

Consumers' acceptability and quality characteristics of white yam puto

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Abstract

There is a lack of initiatives regarding the processing of white yam in the Ilocos. Despite its assignment in the category of the underutilized crop, the white yam is only applied as food for animals. This research then focuses on the formulation of native delicacies specifically puto utilizing different percentages levels of white yam flour as a substitute for wheat flour. The study made use of the experimental method of research. Fifty individuals consisting of students, housewives, farmers, and faculty were the evaluators. The panel of evaluators was invited for the sensory testing of the products made. Frequency count, percentage, weighted mean, and analysis of variance were the statistical tools used. The result of the study concluded that the use of wheat flour is comparable with the formulation of 50% white yam flour and 50% wheat flour in the formulation of puto based on color, aroma, taste, and consistency.

Keywords: wild yam, native delicacies, consumers' acceptability, sensory qualities

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1. Introduction

The yams have received limited attention among global researchers in the past, leading to their placement under the category of neglected or underutilized crops. It is the fourth largest source of carbohydrates (immediately after potatoes, cassava, sweet potato) in the category of roots and tubers which meet the energy requirement of millions of global populations in addition to its role as an important ingredient in animal feed and numerous processed products for human consumption (Pradhan and Panda, 2020; Viruel et al., 2015). Even though *Dioscorea* spp. is an underutilized crop, it is found almost all over the country and its tubers are primarily used as vegetables (Alam et al., 2008). Besides the presence of carbohydrates and essential minerals, the yam tubers are thought to be a rich source of nutraceuticals; indispensable for the good health and well-being of mankind (Jahan et al., 2019).

One of the challenges that most travelers are facing is eating the delicacy of a particular place. Some nationalities get surprised to note that there are foodstuffs that can be produced out of seemingly inedible parts of plants and animals. Some people are surprised that some great foods can come from smelly origins. Eating the cheap local delicacies offered by a certain place is quite an adventure. It is an experience not only for the taste buds but for the other senses as well. One gets to savor the smell, experience the texture, and hear the crunch of each bite of food that passes one's lips. Many people especially Filipinos love eating varieties of food. There is the classic Lutong Bahay, the Lechon, the Halo-Halo, and others. But one should never forget to taste all the Sweet native delicacies meticulously prepared by the locals of each province.

A native delicacy otherwise known as *kakanin* is a recipe that is quite popular in the country and not well-known in other areas of the world. It is a kind of food item made from rice or glutinous rice or any root crop like cassava, sweet potato, taro, or any crop combined with other ingredients traditionally prepared. It uses coconut or coconut milk. It is a local food that is eaten commonly or a food that is prepared and served as snacks for special occasions like birthdays, *pandesal*, anniversaries, and fiestas. They are especially popular during the Holiday Season like Christmas and New Year. It is an integral part of the Filipino food culture. Some provinces in the Philippines boast their very own *kakanin*, while most of these *kakanin* are widely sold in the markets and malls. Each of these treats symbolizes the sweetness and closeness of every Filipino Family.

The Philippines through an agricultural country is still importing flour and glutinous rice, some of these baked products are not affordable to some people. Since yams are a valuable source of starches, the researchers thought of producing native delicacies out of them. Yams are rich in carbohydrates, an excellent source of the B-complex group of vitamins and minerals. Besides being used as foods, they are symbolically associated with culture and ritualism in some parts of Asia. They also possess health benefits like reducing constipation, decreasing bad cholesterol levels, lowering colon cancer risk, and regulating a steady rise in blood sugar. These root crops are also gaining popularity as flavoring and ingredients for a wide array of food products (Salda et al., 2005). The researchers then were motivated to prepare native delicacies like *puto*, *bibingka*, and *dudol*. It is believed that the results of this study will make the community aware of the varied uses of white yam. They will be encouraged to plant more even in their backyards which later serves as an additional income. It will augment the meager income of the family through the development of different yam products.

1.1 Objectives of the study

The study tried to formulate puto using white yam as the main ingredient. Specifically, it sought to determine the following: (1) the microbial analysis of the puto mixture formulations; (2) the sensory characteristics of puto in terms of using three mixtures as color, aroma, texture, taste and consistency; (3) there is

a significant difference in the sensory characteristics of puto formulations; (4) the proximate analysis of best puto formulation; (5) the cost and return analysis of yam puto; and (6) the shelf life of the best formulations.

2. Methods

Research Design - This research is experimental research using four treatments. It allows researchers to have a stronghold over variables and collect desired results. Results are usually specific. The effectiveness of the research isn't affected by the subject. Findings from the results usually apply to similar situations and ideas. It includes the following treatments.

