
Nutritive Value and Sensory Acceptability of Corn and Sweet Potato Buchi Based Food

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ABSTRACT: This study focused on the production of corn and sweet potato buchi-based food product and the evaluation of their quality and potential for acceptance, aiming to improve nutrition and diversify the food sources of low-income families, especially in the City of Ilagan, Isabela. Corn and sweet potato buchi-based food were produced from white corn, sweet potato, and glutinous rice. An increase in nutritive content like thiamin and vitamin C in the product is obtained from corn and sweet potatoes. Every 150 grams of cooked white corn provides 0.33 mg, or 33%, of thiamine, and every 185 grams (1 cup) of purple sweet potato, boiled, provides 53.77 mg, or 72%, of vitamin-C. The developed food product was evaluated by the respondents to determine the level of acceptability in terms of appearance, taste, and texture, which garnered an overall descriptive rating of highly acceptable. An equal amount of white corn powder, sweet potato, glutinous rice, and other essential ingredients will produce excellent buchi dough. The study shows that the developed buchi product has more essential nutrients derived from corn and sweet potatoes as its main ingredients. Fruit fillings like mango, jackfruit, and other fruit jams are recommended for corn and sweet potato buchi. Being cheap in production cost, ease of preparation, abundance, and availability of ingredients, it is recommended that the developed food product be introduced and advertised in the City of Ilagan, the Corn Capital of the Philippines, and the Province of Isabela as a whole.

KEYWORDS: Corn, Sweet Potato, Nutrition, Buchi, Sensory Acceptability

INTRODUCTION

Filipinos have traditionally liked creating various types of dishes, particularly native delicacies, for special events or family bonding. Simple foods bring us all joy and satisfaction. Filipinos have always enjoyed cooking a variety of foods, especially their own specialties, for special occasions or family get-togethers. Simple meals make us all happy and fulfilled. Their own backyard provides a variety of fresh and healthful meals, including fruits, vegetables, and root crops, but none of them are processed to meet the family's daily nutritional requirements. Most of the time, fizzy beverages and junk food are offered as family snacks instead of organic meals that are prepared and served, which can lead to a number of health problems.

The development of nutritious food products delivers particular health benefits to everyone. Everyone wishes to have a better lifestyle. Development encourages innovation and ongoing food remodelling. It is difficult to discover or introduce new items to everyone, from the formula, components, flavouring, shelf life, and packaging. Developing a new product entails assembling and analyzing a prototype of the product to see how the ingredients interact and to balance the technical realities of the product with its market goals. One way to combat or address malnutrition issues is to develop nutritious food products using materials that are readily available in the market. This is also to prevent the temptation to eat unhealthy foods such as junk food. Shifting to organic food is essential to maintaining a healthy body; it is generally free of pesticides and chemical crops and has minimal additives. According to the Organic Trade Association, organic foods are processed minimally and are free from artificial ingredients and preservatives "to maintain the integrity of the food".

The purpose of this study was to help the homemakers, teachers, parents as well as students to appreciate and utilize corn and sweet potato in making buchi with different fillings. Specifically, this study is deemed significant to many. Menu planners will be informed of the use of nutritious corn and sweet potato buchi as dessert for all occasions. Likewise it will be beneficial to entrepreneurs as they will be encourage making new or additional variants of corn and sweet potato buchi which are affordable and of high nutritive value. The Department of Agriculture will be informed and provided of the food developed; this will help the researcher introduce and advertise the product in the province of Isabela. Farmers and farm owners will be encouraged to propagate and plant to increase their production of white corn and sweet potato for profit. Moreover, the university officials, food technology teachers will be informed about the food product developed; which can be later introduced to students, entrepreneurs, and to the community through a product demo during food expo or community outreach programs and finally, for future

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researchers and students to be provided with a basis for an intensive investigation and research study on the acceptability and profitability of corn and sweet potato buchi.

LITERATURE REVIEW

Buchi

Buchi or butsi is a rice cake made from sweet rice flour that is molded into shape with a sweet bean paste filling and sesame seed coating. This delectable treat is deep fried under high heat before serving. There are several types of filling that are used for butchi. The most common is the sweetened red bean paste while the ube and condensed milk mixtures are also becoming delicacies of Filipinos.

In the Philippines, jian dui or sesame balls [1] are a type of fried Chinese pastry made from glutinous rice flour. The pastry is coated with sesame seeds on the outside and is crisp and chewy after immediately being cooked. Inside the pastry is a large hollow, caused by the expansion of the dough. The hollow of the pastry is filled with a filling usually consisting of lotus paste, or alternatively, sweet black bean paste, or red bean paste. Due to hundreds of year of Chinese settlement in the Philippines, the integration of Chinese cuisine (Particularly Cantonese and Fujian) to local dishes has made butchi quite popular. To an extent, it has already been considered an icon of Chinese Filipino culinary tradition, sometimes associated with auspiciousness. At it is well- known among ethnic Chinese and other Filipino alike, local restaurant which are sometimes not even Chinese and fast food chain such as chowking have added the delicacy to the menu. Aside from the usual lotus and red bean paste, non-Chinese and indigenous ingredients have also been used for variety, such as ube-flavored butsi [2]. Unlike jian dui, Filipino buchi and derivatives (like mache, masi, moche, and palitaw) can also be boiled or steamed, in addition to being deep fried.



