

QUALITY OF GIANT SWAMP TARO (*CYRTOSPERMA MERKUSII*) CORM JAM AS AFFECTED BY VARIOUS INGREDIENT PROPORTIONS

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Abstract

The study aimed to investigate the quality of prepared giant swamp taro corm jam on various ingredient proportions. Modeling procedure were made for the ingredient proportion 1 and for the ingredient proportion 2 of GST corm jam and were evaluated using the 9-point Hedonic Scale Organoleptic test by panel of experts as evaluators. Linear Programming Method were utilized and Analysis of Variance were used to interpret the data gathered. Study revealed that as the evaporated milk ratio increases together with the ratio of all-purpose cream increases, the consistency of the jam becomes weak leading to non-sticky mixture that caused for the ingredient proportion 2 to be rated slightly like compared to the first ingredient proportion for the preparation of giant swamp taro corm jam which obtained the higher rating for acceptability using sensory test as rated by experts' panel as evaluators. This finding implied that ingredient proportion 1 for making excellent jam for GST is best ingredient in preparing GST corm jam and could possibly earn more income as far as profit maximization is concerned. The optimizations were successful in fulfilling a model recipe for GST corm and provided a feasible and promising recipes that is acceptable with its appearance, taste, texture, color and odor. Finally, although making giant swamp taro corm jam was tedious due to the lack of technology for ease and convenience of the preparation, GST corm can be used for food consumption and income generating like other root crops. Therefore, proper formulation of ingredients can help control the quality taste of the product which can pave way to produce more GST Corm jams as evident in the linear programming methodology hence, provided a systematic tool for testing the level of acceptability. Study showed that there is a significant difference on the taste, color, odor, appearance. It can be concluded that ingredient proportion 1 be introduced in the market since it has a promising potential for food consumption, income generating paving way to counter hunger, for food safety and for poverty alleviation to attain improvement of quality life as our response to our quest for the "Ambisyon Natin 2040."

Keywords: *Innovation, Giant Swamp Taro Corm, jam, quality, various ingredient proportions*

Introduction

Filipinos are fond of preparing mouth-watering desserts as one of the menus presented in either ordinary occasions or special occasion. Technically, process of jam making includes boiling with nutritive sweeteners namely sugar, dextrose, invert sugar or liquid glucose until reaching its suitable consistency using sound, ripe, fresh, dehydrated, frozen or previously packed fruits including fruit juices, fruit pulp, fruit juice concentrate or dry fruit. [1] There are various methods of food preservation but making jam is the most suitable among those methods. Hence,

it is quite to note that jams preparation mainly came from puree of fruits, however in this invention it came from a root crop which had not given more importance compared to other root crops in town or even in the country.

Giant Swamp Taro (*Cyrtosperma merkusii*), locally called "Palauan," is one of the earliest crops domesticated in New Guinea, originating in Southern Asia. In the Philippines, this is considered a native plant with varieties across regions and is regarded as one of the staple foods that can be found and cultivated in freshwater marshes or swampy areas and can produce an estimated 1 and 5 kg. Tubers. In the same line of thought, aside from being a staple food, it is believed to have a tremendous cultural significance to the inhabitants of countries in Southern Asia [2]. In some other countries, during natural catastrophes, this plant had been utilized for the emergent purpose of feeding hungry bodies. As part of their practice, they would eat the peeled, chopped stalks in soups during World War 2 since this plant has much potential because it can be grown by small-scale farmers, even in climate change [3]. In Hawaii, they call it "Poi" an edible paste from the pounded roots of a taro corm. In Guam, they prepare taro with a process of peeling and slicing the tubers and cooked with coconut milk. They also boiled, dried and ground taro into flour.

