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Technology Process And Standardization Of Sweet Potato (Ipomoea Batatas Linn.) Pie

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Abstract

Sweet potato locally known as "camote" was studied to determine its effects to Camote Pie. Crust and filling preparations was subjected to organolyptic tests using the 9-point hedonic scale in terms of food attributes by the different panelists that include food experts, students and professors. There were four treatments as to Crust: T_1 is a mixture of 210g all-purpose flour and 70g camote flour, T_2 is 140g all-purpose flour and 140g camote flour, T_3 is 70g all-purpose flour and 210g camote flour and T_4 is pure 280g camote flour. For filling preparation T_1 is a mixture of 2 cups cooked camote and 1 cup evaporated milk, T_2 is 2 ½ cup camote, ¾ cup milk and ¼ cup water, $T_3$is 3 cups camote, ½cup milk and ½ cup water and T_4 is 3 ½ cups camote, ¼ cup milk and ¾ cup water. Results showed that in terms of odor, texture, flavor and general acceptability all the treatments for fillings were rated like very much while for crust the texture and flavor were rated like moderately. Analysis of Variance (ANOVA) showed that there is a high significant mean difference on the respondents' group/panelists' perception for crust and filling texture, odor, and flavor but no significant difference on camote pie general acceptability. Nutrition facts of camote pie for 900g content based on 2015 RENI PDRI adult requirements of 19-29 years old male showed that calories (kcal) is 13%, cholesterol (mg) is 30%, total carbohydrate is 15% and protein is 8%.

Keywords: Product Development, Camote Pie, Experimental Design, Nutrition fact, San Francisco, Cebu, Philippines

INTRODUCTION

Sweet potato (Ipomoea batatas L.) is an important staple food crop and highly produced in the Asian countries. It is the sweetest tasting root vegetable dicotyledonous plant that belongs to the family Convolvulaceae (Giango & Añero, 2017). It is considered as one of the most significant food crop due to its health contributing principles in tubers and leaves. Across China and Southeast Asian countries, the food industries are increasingly using sweet potato in several value added food products. Processed sweet potatoes are common in the countries of Indonesia, Philippines, Thailand, Malaysia and Vietnam. The tubers or roots of sweet potato are eaten after boiling or baking, thus increasing the sugars during

these processes. In the Philippines it plays a major role in the food security system where its production in 2016 was 127.85 thousand metric tons (PSA, 2016). It is now gaining popularity due to the increased consumer awareness of healthy and nutritious diets as well as interest in the food industry using its raw materials. It is considered a significant crop for climate adaption and disaster recovery/ resilience in many areas in the country during disasters (DOST-PCAARD Proceedings, 2015).

Sweet potatoes locally called as “camote” in Camotes Islands, Cebu in which historically the name Camotes derived from camote during the Spanish era. Production of camote in Camotes Islands is sponsored by the Department of Agriculture where planting of crops maintained for market. The farmers are also distributed with different varieties of camote root crops for cultivation and farming.

The largest supply of sweet potato varieties in the world with more than 6,500 wild traditional and improved species was found in the International Potato Centre (CIP) as informed by the Food and Culture Encyclopedia, 2003. The West African sweet potato cultivars production produced to 2.516 million metric tons as reported by FAO, (2006) statistics.

Olowule et al., (2012) cited in the study conducted in Nigeria that orange-fleshed sweet potato is widelyprocessed into flour and found to attract higher prices by consumers than from other varieties. The crop was well patronized as a daytime snack in schools, offices and in homes. It can also be eaten boiled,fried and in roasted form. In addition, it can be sliced, dried in the sun and ground to give flour that remains in good condition for a long time; and as well be used as a dough conditioner in bread manufacturing and as a major raw material in snack and noodles production as well as a stabilizer in the ice cream industry.

Several studies and developments of sweet potatoes are done in terms of production. But a greater needs to undergo processing initiatives or product development of sweet potato to meet the demands of the market as it is a target food product in disaster affected areas as recommended by DOST-PCAARD.

