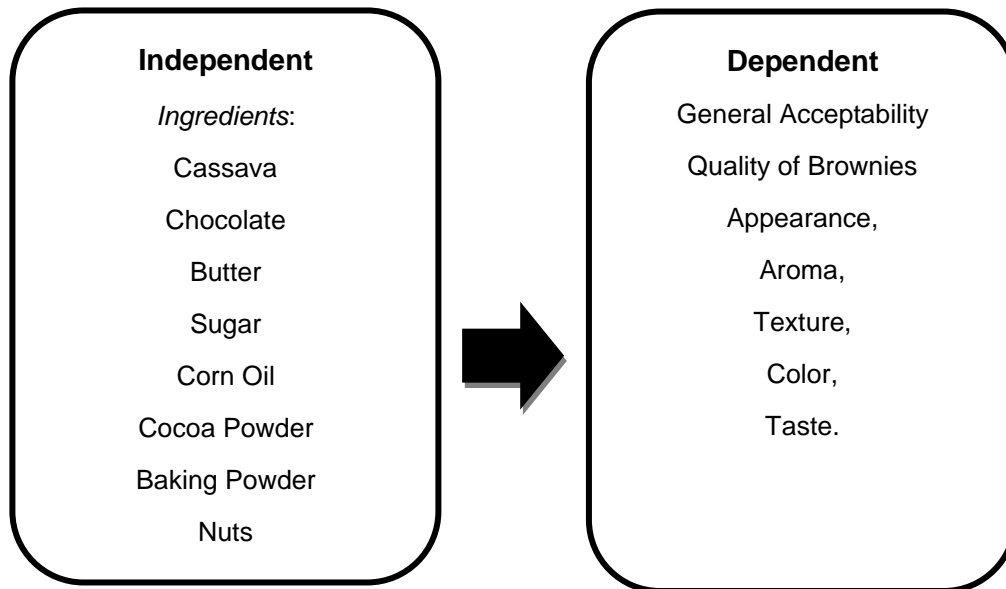


Figure 1. Conceptual Framework

The conceptual framework presents the independent and the dependent variables of the study. The independent variables show the cassava pulp/flour as the main ingredient in baking brownies, including all the other ingredients needed for the product, while the dependent variable is the final output which is the cassava brownies and their sensory acceptability in terms of appearance, aroma, texture, color, taste and the general acceptability.

The main goal of the researchers was to make brownies utilizing locally available cassava that is very common in the market. Specifically, the research sought to answer the following questions:

1. How may the cassava used in baking brownies be prepared?
2. How may the cassava in baking brownies be evaluated in terms of sensory acceptability:
 - 2.1 Appearance
 - 2.2 Taste
 - 2.3 Texture
 - 2.4 Color
 - 2.5 Aroma
 - 2.6 General Acceptability
3. How may the Return of Investment (ROI) of consumer acceptability of cassava in making brownies be determined?
4. Is there a significant difference in the general acceptability of cassava brownies treatments?

The focus of the study is the acceptability of cassava (*Manihot esculenta*) as the main ingredient in baking brownies. It is concerned with the acceptability or sensory attributes of cassava (*Manihot esculenta*) in baking brownies in terms of texture, aroma, appearance, color, and consumer acceptability. The pulp of the cassava was used to bake brownies that are more nutritious. This study did not undergo any laboratory tests. The respondents were the students who were available at the time of the food tasting. The survey was conducted at City College of Angeles from August to November 2019.

Method and Procedure

The study employed Research and Development. According to Hall (2006), Research and Development (R&D) is the term commonly used to describe the activities undertaken by firms and other entities such as individual entrepreneurs in order to create new or improved products and processes. The broadest meaning of the term covers activities from basic scientific research performed in universities and laboratories all the way to testing and refining products before commercial sale or use. The performance of, incentives for and the contributions of R&D are topics that are widely studied in management, economics, and other social science disciplines. Total spending on R&D activities is also one of the most widely used indicators of the innovative performance of firms, industries, and countries. In the process, the researchers described the sensory characteristics of cassava brownies in terms of appearance, taste, texture, color, aroma, and general acceptability.