T0- 100% All Purpose Flour + basic ingredients

T1- 100% yam flour + basic ingredients

T2- 75% yam flour and 25% APF + basic ingredients

T3 – 50% yam flour and 50% APF + basic ingredients

Population and Sampling - Fifty individuals consisting of students, housewives, farmers, and faculty were the evaluators. The panel of evaluators were invited for the sensory testing of the products made. In selecting the respondents, the researchers consider the specialization of students and faculty. Wherein, they are highly skilled in terms of product evaluation and sensory qualities. In the case of housewives and farmers, the researchers selected the cultivators of wild yam and those who are inclined to puto production or entrepreneurial activities.

Data Gathering Procedure - Pre trials of the different treatments were made to obtain the best formulations before the microbial analysis. Microbial analysis of the four products was sent to a laboratory to determine the microbial load content and to observe safety protocol in the conduct of the sensory evaluation. If the products were found safe for human consumption, sensory evaluation proceeded for testing on the different groups of consumers. Instructions were given and a glass of water was served to wash the palate before testing another product. The invited panel of evaluators tested the products four to three times to verify the result of every treatment tested. The ingredients are 2 cups Purpose Flour/Yam, 1 cup sugar, 1 tbsp Baking Powder, 1 cup evaporated milk, ¼ cup melted butter, 1 egg and 1 1/2 cup water. As to the procedure of preparing white yam puto, first, pour the water into the steamer or cooking pot, let it boil, then melt the margarine and set it aside. Sift flour, sugar, and baking powder, combine in a bowl and mix, add the egg, margarine, and milk, and gradually add the water while stirring, continue to stir until the texture of the mixture becomes smooth, pour the mixture into a small to medium-sized mold, arrange in a steamer, cover, and steam for 45 minutes, gently remove the cooked puto from the mold with the help of a spatula and lastly, serve 25 consumers.

Instrumentation - Evaluation form was the primary instrument used. Products were evaluated three times by the panel of evaluators. On the level of acceptance of the different mixtures used for production, the following were utilized: 4.21- 5.00 is very much acceptable, 3.41 - 4.20 is much acceptable, 2.61 - 3.40 is moderately acceptable, 1.81 - 2.60 is fairly acceptable, and 1.00 – 1.80 is not acceptable.

3. Results and discussions

Table 1

Characteristics of yam puto

COLOR	Treatment 0		Treatment 1		Treatment 2		Treatment 3	
	F	%	f	%	f	%	f	%
White	1	2.00	0	0.00	0	0.00	0	0.00
Off White	19	38.00	1	2.00	1	2.00	1	2.00
Yellow	30	60.00	0	0.00	0	0.00	0	0.00
Brown	0	0.00	26	52.00	46	92.00	40	80.00

Table 1 ...continued

COLOR	Treatment 0		Treatment 1		Treatment 2		Treatment 3	
	F	%	f	%	f	%	f	%
Light Brown	0	0.00	0	0.00	1	2.00	7	14.00
Dark Brown	0	0.00	23	46.00	2	4.00	2	4.00
TOTAL	50	100.00	50	100.00	50	100.00	50	100.00
AROMA								
Floury	21	42.00	16	32.00	17	34.00	17	34.00
Eggy	0	0.00	1	2.00	0	0.00	1	2.00
Milky	29	58.00	8	16.00	12	24.00	10	20.00
Yam	0	0.00	25	50.00	21	42.00	22	44.00
TOTAL	50	100.00	50	100.00	50	100.00	50	100.00
TEXTURE								
Coarse	1	2.00	25	50.00	19	38.00	17	34.00
Smooth	49	98.00	25	50.00	31	62.00	33	66.00
TOTAL	50	100.00	50	100.00	50	100.00	50	100.00
TASTE								
Slightly	18	36.00	18	36.00	26	52.00	24	48.00
Sweet	32	64.00	26	52.00	21	42.00	25	50.00
Very Sweet	0	0.00	6	12.00	3	6.00	1	2.00
TOTAL	50	100.00	50	100.00	50	100.00	50	100.00
CONSISTENCY								
Compact	7	14.00	14	28.00	15	30.00	15	30.00
Crumbly	14	28.00	17	34.00	8	16.00	9	18.00
Moist	23	46.00	17	34.00	26	52.00	24	48.00
Sticky	6	12.00	2	4.00	1	2.00	2	4.00
TOTAL	50	100.00	50	100.00	50	100.00	50	100.00

The control mixture appeared a yellow color, while the three experimental mixtures are colored” Brown “. Results show that the brown color of the white yam when dried and pulverized dominated the other ingredients. The aroma of the control recipe is milky while the three experimental recipes have a yam aroma. The texture of the puto using control and experimental mixtures was smooth. In the control recipe, Mixtures A and C have a sweet taste while Mixture B has a slightly sweet taste. The milky flavor is seen in the Control recipe and yam flavor in the three experimental mixtures. Moist consistency is exhibited in all the mixtures. The greater the amount of yam used the more it affects the aroma, taste, and flavor of the mixtures.