Product development involves the modification or creation of a new product in which sweet potato pie was tested by determination of its acceptability to the consumer panelists. This could be a great potential in the market considering that the study included the nutrient analysis of the product for the nutritive value of the camote pie. The study can be a potential to contribute to food resilience in the country considering its health benefits and nutrient composition

Review of Related Literature

Sweet potato is one of the world’s major food commodities. It produces more calories per hectare per day than rice, wheat, corn or cassava. Most varieties are high in beta-carotene. The crop can be processed into starch, flour or animal feed as cited in the study of Olowule et al., (2012). In the tropical region, consumption of sweet potatoes should be done after harvest due to shorter shelf life because of high moisture content especially if it is not processed. Shelf life of cooked camote is as short as one week as well the raw one that will be consumed after a week of harvest.

Sweet potatoes arerich in Vitamins A and C particularly the dark orange and yellow-fleshed varieties in which the minerals found were calcium and potassium and is higher than other root crops such cassava, ubi and gabi.. There are three varietal groups of sweet potatoes, the white variety that rich in fiber, ash and protein contents and are highly recommended for infant foods formulations (Sanoussi, 2016). As reported by Jenkin, (2015), orange-fleshed sweet potato (OFSP) is potentially

affected the increased of Vitamin A deficiency of women and children in Mozambique and populations worldwide as well as potential source of carbohydrate base inbaby food production.

Many countries are engaged in the processing of sweet potatoes that includes prickles, juices, snack products such as camote chips, cakes, and other processed formed such as baked and dried products. Sweet potatoes were consumed as lacto-juices by processing it with lacticacid bacteria as the fermenting organism and the juice produced has been reported to be very rich in minerals and vitamins. It is also used as a major source of raw material for feed production for piggery in Asia particularly in countries like China and Japan.

Studies are also done investigating the possibility of fermenting sweet potation to flour as a means of promoting food and nutritions ecurity in the developing countries. It is believed that a successful development and production of good quality flour will eventually be promoted in the villages where sweet potatoes are grown in abundance. Eventually this product will assist in minimizing postharvest losses associated with sweet potato and ensure increased earnings by sweet potato farmers particularly in the developing countries in Africa. It will also lead to production of novel food products from sweet potato crops thus assisting in minimizing food insecurity problems particularly in most developing African countries where hunger poverty and starvation are highly prevalent.

A study conducted by (DOST, 2007) in order to enhance the consumption of sweet potato due to its nutritional advantages and was found out that it is significantly viable in combining with popular dish like rice as an important tropical cereal. In this study, result further showed that during the sensory evaluation the porridge with 100% sweet potato (SP100) showed the highest preference score in allthe sensory attributes as evaluated and competed in the porridge product of the Ghanaian market. As recommended in the study that breakfast meal be made solely and developed from sweet potato, as well as combination or rice and sweet potato composites (with higher rice proportions) can also bee ncouraged.

Oluwole et al., (2012) study the possibility of producing acceptable fermented sweet potato flour. The study has revealed the potentials and possibilities of utilizing fermented sweet potato flour as meal and results showed that the product could serve as an alternative to the popular fermented cassava flour that is conventionally utilized domestically in form of meal. The process technology involved required minimum processing equipment of fermentation vessels, peeling and chipping equipment as well as a solar/tray/cabinet. Further, the study revealed that the crude protein contained (4.27%) and carbohydrate (84.81%) contents of the fermented sweet potato flour. Fat, crude fiber and ash contents of the fermented flour were significantly lower than in the raw sweet potato. Moreover, the study revealed that during the fermentation period, the microbial profiles of the fermenting medium increases with increase in time while the pH of the medium decreases with time. The study revealed the nutritional quality aswell as the pasting characteristics of the fermented sweet potato flour that has a great influence and implication on its utilization as afood security crop.