Both fries and chips from taro are popular way of food preparation and an excellent delicious snacks and also a healthier alternative for potato chips and French fries [8]. Among the countries in the world, Nigeria topped as taro producer. "Cocoyam" as well-known in the country and "Ede" as called in the locals from Igbo branded as staple food in the state can be prepared through frying, boiling and even roasting [4]. Ghana also considered taro as staple crop and "cocoyam" as it is called by its natives used cocoyam leaves to make "egusi" and palaver sauce both famous local sauces and also used to make chips, baby food and fufu as a substitute for plantains when they are out of season [5]. They prepare taro corms by peeling and boiling in water, it is also used to be cooked with coconut milk after peeled and chopped have tried to be roasted or steamed, and sometimes stored for a few months after peeled, scalded, chopped and sundried [6]. Taro has cultural significance in many Pacific cultures. Except for the skin, every part of the plant is edible. Growing requires plenty of rain and deep, rich soil [7]. Taro is an essential food value to countries that use it either for feasts and exchanges in the household. However, it is considered with marginal importance as far as the world food crops is concerned. Taro ranked behind root crops such as cassava, sweet potatoes and yams likewise with bananas in amounts consumed. Nonetheless, taros can potentially promote in an increase of variety of the world food supply and could significantly contribute if ever a more excellent agronomic investment will be done [8]. Glad to know that some other countries of the world had an attempt to address issues of promoting diversification and production of food from giant swamp taro. In the United States through its Root Crops programs of the Food and Agriculture (FAO) in cooperation with the Australian Centre for International Agricultural Research (ACIAR) [9]. Due to oxalic acid crystals (may cause irritation and swelling of mouth and throat) content in the taro in its outer layer and leaves, its cooking and processing were done with extra care as practiced even when ancient times [10]. Today people on Pacific Island prefer taro cooked whole and then

cut into slices for presentation to the household [11]. Similarly, taro after harvesting is cooked as quickly as possible to retain the best flavor and avoid decay. It is a wise practice that before cooking, each corm or stem of taro is carefully peeled, a process that can produce skin irritation for those unaccustomed to it. In some countries, grated taro mixed with coconut cream and baked in the earth oven to make a pudding [12].

In Hawaii, they process taro through fermentation and are eaten as Poi through steaming, peeling, grinding, and straining the corms to yield a thick paste of 30% solids, known as "ready-to-mix" Poi. And if added more water to produce a thinner paste of 18 & solids, making it a "ready-to-eat" poi. In terms of commercialization, in the Pacific, taros are sold as a whole and unprocessed since it needs quick sales [13]. In a similar study, Brown explained that Poi is made from a cooked pastry starched, mashed corm of the taro plant (*Colocasia esculenta* L.). It is quite to note that this root crop is now found primarily in tropical and subtropical regions but originated in Asia, however, in the Pacific Islands taro became the major dietary staple food [14].

However, in The Philippines, there is a need to introduce and promote food products from taro corm since this root crop had not given much importance than any other root crops considering its potential for developing into functional food for consumption and for generating family income aside from its health benefits.

The researcher believed that this study on the utilization and product development of Giant Swamp Taro would help marginalized Filipinos. Moreover, this will help them engage in Small and Medium Enterprises once they learn the technical knowledge of product development from this root crop. This study is also a favorable response to the President's call to enhance the agriculture sector, cultivate giant swamp taro, and product development from its corm. In addition, several root crops can withstand Filipinos' economic situation today by initiating some business opportunities through technology transfer [15].

This study focuses on investigating the quality of prepared giant swamp taro corm jam on various ingredient proportions. The ingredient proportion 1 and ingredient proportion 2 of GST Corm jam were evaluated using the 9-point Hedonic Scale organoleptic test by panel of experts as evaluators.

Objectives

Generally, this study aimed to investigate the quality of prepared giant swamp taro corm jam on various ingredient proportions.

2. Materials and Methods

2.1 Sample preparations

Modification of ingredients were made to ensure the good quality of GST Corm Jam making the finished product be acceptable to the experts' panel of evaluators.

2.1.1 Ingredient Proportion 1

Giant Swamp Taro Jam ingredients proportion 1 comprising the following ingredients: (a) 75 % cooked grated taro corm; (b) 1.5% coco milk; (c) 9% evaporated milk; (d) 7% all-purpose cream; (e) 1.5% sugar cane puree; (f) 3% condensed milk; (g) 2% butter; (h) .75%. hog fat; and (i) .25% finely chopped lemon rind. On the other hand, the second proportion for giant swamp taro corm jam comprised the following ingredients: (a) 65 % cooked grated taro corm; (b) 1.5% coco milk; (c) 14% evaporated milk; (d) 12% all-purpose cream; (e) 1.5% sugar cane puree; (f) 3% condensed milk; (g) 2% butter; (h) .75%. hog fat; and (i) .25% finely chopped lemon rind.