3.1 Sensory Evaluation of Yam Puto

Respondents' level of acceptability of the control mixture is very much acceptable in all the sensory parameters while the three experimental mixtures are much more acceptable. Findings show that the yam powder cannot substitute for All-Purpose Flour in the preparation of puto. However, when compared with the different sensory characteristics in all the treatments, significant differences were observed. It appears that the use of flour. The characteristics of the typical puto are still prepared by the consumer in the sense that using flour is softer than the yam flour makes the consumer preferences differ. The addition of minimal yam flour to the recipe is possible for consumers' acceptability. As mentioned by Bulosan (2022), the typical puto sold in the market is given a new taste by adding fillings such as chocolate, ube, and coffee.

Table 2

Respondents' level of acceptability

Parameter	Experimental Lot	Mean	Descriptive Rating
Color	T0- 100% APF + Basic Ingredients	4.41a	Very Much Acceptable
	T1- 100% Yam Flour + Basic Ingredients	4.05b	Much Acceptable
	T2- 75% Yam Flour & 25% APF + Basic Ingredients	3.92ab	Much Acceptable
	T3- 50% Yam Flour and 50% APF + Basic Ingredients	4.11a	Much Acceptable
Anova = 4.93*			
Aroma	T0- 100% APF + Basic Ingredients	4.34a	Very Much Acceptable
	T1- 100% Yam Flour + Basic Ingredients	3.56b	Much Acceptable
	T2- 75% Yam Flour & 25% APF + Basic Ingredients	3.65b	Much Acceptable
	T3- 50% Yam Flour and 50% APF + Basic Ingredients	4.02ab	Much Acceptable

Table 2 ...continued

Parameter	Experimental Lot	Mean	Descriptive Rating
Anova = 314.19**			
Texture	T0- 100% APF + Basic Ingredients	4.35a	Very Much Acceptable
	T1- 100% Yam Flour + Basic Ingredients	3.61b	Much Acceptable
	T2- 75% Yam Flour & 25% APF + Basic Ingredients	3.67b	Much Acceptable
	T3- 50% Yam Flour and 50% APF + Basic Ingredients	4.05ab	Much Acceptable
Anova = 99.65**			
Taste	T0- 100% APF + Basic Ingredients	4.32a	Very Much Acceptable
	T1- 100% Yam Flour + Basic Ingredients	3.48c	Very Acceptable
	T2- 75% Yam Flour & 25% APF + Basic Ingredients	3.60c	Very Acceptable
	T3- 50% Yam Flour and 50% APF + Basic Ingredients	4.04b	Very Acceptable
Anova= 651.42**			
Consistency	T0- 100% APF + Basic Ingredients	4.40a	Very Much Acceptable
	T1- 100% Yam Flour + Basic Ingredients	3.60b	Much Acceptable
	T2- 75% Yam Flour & 25% APF + Basic Ingredients	3.65b	Much Acceptable
	T3- 50% Yam Flour and 50% APF + Basic Ingredients	3.92b	Much Acceptable
Anova = 300.8 **			

3.2 Multiple Comparisons of the Different Yam Puto Formulations

The data were further tested with the Post Hoc test to determine which of the different treatment combinations were found significant. In terms of color, there is a significant difference significant differences between and among treatments. When compared between treatments, T0 vs T1, T2 and T3 have significant differences while T1 Vs T2 and T0 vs T3 found no significant differences. No significant differences were also observed between T1 Vs T2 and T3 in the aroma and texture but indicated significant differences between T0 VS T1 to T3. In terms of taste, it was found a significant difference between T1 and T2 but significant differences between T0 vs T1 to T3. For consistency, it was also noticed that there are significant differences between T vs T2 and T3 but significant differences between T0 vs T1 to T3. As observed, it shows that the use of the traditional recipe using flour as the main ingredient is better than the use of white yam flour. However, 50% of yam flour as a substitute for the main ingredients is acceptable. Higher than 50% yam flour point out that the acceptability of the products reduces the consumer's acceptability. I further show that using yam flour with native delicacies should be balance in order to produce an enhance puto.