Mutai et al., (2013) stressed that sweet potato has a potential in increasing the farmers' rural incomes and job opportunities. This can achieve especially if they concentrate in the production and marketing of local crops requiring low inputs. This isin the so called market participation of sweet potato. In the study of Mutai et al., (2013) about the factors that determine farmers' shift in market participation of sweet potato from village to regional market in Vihiga County recommends that there is a need to increase the government support from local and nationals in the establishment of sweet

potato markets. Improve the rural road networks to cut down transport costs and increase support to farmer groups or associations in order to increase farmers' market participation.

Low et al., (2007) reported that there is an increase in the vitamin A intakes when orange sweet potato varieties were consumed in young children in the rural Mozambique. As cited by Bonsi (2014) that the processed bread with 30% orange sweet potato flour met the daily needs of children from 3-6 years old. Ji et al., (2015) conducted a study on the nutrition composition analysis of sweet potato and result showed that flesh color sweet potato variety showed favorable nutrient content and sweet potato varieties differs significantly in the amount of nutrients such as protein, fats and starch.

The starch content of sweet potato Beijing 553 and Shangshu 19 were higher, but fat contents were rich lower than other varieties. The protein content of Shangshu 19 was the highest followed by Jizi 01 andXinong 431 sweet potato varieties. Results of nutrient analysis confirmed that purple fleshed sweet potato possesses much higher anthocyanins content than others varieties that reach to up to 6.23 mg/g dry matter, the dietary fiber, total phenolics content, and total antioxidant capacity of Jizi 01 were also higher compared to other varieties. Determining the nutrient composition of a food product can gain knowledge and understanding on food choice.

Tucar, (2017) mentioned in her study on the sensory characterization of cupcakes made of sweet potato flour enriched with turmeric that sweet potato is a much cheaper but excellent source of carbohydrates, Vitamin A, carotene, calcium and phosphorus. It has much of high nutritive value than cupcakes made of all -purpose flour.

Sweet potatoes were studied in terms of determining nutrient composition as affected by the amount of fertilizer added. It was found out that application of nitrogen more than 80 kgN/ha does not affect the increase of nutrients in the Camote as well as the amount of protein in it. However, the application of nitrogen fertilizer to the varieties of sweet potatoes increased the mineral contents excluding the phosphorous. The overall results indicated the increased bioavailability of ß-carotene (Provitamin A) and crude protein which are essential for good nutrition and healthy diet (Ukom et al., 2009).

The Recommended Energy and Nutrient Intake (RENI) is the new dietary standard as set in the Philippines. The standards are expressed in terms of energy and nutrients that Filipinos should intake and not in the amount of foods or diets. The RENI is defined as the "levels of intakes of energy and essential nutrients" which are considered the basis of adequate and maintenance of one's health and well-being for attaining a healthy person in the population (Barbara and Cabrera, 2008). Furthermore, the recommended nutrient intake is defined as the intake level of sufficient energy to meet the daily requirements of most individuals in a specific life stage and gender group. It is based on an estimated requirement plus two standard deviations above the mean. They are recommended intakes estimated to exceed the requirements of most individuals to ensure that the needs of nearly all individuals in the population are met. The recommendations are expressed in terms of usual intakes of nutrients that population groups should consume over a period of time. The recommendations are for apparently healthy populations, that is, those who are not ill based on clinical signs and symptoms and body function, normally assessed by routine laboratory methods and physical evaluation. These intake levels could be met by a diet of a wide variety of foods including fortified foods. Nutrient supplementation may however be needed for the vulnerable groups.

Objectives

1. To identify prior culinary arts using sweet potato (camote) as composite ingredients
2. To determine the formulation of camote pie in different treatments for the:
   2.1. Crust and
   2.2. Fillings
3. To find out the acceptability of the formulated camote pie as to the different food attributes:
   3.1. aroma,
   3.2. texture,
   3.3. flavor, and
   3.4. general acceptability
4. To find out the effect of the different formulations to the various food attributes,
5. To determine the nutritive value of the most acceptable formulation,
6. To compute the significant mean difference of the effect of formulated Camote Pie recipe using varied fillings and crust.