2.1.2 Ingredient Proportion 2

Giant Swamp Taro Jam ingredients proportion 2 comprising the following ingredients:(a) 65 % cooked grated taro corm; (b) 1.5% coco milk; (c) 14% evaporated milk; (d) 12% all-purpose cream; (e) 1.5% sugar cane puree; (f) 3% condensed milk; (g) 2% butter; (h) .75%. hog fat; and (i) .25% finely chopped lemon rind.

Both ingredient proportions followed similar methods of food preparation composed of the following steps/procedures:

Clean the GST corm and cook for at least 45-60 minutes. When done pared with sharp knife. Grate. Set aside. Combine evaporated milk, condensed milk and mix thoroughly. Add grated giant swamp taro corm. Blend set aside. Heat the carajay add the butter let it melt. Add the mixture Stirring constantly add the sugar cane puree and finely chopped lemon rind stirring constantly until desired consistency achieved for at least 1 hour with medium to low heat. When done put in a clean basin and let it cool. Place in a sterilized glass jar. Cover tightly and label completely.

2.5 Statistical Analysis

T-test was utilized to examine the significant difference between the ingredient proportions employed in the preparation of GWT Corm jam.

3. Results

Table 1 shows the sensory evaluations result on various ingredient proportions for GST corm jam. Data shows that on ingredient proportion 1 utilized, panel of evaluators composed of faculty, students and food lovers rated GST corm jam 8.64 with a description of **like very much** on its appearance, taste, texture, color and odor. This finding confirmed with the study of Pobar that it is used as food and is prepared in several ways like roasting, grating, or baking the corm whole [16] In same line of thought, researchers from other countries stressed the essence of GST corm since it contains both carotenoids and minerals which are substantial elements that need to be promoted for these elements have potential health benefits [17]. Nguimbou et al proved that in Cameroon taro preparation includes combination with with other varieties of taro since food needs of the inhabitants need to be satisfied [18].

It implies that ingredient proportion 1 is most acceptable than ingredient proportion 2 which comprised an overall rating from the three (3) evaluators such as 6.18 a with description of like slightly as rated by both faculty and students respectively; however, jam lovers rated 6.12 with a description of slightly like. This negates with the results of the study conducted by Owusu, that mechanical effects of raphides—crystals of calcium oxalate and other components—produce irritation when raw corm tissue is ingested resulting in several levels of discomfort [18].

Table 1 Sensory Evaluation Results on Various Ingredient Proportions for Giant Swamp Taro Corm Jam

Quality Attributes	1 st Proportion			2 nd Proportion		
	Evaluator 1	Evaluator 2	Evaluator 3	Evaluator 1	Evaluator 2	Evaluator 3
Appearance	8.64	8.64	8.64	6.16	6.15	6.20
Taste	8.64	8.64	8.64	6.20	6.20	6.20
Texture	8.64	8.64	8.64	6.20	6.20	6.20
Color	8.64	8.64	8.64	6.15	6.20	6.16
Odor	8.64	8.64	8.64	6.15	6.16	6.16
Overall rating	8.64	8.64	8.64	6.18	6.18	6.12
DESCRIPTION	Like very much			Like slightly		
Rank	1			2		

Table 2 Overall Rating of the Sensory Evaluation of Giant Swamp Taro Corm Jam Using Ingredient Proportion 1

To test the overall rating of the sensory evaluation of giant swamp taro jam using proportion one, One Way analysis of variance (ANOVA) was used. It reflects that there is a sufficient statistical evidence that there is no significant difference on the proportion 1 of giant swamp taro jam overall evaluation, $F(2,12) = 1.28$ $p=0.31$. This means that the null hypothesis is accepted, thus the three groups of respondents did not signify difference. It implies that faculty, students, and jam lover evaluated the giant swamp taro jam as very much liked. Further, faculty and jam lovers gave the same average ($M=8.64$) while student respondents gave a lower average ($M=8.54$)

Table 2: One-Way Analysis to test the sensory evaluation of proportion 1 of giant swamp taro corm jam

SUMMARY

Groups	Count	Sum	Average	Variance
Faculty	5	23.2	8.64	0.013
Students	5	22.7	8.64	0.013
Jam lovers	5	23.2	8.54	0.013

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.033333	2	0.016667	1.282051	0.312885	3.885294
Within Groups	0.156	12	0.013			
Total	0.189333	14				