The researchers described the sensory acceptability of cassava (*Manihot eculenta*) in making brownies in terms of appearance, taste, texture, color, aroma, and general acceptability. The researchers used a consumer type panel to determine the product's acceptability using the 5-point Hedonic scale. Implications for Technical Teacher Education were formulated on the basis of the results of the study.

This study was conducted at the Institute of Education, Arts, and Sciences of City College of Angeles. A total of 50 college students from City College of Angeles were randomly selected and asked to rate the product. These were the students present during the conduct of the survey.

The researchers utilized the questionnaire as the main research instrument. Items in the questionnaire are as follows: appearance, taste, texture, color, aroma, and general acceptability for the purpose of measuring the food preferences of the respondents. Related literature and studies in line with the objectives of this study were used in designing and preparing the questionnaire. This was then shown to the researchers' adviser and the BTTE Program Coordinator for their suggestions in order to improve it. There were changes and revisions made before it was administered to the respondents not included in the sample group for further enhancement in form and language. The questionnaire was modified on the basis of the pre-test results in accordance with the objectives of the study.

The researchers used consumer type panel to know the acceptability of the product utilizing the 5-point Hedonic scale. The scale was adopted by the food industry and used for measuring the acceptability of food. Hedonic scale was prepared arbitrarily by the researchers:

Statistical Range	Descriptive Range
5.0 – 4.50	Liked Very Much (LVM)
4.49 – 3.50	Liked a Little (LL)
3.49 – 2.50	Not Sure (NS)
2.49 – 1.50	Disliked a Little (DL)
1.49 – 1.00	Disliked Very Much (DVM)

The researchers asked permission from the Dean of the Institute of Education, Arts and Sciences to allow them to conduct the assessment on the sensory acceptability of cassava in making brownies in terms of appearance, taste, texture, color, aroma, and general acceptability. To ensure the high percentage of participation, the respondents were assured of anonymity.

The questionnaire of each respondent was hand scored. Data were classified, tallied, tabulated, analyzed, and interpreted. Data collected were analyzed and interpreted using

descriptive statistics in order to describe and to summarize the data in a meaningful and useful manner, including frequency and percentage distribution, weighted and composite mean.

Results and Discussion

Preparation of the Cassava Brownies

The ingredients used in baking brownies are as follows:

- Cassava
- Oil
- Sugar
- Vanilla extract
- Cocoa
- Baking Soda
- Nuts
- Chocolate

The tools and materials used in baking cassava brownies are as follows:

- Bowls
- Spatula
- Measuring spoon and cups
- Blender
- Grater
- Casserole
- Baking pan
- Plates

The procedure for the preparation of the cassava brownies is as follows:

1. Peel the cassava.



2. Grate the cassava.



3. Blend the cassava to make it fine.



4. Squeeze the pulp until dry and set aside.



5. Melt the chocolate with the oil.



6. Mix eggs, vanilla, and sugar.



7. In a separate bowl, mix the cassava pulp, cocoa powder, and baking soda.



8. Mix all the ingredients.



9. Put the mixture in the baking pan and sprinkle the nuts.



10. Serve the Finished product.



Sensory Acceptability of the Cassava Brownies

Table 1. Level of consumers' acceptability of cassava pulp/flour in baking brownies as the main ingredient in terms of appearance

	Mean	SD	Interpretation
Appearance	4.94	0.24	Liked Very Much

Table 2. Level of consumers' acceptability of cassava pulp/flour in baking brownies as the main ingredient in terms of color

	Mean	SD	Interpretation
Color	4.7	0.51	Liked Very Much

Table 2 represents the consumers' acceptability of cassava pulp/flour in baking brownies as the main ingredient in terms of color. It is reflected that color's mean is 4.7 and its standard deviation (SD) is 0.51, which means that it is liked very much by the consumers.