MATERIALS AND METHODS

The study uses the experimental research design of research using laboratory and sensory analysis. A 9-Point Hedonic scale was used for descriptive rating of each formulation and organoleptic tests by the panelists was done using sensory evaluation. Nutrient analysis in the laboratory conducted by First Analytical Services and Technical Cooperative [F.A.S.T.] Laboratories**.** The prepared recipe for sweet potato pie was done in four treatments using two types of properties in the testing of its organoleptic tests: the filling and the crust of sweet potato pie.

The study utilized 51 members as panelists that composed the sensory evaluators, 20 of them are food experts/ professors or instructors of CTU- San Francisco, Cebu, 15areselected Hospitality students in the Bachelor of Science in Hospitality Management course and 16 are from students in the Bachelor in Secondary Education major in Technology Livelihood Education (TLE).

The experiment was divided into five phases:

Phase 1--- Preparation of Sweet Potato Pie in different preparations
Phase 2--- Try outs of the Recipes
Phase 3--- Standardization of the Recipe
Phase 4--- Evaluation or Preference Test/ Panel Tasting of Recipe
Phase 5 --- Costing

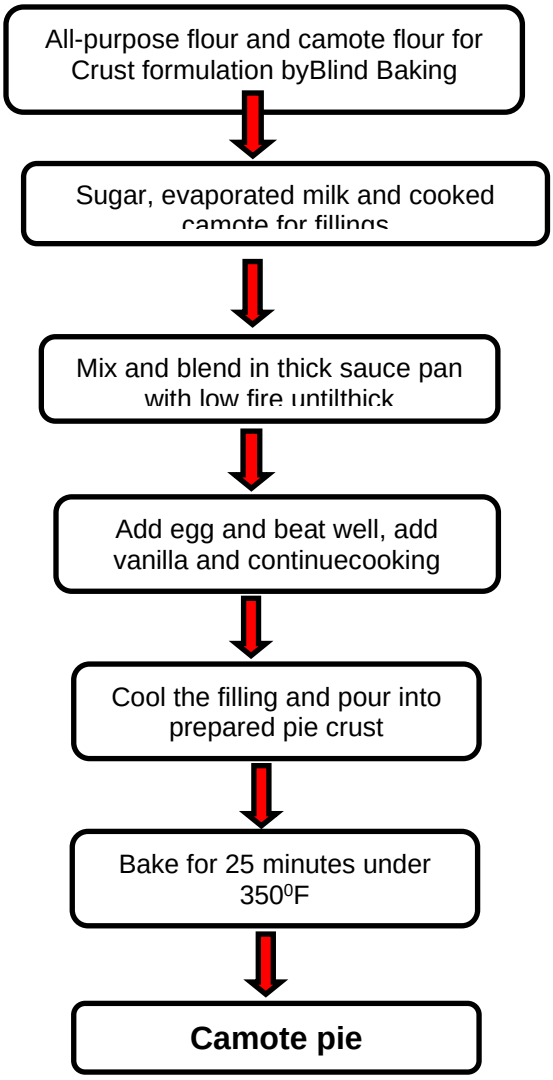

Figure 1
Flow chart for Processing
Camote Pie

RESULTS AND DISCUSSIONS

RESULTS AND DISCUSSION

The following are results of the study.

PRIOR CULINARY ARTS OF SWEET POTATO

Sweet potatoes are cultivated and are utilized extensively in Asia and Southeast Asian countries and the processed products are common in the countries of Indonesia, Malaysia, Thailand, Vietnam and the Philippines. The following are the earlier and or previous list of culinary arts or food processing techniques of utilizing sweet potato into varied snack and baked products. There are five baked products presented below as a comparable cooking preparation of the Sweet Potato or Camote Pie.