Figure 1. Example of Buchi [3].

Maize (corn)

Corn, or maize as it is known locally, is the second most significant crop in the Philippines, behind rice. Corn is not quite as popular as rice, nor is it as much of a way of life and part of the culture as rice, even though it is the second most common staple food in the Philippines. This is due to the fact that it is utilized to feed animals rather than residents. Still, a lot of individuals believe that maize will solve a lot of the issues facing the Philippines. Since maize could readily replace 10% of rice imports, many locals are against the Philippines' importation of rice from foreign nations. Not only would having a larger diet of maize stop so many imports into the Philippines, but it would also be better off for corn farmers if people started to eat their produce. Also, the swap could help with food security and malnutrition in the Philippines.

Maize as Food Product

In many parts of the world, maize and cornmeal—ground, dried maize—are basic foods [4]. Cornstarch is a culinary ingredient made from maize. Enzymatic treatment and hydrolysis of maize starch can provide high fructose corn syrup, a sweetener [5]. Bourbon whiskey is made by fermenting and distilling maize [6]. Grain germ is where corn oil is derived [7]. In the Philippines, corn ranks as the second most significant crop. About 14 million Filipinos favor white maize as their primary diet, whereas yellow corn accounts for over half of animal mixed feeds.

There can be lot of food product that can be produced out of corn. Corn can be processed into an intermediate form to be cooked further. These processes include drying, milling, and nixtamalization. In the Philippines, corn recipes like binatog, Filipino grilled corn, and corn and vegetable soup are very popular healthy dish.



Figure 2. Photo of Grilled Corn on the Cob with Parmesan Cheese [8].

Corn-Based Nutrition

The third-largest source of plant-based food worldwide is corn. Corn is not as nutritious as other cereals, even though it is a staple diet in many regions of the world. It has low-quality protein and insufficient amounts of niacin. Diets in which it predominates often result in pellagra (niacin-deficiency disease). Corn is high in dietary fiber and rich in antioxidants.

Corn flour is gluten-free and cannot be used by itself to manufacture rising breads, in contrast to many other cereal grains. However, it is frequently used to prepare dough in Latin American cooking, which is used to make traditional dishes like tamales, arepas, and tortillas. Sweet corn is prepared in a variety of ways, including boiling or roasted on the cob, creamed, mashed, made into meal or hominy (hulled kernels), and used to make corn puddings, polenta, griddle cakes, cornbread, and scrapple. It's also used for making confections, popcorn, and several kinds of processed breakfast cereal.

Furthermore, corn oil is mostly utilized for food and is prized for its pale color and bland flavor. It is preferred for usage as a frying and salad oil due to its low cholesterol content. By hydrogenating corn oil—combining it with hydrogen at high pressure and temperature while a catalyst is present—margarine can be produced. Bourbon and other corn whiskeys are among the alcoholic beverages made from fermented corn [9].

Sweet Potato

Sweet potato (*Ipomoea batatas*) is a widely cultivated tuber that is one of the main sources of energy globally [10]. Based on the quantity produced, it is positioned as the seventh staple crop after maize, rice, cassava, potato, and wheat [11]. Sweet potato, as a food source of carbohydrates, is composed of various components that can provide health benefits. Dutta (2015) reported that sweet potatoes have a low glycemic index, which is good for both diabetics and pre-diabetics as it regulates blood sugar and insulin metabolism. Various varieties of sweet potatoes, whether white, yellow, orange, and purple, have active components that are beneficial to health, although each has its own distinctive properties. Yellow sweet potato is composed of beta-carotene (Rose and Vasanthakalam, 2011). Aywa et al. (2013) reported that beta-carotene is present in yellow and orange sweet potatoes, but not in white sweet potato. Otake et al. (1992), Goda et al. (1997) and Montilla et al. (2011) stated that purple sweet potato is composed of anthocyanins, which give the purple color [12].

The abundance of corn and sweet potatoes presents a chance to develop a nutritious and healthy food product. As a result, the researcher intends to begin producing maize and sweet potato buchi and assess its quality and acceptance, with the goal of enhancing nutrition and diversifying low-income households' food sources, particularly in the City of Ilagan, Isabela.

MATERIALS and METHODS

Tools and Equipment

The following tools and equipment were used during the conduct of the study. Preparation tools, measuring tools, mixing tools, cutting tools, cooking tools, and equipment are listed in the table below.