Figure 1 shows that rater/evaluator 1 who were experts in the academe

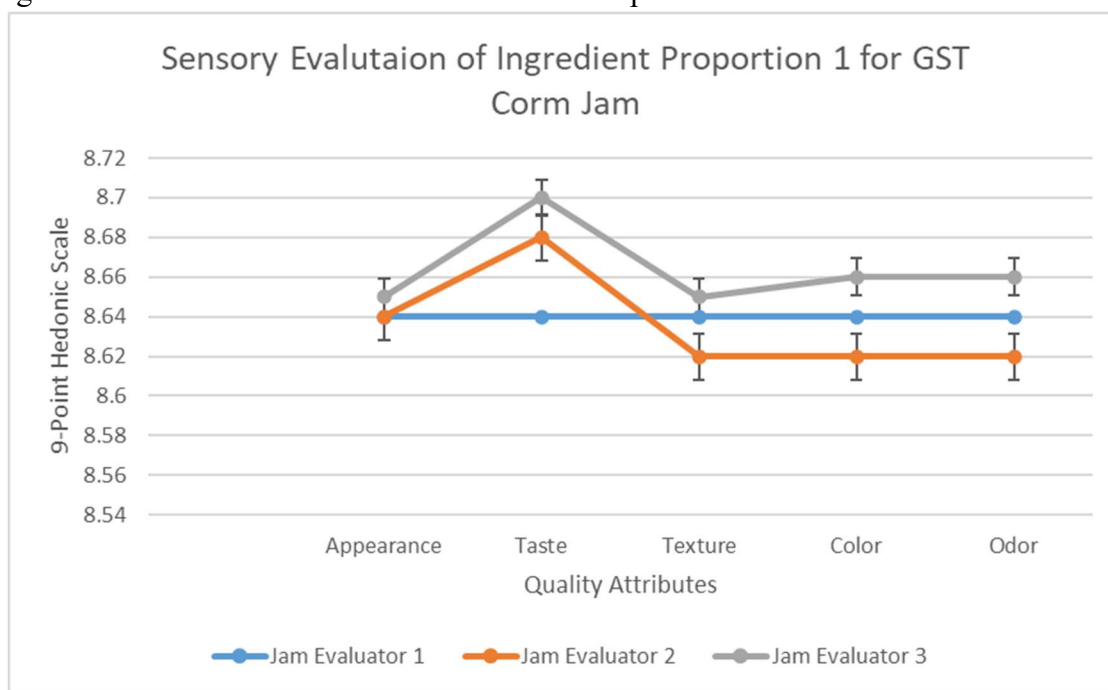


Figure 1. Sensory Evaluation on Ingredient Proportion 1 for GST Corm Jam

Table 3 Overall Rating of the Sensory Evaluation of Giant Swamp Taro Corm Jam Using Ingredient Proportion 2

For proportion 2, One-way analysis of variance was used to test the overall rating of the sensory evaluation of giant swamp taro jam, data shows that there is a sufficient statistical evidence that there is no significant difference on the proportion 2 of giant swamp taro jam overall evaluation, $F(2,12) = 0.86$ $P = 0.45$. This means that the null hypothesis is accepted, thus the three group of respondents did not signify difference. It implies that students ($M = 6.18$) and faculty ($M = 6.18$) respondents gave the same rating on GST corm jam using ingredient proportion 2 compared to food lovers ($M = 6.12$). This confirms with the study of

Table 3: One-Way Analysis to test the sensory evaluation of proportion 2 of giant swam taro corm jam

SUMMARY

Groups	Count	Sum	Average	Variance
Faculty	5	20.6	6.18	0.007
Students	5	20.9	6.18	0.007
Jam lovers	5	20.9	6.12	0.007

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.012	2	0.006	0.857143	0.448795	3.885294
Within Groups	0.084	12	0.007			
Total	0.096	14				

Figure 2 shows the sensory evaluation results of ingredient proportion 2 for GST corm jam.