Preparation No. 1.

Maize Based Orange – Fleshed Sweet Potato Flat Bread

Ingredients:

Maize flour Orange- fleshed Sweet potato flour
Salt Oil Water

Procedure:

1. A 100 grams of ingredients with different proportion were put and mixed together in three bowls: maize and orange fleshed sweet potato flour and one bowl with maize flour only.
2. The ingredients in each bowl were mixed until they became uniform and sieved three times by similar sieve having series opening of 1.00 mm.
3. Salt and one teaspoon of oil were added and mixed during the preparation.
4. Warm water was added a little at a time while mixing and kneading the dough until it became smooth.
5. The dough was sheeted and baked in a hot oven with a constant time (10 minutes) and maximum temperature of 78°C.
6. The flat bread samples were removed from the oven and allowed to cool down.
7. Finally the flat bread samples were sealed separately in a black Polyethylene bags and were put in a deep freezer till nutrient analysis was carried out.

Preparation No.2.

Chocolate Filled Sweet Potato Cupcakes

Ingredients:

1 pound sweet potato, peeled and mashed
2 cups all-purpose flour 2 tsp. pumpkin pie piece
1 ½ tsp baking powder ½ tsp baking soda
¼ tsp salt 1 cup unsalted butter, softened
1 ¼ granulated sugar 3 eggs
¼ cup milk 1 tsp vanilla
24 milk chocolate or dark chocolate kisses

Procedure:

1. Pre heat oven and line 20 muffin cups. Set aside
2. In a bowl combine flour, pumpkin pie spice, baking powder, baking soda, and salt. Set aside. In another bowl beat the butter for 30 sec. Add granulated sugar, beat until light and fluffy.

3. Beat eggs one at a time, add the sweet potato , milk, vanilla and beat on low speed.
4. Add the flour mixture to the sugar-egg mixture, beat on low until combined.
5. Fill each muffin up. Bake for 5 minutes. Carefully remove pan from oven. Gently press kisses, tips up, about halfway into each cup. Bake for 14 minutes. Cool cupcakes in pan for 10 minutes.

Preparation No.3.

Sweet Potato Jam

Ingredients:

1 ½ lbs Cooked Sweet potato, peeled and finely diced

4 whole cloves	1 cinnamon stock	½ vanilla bean
2 cups Sugar	4 cups water	1 lemon

Procedure:

1. Add 4 cups water to saucepan.
2. Add sweet potato to lemon water in saucepan
3. Add sugar, cheesecloth and contents, cinnamon stick, vanilla bean.
4. Bring mixture to boil. Reduce heat and simmer until thick and jam like about 30 minutes.
5. Using a spoon, skim off any foam that may rise to the surface as the jam cooks. Remove from heat.
6. The potatoes should be soft enough to fall apart on their own, but if they don't, mash them with the back of a wooden spoon.
7. Remove and discard cheesecloth and contents.
8. Ladle jam into hot, clean jars.

Preparation No.4.

Sweet Potato Puree

Ingredients:

3 large sweet potatoes, peeled and cut into 2-inch chunks
Maple-butter, orange ginger or lime-cayenne flavoring
Salt and freshly ground pepper

Procedure:

1. In large saucepan, cover potatoes with water. Bring to boil.
2. Cook until tender when pierced with the tip of a pairing knife, 15-20 minutes.
3. Drain; puree in food processor
4. Add flavorings; if desired; puree.
5. Maple butter-Add 2 tbsp each melted butter and maple syrup. Serve puree with more butter and syrup.
6. Orange ginger- Add i/4 cup each milk and orange juice, 2 tbsp melted butter and 2tsp minced fresh ginger

7. Lime cayenne- Add 1 tbsp lime juice and a pinch of cayenne. Thin with a bit of cooking liquid if needed.
8. Season with salt and pepper, serve.