Table 3

Summary of the sensory characteristics of yam puto

Sensory Characteristics	T0		T1		T2		T3	
	X	DR	X	DR	X	DR	X	DR
Color	4.41	VMA	4.05	MA	3.92	MA	4.11	VMA
Aroma	4.34	VMA	3.56	MA	3.65	MA	4.02	MA
Texture	4.35	VMA	3.61	MA	3.67	MA	4.05	MA
Taste	4.32	VMA	3.48	MA	3.60	MA	4.04	MA
Consistency	4.40	VMA	3.60	MA	3.65	MA	3.92	MA
Overall Acceptability	4.36	VMA	3.66	MA	3.70	MA	4.03	MA

3.3 Summary of the sensory characteristics of Yam Puto

The overall acceptability of the formulated products shows that the original recipe was considered the most acceptable to consumers, followed by the combination of 50% Yam flour and 50% All-Purpose Flour and the least accepted is the 100% Yam Flour. The addition of local ingredients like yam slightly changes the flavor and color of the puto but this will require more work and are a vision of the recipe (Bulosan, 2022).

Table 4*Proximate analysis of white yam puto*

Analysis Name	Result	Methodology
Ash	1.01 g/100g	AOAC Official Methods of Analysis (International) 9335.39., 20 th Edition, 2016.
Moisture Content	38.35 g/100g	AOAC Official Methods of Analysis (International) 925.10, 20 th Edition, 2016
Crude Protein	2.27 g/100g	AOAC Official Methods of Analysis (International) 2001.11, 20 th Edition, 2016.
Crude Fat	3.10 g/100g	AOAC Official Method of Analysis (international) 935.39. 20 th Edition, 2016
Total Carbohydrates	55.27 g/100g	By computation

3.4 Proximate Analysis of White Yam Puto

Based on the analysis, it was found that the 50% Yam Flour and 50% All flour has an ash content of 1.01 grams/100g. of the products made, moisture content of 38.35 g/100g, crude protein of 2.27 g/100g, a crude fat of 3.10 g/100g, and 55.27 g/100 grams of total carbohydrates. This implies that the presence of yam flour has higher nutrients and dietary fiber similar to white rice. Because of consumer interest in low-calorie and dietary fiber-containing foods, rice cake or puto is rapidly gaining widespread-consumer acceptance (Luh, 1994).

3.5 Shelf Life of the Formulated Products

The products under experimentation were observed in refrigerated conditions. Each product formulated was packed individually and was evaluated based on the sensory evaluation as used previously. The results show that the control treatment and the formulated products containing 50% yam flour and wheat flour lasted for 3 days. Beyond that, the detection of molds starts to grow which indicates that the product is not advisable for human consumption. It shows also that yam flour being used as a substitute of wheat flour makes the shelf life of the product shorter. However, it provides better taste and flavor as manifested by the evaluation of the respondents.

Table 5*Direct material cost of yam puto formulations*

Ingredients	As purchased price	Quantity	Unit	Total Cost (T0)	Total Cost (T1)	Total Cost (T2)	Total Cost (T3)
All-Purpose Flour	50.00/kilo	2	cups	12.50		3.15	6.25
Yam Flour	80.00/kilo				20.00	15.00	10.00
Sugar		1	cup	10.00	10.00	10.00	10.00
Evaporated Milk		1	cup	15.00	15.00	15.00	15.00
Butter		¼	cup	5.00	5.00	5.00	5.00
Egg	5.50/pc	1	pc	5.50	5.50	5.50	5.50
Baking Powder		1	tbsp	0.50	0.50	0.50	0.50
Total Expenses				48.50	56.00	54.15	52.25
No. of pcs. Produced/price per piece		20 pcs/5.00	pcs	100.00	100.00	100.00	100.00
Net income				51.50	44.00	45.85	47.75
ROI				106.19	78.57	84.67	91.39

The result of the cost and return analysis as reflected in the table show that the pure wheat flour has the highest return of investment followed by the 50% yam flour and 50% wheat flour. This indicates that though puto made of wheat flour having highest return investment, the 50% of yam flour and 50% wheat flour is comparable in terms of the net income obtained which means it is recommended for dissemination or commercialization. Aside from the financial importance, the usability of the unutilized raw materials for yam can now be used for native product recipes. This implies also that farmers and housewives could now utilize yam as a source of flour and it will serve as an eye opener for them to commercial the product that is being developed.

4. Conclusions and Recommendations

Based from the findings, the following are concluded: The control/traditional recipe is yellow while the experimental recipes have a brown color, The puto made of pure All-Purpose Flour is the most acceptable to the

consumers, The substitution of 50% yam flour as the main ingredient is acceptable. Higher than 50% yam flour, the acceptability of the products reduces the consumer's acceptability, Consumer interest in low-calorie and dietary fiber in yam puto provides a new taste as its gains consumer acceptability and On the cost and return analysis, the pure wheat flour has the highest return of investment followed by the 50% yam flour and 50% wheat flour.

The researchers recommend the following: The use of 50% yam flour and 50% wheat flour is recommended, The utilization of yam as raw materials can be made into yam flour for the production of native delicacies, Another native delicacies using yam flour as the main ingredients, The use of fabricated materials for yam flour making is recommended and Patent application of the product is recommended

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