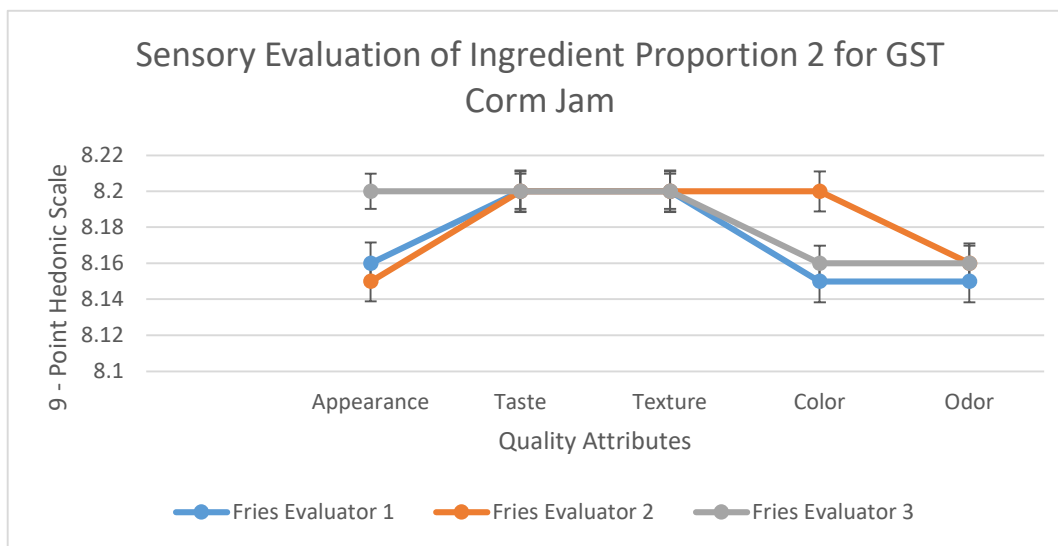


Figure 2. Sensory Evaluation on Ingredient Proportion 2 for GST Corm Jam

Table 4 Test of Difference of Ingredient Proportion 1 and Ingredient Proportion 2 For Preparing Giant Swamp Taro Corm Jam

Table 4 presents the test of difference between the proportion 1 and proportion 2 of ingredients of Giant Swamp taro jam.

Based on the findings, there was a sufficient statistical evidence that there is a significant difference on the proportion 1 and proportion 2 of giant swam taro ($t = 4.303, p = 0.001$).

Table 4: Test of Difference of Ingredient Proportion 1 and Ingredient Proportion 2 For Preparing Giant Swamp Taro Corm Jam

Groups	t- value	p-value	Level of significance	Decision	interpretation
Proportion 1	4.303	0.001	0.05	Reject Ho	Significant
Proportion 2					

Figure 3 reflects the ingredient proportions for GST corm jam composed of ingredient proportion 1 and ingredient proportion 2. As presented in the graph, it can be noted that ingredient proportion 1 comprised the following ingredients: while ingredient proportion 2 comprised the following ingredients: It can also be noted that ingredient proportions differ in percentages on the following ingredients: cooked grated GST corm, evaporated milk and all-purpose cream, however on all other ingredients such as coco milk, evaporated milk, sugar cane puree, butter, hog fat, and chopped lemon rind comprised with same proportions as used in ingredient proportion 1 and ingredient proportion 2 respectively.