Table 1. Tools and Equipment used in the conduct of the study.

Preparation Tools	Measuring Tools	Mixing Tools	Cutting Tools	Cooking Tools	Equipment
Flour Sifter	Measuring cups	Mixing bowls	Knife	Frying Pan	Gas range
Grater	Measuring spoon	Wooden spoon	Chopping board	Casserole	
Spatula				Food tong	
Utility tray				Ladle	

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Ingredients

The following ingredients are used in the conduct of the study as shown below.

Table 2. Ingredients needed in the production of corn and sweet potato buchi.

Quantity	Measurement	Description
2	Cups	White Corn Flour
2	Cups	Sweet Potato
1 1/2	Cups	Glutinous Flour
1 1/2	Cups	Refined Sugar
3/4	Cup	Water
1/4	Cup	Sesame Seed
2	Cups	Young Coconut Meat (buko/shredded)

Research Design

The study has made use of the product development method (PDM). This method of PDM involves the process of creating, designing, and developing the product. The mixture of corn flour and sweet potato has undergone different stages of development, starting from measurement to cooking. Through these stages of development, observations and analysis were done to come up with feasible corn and sweet potato buchi.

Developmental Procedure

Newly harvested and dried white corn and glutinous white rice were obtained from a local farmer of Barangay Cabanuangan, City of Ilagan, while sweet potatoes and all important ingredients were bought from local market of the same city. The food development process began with the preparation of the maize and sweet potato-based food's ingredients.

After preparing all important ingredients, the food development goes through the following process; 1) preparing the dough by mixing the corn, mashed sweet potato and glutinous rice flour, 2) shaping the dough by pitching of small portion of the dough and rolling them into small balls, usually about two inches in diameter, 3) flattening each dough ball with fingers or a rolling pin to create a small disc, 4) placing a small amount of sweet coconut meat paste in the center of each dough disc, 5) folding the edges of the dough over the filling to enclose it completely, then gently rolling it between palms to form a smooth ball again, making sure there are no cracks or openings where the filling could escape, 6) rolling each filled dough ball in sesame seeds, 7) heating cooking oil in a deep fryer, 8) carefully dropping the buchi into the hot oil. Frying them until they turn golden brown and crispy on the outside; 9) removing the fried buchi from the oil using a slotted spoon and transferring them to a plate lined with paper towels to drain excess oil; and 10) allowing the buchi to cool slightly before serving.

Sensory Evaluation

The finished products were subjected to sensory evaluation. One hundred fifty (150) respondents were randomly selected. Among of which are children, teenagers, and adults. Also, some were food technology faculty members (experts) and students of Isabela State University, City of Ilagan, Isabela. The evaluators were in good health condition. They were properly oriented on what and how to evaluate the food products using a validated survey instrument.

The corn and sweet potato buchi based food product samples were served on a dining table, each respondent were asked to taste the samples of the products. Data of the appearance, taste, and texture of food product were collected and subjected to statistical analysis.

The evaluation was conducted through survey, using qualitative analysis method of determining the acceptability of the food product. The responses as to the level of acceptability of the developed corn and sweet potato based food in terms of appearance, taste and texture were solicited using the five point Likert Scale and given weight as shown in Table 3.

Table 3. The Range Numerical Rating and its Equivalent Descriptive Rating

Range	Descriptive Rating
4.21-5.00	Highly Acceptable
3.41-4.20	Acceptable
2.61- 3.40	Moderately Acceptable
1.81-2.60	Least Acceptable
1.00-1.80	Not Acceptable

Statistical Tools Used

All data were gathered from the questionnaire/evaluation form given to the evaluators. The variables were analyzed and interpreted based from the computer output of the Statistic Package for Social Science Software.

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1. Mean (M). This was utilized to gauge the level of acceptability of the corn and sweet potato buchi based food as to respondents' age groups and criteria used.

Table 4. The Level of Acceptability of the corn and sweet potato buchi based food was interpreted using the following scale.

Numerical Rating	Level of Acceptability
5	Highly Acceptable
4	Acceptable
3	Moderately Acceptable
2	Slightly Acceptable
1	Not Acceptable

2. One Way Between Groups Analysis of Variance (ANOVA). This was utilized to determine the differences of the level of general acceptability of the corn and sweet potato buchi food based across the four age groups.

RESULTS AND DISCUSSION:

Product Evaluation

To determine the level of acceptability of corn and sweet potato buchi based food, the respondents evaluated the food products with regard to its appearance, taste and texture. For clearer understanding, the data were carefully analyzed and presented in table form.