Table 3. Level of Consumers' Acceptability of Cassava Palp/Flour in Baking Brownies as the Main Ingredient in Terms of Texture

	Mean	SD	Interpretation
Texture	4.56	0.54	Liked Very Much

Table 3 presents the consumers' acceptability of cassava pulp/flour in baking brownies as the main ingredient in terms of appearance. It is reflected that texture's mean is 4.56 and its SD is 0.54. This means that the consumers liked the product very much.

Table 4. Level of consumers' acceptability of cassava pulp/flour in baking brownies as the main ingredient in terms of aroma

	Mean	SD	Interpretation
Aroma	4.92	0.27	Liked Very Much

Table 4 presents the consumers' acceptability of cassava pulp/flour in baking brownies as the main ingredient in terms of aroma. It is reflected that aroma's mean is 4.92 and its SD is 0.27. This means that the consumers liked the product very much.

Table 5. Level of consumers' acceptability of cassava pulp/flour in baking brownies as the main ingredient in terms of taste

	Mean	SD	Interpretation
Taste	4.8	0.45	Liked Very Much

Table 5 represents the consumers' acceptability of cassava pulp/flour in baking brownies as the main ingredient in terms of taste. It is reflected that taste's mean is 4.8 and its SD is 0.45. This means that the consumers liked the product very much.

Table 6. Level of consumers' acceptability of cassava pulp/flour in baking brownies as the main ingredient

	Mean	SD	Interpretation
Appearance	4.94	0.24	Liked Very Much
Color	4.7	0.51	Liked Very Much
Texture	4.56	0.54	Liked Very Much
Aroma	4.92	0.27	Liked Very Much
Taste	4.8	0.45	Liked Very Much

Table 6 presents the level of acceptability of the cassava pulp/flour as the main ingredient in baking brownies. It is reflected that appearance (Mean = 4.94, SD = 0.24), color (Mean = 4.7, SD = 0.51), texture (Mean = 4.56, SD = 0.54), aroma (Mean = 4.92, SD = 0.27), and taste (Mean = 4.8, SD = 0.45) were "liked very much" by the consumers.

Results show that the cassava brownies' recipe is acceptable to the respondents in terms of appearance, taste, texture, color, aroma, and general acceptability. Thus, the recipe can be considered as a very good source of food that is highly nutritious and rich in carbohydrates, key vitamins, and minerals. This study provides information on the discovery of a new food product which is the brownies that are nutritious and acceptable to people. Thus, it could be commercialized. The cassava brownies' recipe is a source for making nutritious food. Cassava brownies provide the needed vitamins and minerals for the body. Furthermore, this activity could be used as an example in the discovery of new food products in the course "Basic Baking."

Return of investment (ROI) of cassava brownies

A. Input

Ingredients	Unit Price
• 1 cup of cassava	P 10.00
• ½ cup oil	P 15.00
• 1 cup of sugar	P 12.00
• 1 vanilla teaspoon extract	P 2.00
• 1 salt of teaspoon	P 0.50
• 1/2 cup powder of cocoa	P 15.00
• 1 soda baking teaspoon	P 1.00
• ¼ cup nuts	P 5.00
• ¼ cup chocolate	P 10.00
Total Amount:	P 70.50

B. Output

A box of Cassava Brownies
Price per box = P 150

C. Net Income

P 150 – 70.5 = 79.5

D. Return of Investment (ROI)

P 79.5 / P 150.00 x 100 = 53%

Conclusions and Recommendations

Results show that cassava is a good ingredient in baking brownies. It is appropriate in terms of appearance, sweet in terms of taste, soft in terms of texture, brown in terms of color, and moderate in terms of aroma. It is generally accepted in terms of appearance, taste, texture, color, and aroma. Cassava brownies are generally accepted in terms of customers' preference and could be commercially produced.

Based on the findings and recommendations of the study, the following recommendations are offered: the cassava may be used to other pastry products like cakes, cupcakes, cookies etc.; various tests of the product in terms of shelf life could be conducted; another preparation could be tested using cassava; and the cassava pulp may be used as a substitute in making *embutido*.

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