Graph of ingredient proportion

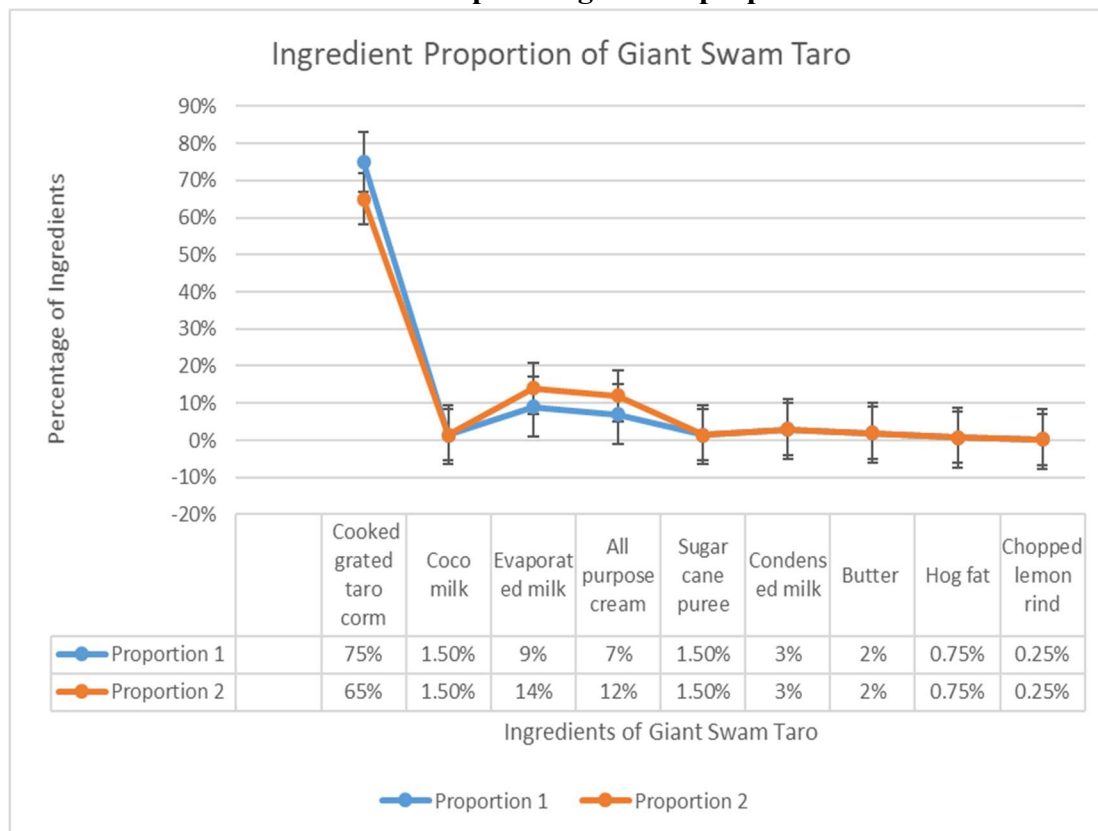


Figure 3 Ingredient Proportions of Giant Swamp Taro Jam Recipe Used in Proportion 1 and Proportion

Level of acceptability of ingredient proportion 1

Data showed that the overall rating on the first ingredient proportion as rated by the three evaluators based on the sensory evaluation using the 9-point Hedonic Scale was 8.64 Interpreted as like very much. This implies that the quality of cooked GST corm using ingredient proportion 1 is accepted when it comes to its appearance, taste, texture, color and odor.

Table 5 Level of acceptability on the Ingredient Proportion 1 of GST Corm Jam

Quality Attributes	1 st Ingredient Proportion		
	Evaluator 1	Evaluator 2	Evaluator 3
Appearance	8.64	8.64	8.64
Taste	8.64	8.64	8.64
Texture	8.64	8.64	8.64
Color	8.64	8.64	8.64
Odor	8.64	8.64	8.64
Overall rating	8.64	8.64	8.64
DESCRIPTION	Like very much		

Level of acceptability of ingredient proportion 2

Data showed that the overall rating on the second ingredient proportion as rated by the three evaluators based on the sensory evaluation using the 9-point Hedonic Scale are as follow: both evaluator 1 and 2 has an overall rating on the ingredient proportion 2 regarding its appearance, taste, texture, color and odor of 6.18 and evaluator 3 6.12 with a descriptive interpretation as like slightly.

Table 6 Level of acceptability on the Ingredient Proportion 2 of GST Corm Jam

Quality Attributes	2 nd Ingredient Proportion		
	Evaluator 1	Evaluator 2	Evaluator 3
Appearance	6.16	6.15	6.20
Taste	6.20	6.20	6.20

Texture	6.20	6.20	6.20
Color	6.15	6.20	6.16
Odor	6.15	6.16	6.16
Overall rating	6.18	6.18	6.12
DESCRIPTION	Like slightly		

Summary and Conclusion

The optimizations were successful in fulfilling a model recipe for GST corm and provided a feasible and promising recipes that is acceptable with its appearance, taste, texture, color and odor. Finally, although making giant swamp taro corm jam was tedious due to the lack of technology for ease and convenience of the preparation, GST corm can be used for food consumption and income generating like other root crops. Therefore, proper formulation of ingredients can help control the quality taste of the product which can pave way to produce more GST Corm jams as evident in the linear programming methodology hence, provided a systematic tool for testing the level of acceptability. Study showed that there is a significant difference on the taste, color, odor, appearance. It can be concluded that ingredient proportion 1 be introduced in the market since it has a promising potential for food consumption, income generating paving way to counter hunger, for food safety and poverty alleviation to attain improvement of quality life as our response to our quest for the “Ambisyon Natin 2040.”

Implications and Recommendations

Based on the findings and conclusions, the researcher strongly advised that for future similar studies be conducted and explore various areas such that enhancement and further examinations such as the nutrient content of various food products developed be determined for market introduction, commercialization and effective sales promotion.

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