Table 5. Extent of Acceptability of Corn and Sweet Potato Buchi Based Food

Criteria	WAM	Descriptive Rating
Appearance	4.75	Highly Acceptable
Taste	4.71	Highly Acceptable
Texture	4.76	Highly Acceptable

The table above shows the acceptability of corn and sweet potato buchi based food as evaluated by the respondents. It reflects a highly acceptable level of acceptability from the respondents in terms of appearance (WAM: 4.75), taste (WAM: 4.71), and texture (WAM: 4.76).

Table 6. Respondents' Sensorial Evaluation of the Corn and Sweet Potato Buchi Based Food in Terms of Their Age Group

Age Group	OWAM	Descriptive Rating
Children	4.70	Highly Acceptable
Teenager	4.73	Highly Acceptable
Adult	4.71	Highly Acceptable
Expert	4.77	Highly Acceptable

The table above displays the respondents' sensorial evaluation of the corn and sweet potato buchi based food in terms of their age groups. It shows that all age group has a highly acceptable evaluation: children (OWAM: 4.70), teenagers (OWAM: 4.73), adults (OWAM: 4.71), and experts (OWAM: 4.77). The overall sensorial evaluation is highly acceptable with a mean of 4.73.

Table 7. ANOVA of Corn and Sweet Potato Buchi

		Sum of Squares	df	Sig.
Children	Between Groups	.322	2	.234
	Within Groups	.000	0	
	Total	.322	2	
Teenager	Between Groups	.001	2	.304
	Within Groups	.000	0	
	Total	.001	2	
Adult	Between Groups	.002	2	.802
	Within Groups	.000	0	
	Total	.002	2	
Expert	Between Groups	.002	2	.324
	Within Groups	.000	0	
	Total	.002	2	

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The One-way between Groups Analysis of Variance was conducted to investigate the differences in the level of general acceptability of the Corn and sweet potato across the four age groups. There is no significant difference between their levels of acceptability at 0.05 level of significance. This means that this type of Buchi has a similar acceptability across the respondents' age groups.

Nutritive Value of White Corn and Sweet Potato Buchi

White Corn

Nutritive value per 100 grams

Calories 98

	% Daily Value
Total Fat 1.4g	2%
Saturated fat 0.2 g	1%
Polyunsaturated fat 0.6g	
Monounsaturated fat 0.4g	
Cholesterol 0 mg	0%
Sodium 3 mg	0%
Potassium 252 mg	7%
Total Carbohydrate 22 g	7%
Dietary fiber 2.7 g	10%
Sugar 8 g	
Protein 3.3 g	6%
Vitamin A	0%
Vitamin C	10%
Calcium	0%
Iron	3%
Vitamin D	0%
VitaminsB-6	5%

Sweet Potato

Amount Per 100 grams

Calories 86

	% Daily Value*
Total Fat 0.1 g	0%
Saturated fat 0 g	0%
Polyunsaturated fat 0 g	
Monounsaturated fat 0 g	
Cholesterol 0 mg	0%
Sodium 55 mg	2%
Potassium 337 mg	9%
Total Carbohydrate 20 g	6%
Dietary fiber 3 g	12%
Sugar 4.2 g	
Protein 1.6 g	3%
Vitamin A	283%
Vitamin C	4%
Calcium	3%
Iron	3%
Vitamin D	0%
Vitamin B-6	10%
Cobalamin	0%
Magnesium	6%

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FOOD ANALYSIS RESULT

Based from the report of analysis from the Department of Science and Technology (DOST) Regional Standard and Testing Laboratory Region 02 on the Corn and sweet potato buchi food sample, the following results were obtained: Crude Fat (g/100g) 7.17, Crude Protein (g/100g) 4.61, Moisture (g/100g) 25.81.

CONCLUSION / SUMMARY

A nutritious corn and sweet potato buchi based food can be produced from combined white corn, sweet potato, and glutinous rice. Increase in nutritive content like thiamin and vitamin-C of the product is obtained from corn and sweet potato. Every 150 grams of cooked white corn provide 0.33mg or 33% of thiamine and 185 grams (1-cup) of boiled sweet potato purple provides 53.77mg or 72% of vitamin-C. The developed food product was evaluated by the respondents to determine the level of acceptability in terms of appearance, taste and texture which garnered an overall descriptive rating of **highly acceptable**. Moreover, there was no significant difference in the level of acceptability of corn and sweet potato buchi based food in terms of appearance, taste, and texture as perceived by the respondents according to their age groups.

APPLICATION OF FINDINGS

An equal amount of white corn powder, sweet potato, glutinous rice, and other vital components can be combined to make superb buchi dough. The study found that the produced buchi product contains more important elements from corn and sweet potato. Corn and sweet potato buchi are best served with fruit fillings such as coconut, mango, jackfruit, and various jams. Because of the low cost of manufacturing, ease of preparation, quantity, and availability of ingredients, it is advised that the produced food product be introduced and advertised in the City of Ilagan, the Corn Capital of the Philippines, as well as the Province of Isabela in general.

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