Preparation No. 5

Candied Sweet Potato

Ingredients:

4 lbs sweet potato, quartered 1 ¼ cups margarine
1 ¼ cups brown sugar 3 cups miniature marshmallows, divided
1tsp Ground cinnamon to taste 1tsp. ground nutmeg to taste
1 tbsp vanilla extract salt to taste

Procedure:

1. Peel the sweet potatoes and cut them into slices.
2. Melt the margarine in a heavy skillet and add the sliced sweet potatoes.
3. Mix the sugar, cinnamon, nutmeg and salt. Cover the sweet potatoes with sugar mixture and stir. Cover skillet, reduce heat to low and cook for about 1 hour or until potatoes are candied. They should be tender. Stir in the vanilla just before serving. Serve hot.

FORMULATION OF SWEET POTATO (CAMOTE) PIE

The sweet potato or camote were formulated according to the amount of camote flour and all-purpose flour for the crust and for filling differs to the amount of cooked camote, evaporated milk and water.

Crust Formulation of Camote Pie

The Pie is defined by their crust. The crust is the pastry dough that covers the sweet potato filling ingredients. Crust formulation of Camote Pie was done through blind baking.

Table 1. Formulation of Camote Pie CRUST

Formulation of CRUST	
Constant amount of ingredients in all treatments	Sugar- 3 teaspoons Salt- ½ teaspoon Shortening- 70 grams Butter-85 grams Egg- 1 pc Ice water- 60 ml
Treatments	**Amount of APF and camote flour**
1	All-purpose flour (APF) – **210 grams** Camote flour- **70 grams**
2	All-purpose flour (APF) – **140 grams** Camote flour- **140 grams**
3	All-purpose flour (APF) – **70 grams**

	Camote flour- **210 grams**
4	All-purpose flour (APF) –**0 grams** Camote flour- **280 grams**

Table 1 indicates the amount of the ingredients for the formulated camote pie recipes as to Crust formulation. Crust holds the camote filling of the camote recipe. It is mainly composed of flour and baked in about 12 to 15 minutes with equal proportions of width of the kneaded flour. The crust is the outside appearance of the pie that adds attraction to consumers.

Treatments 1 to 4 vary in the amount of mixture of all-purpose flour (APF) and camote flour. All treatments have equal amount of flour that composed of a total 280 grams per pie. For the first treatment it consisted of 210 grams all-purpose flour that was added with 70 grams camote flour. The camote flour and all-purpose flour was bought in the market and are described as “ready-made” flour. Literature described that the crust of any pie is important as it defined the total appearance and acceptability of the filling that the crust covers. It contributes to the pastry of the pie and serves as the shell or outer hard skin of the pie.

Treatment 2 (T2) consisted of the equal amount of camote flour and all-purpose flour that amounted to 140 grams each while Treatment 3 has the larger amount of camote flour (210 grams) and 70 grams of all-purpose flour and Treatment 3 is purely camote flour which is 280 grams.

Results showed that during trial and standardization of recipe the amount of camote flour added to the all-purpose flour had slight effects. Findings revealed that the presence of less camote flour and more all-purpose flour had a moderately shiny surface than those of pure camote flour which is heavier and firm than the other treatments. Moreover among all the treatments of the camote pie treatment 1 (210 grams of APF and 70 grams of camote flour) and treatment 2 (equal amount of APF and camote flour; 140 g each) were described as moderately shiny surface by the panelists. The crust with more camote adds firmness and heavy content to the product. As described in the result of the study conducted by Zegeye et al., (2015) fleshed sweet potato bread was heavier in texture compared to the wheat based bread as consumed by lactating mothers in Ethiopia. In addition to, another study was conducted by Bonsi et al., (2014) on the acceptability of Ghana bread made with orange sweet potato puree indicated that the higher the percentage of sweet potato substitution, the firmer (less soft) is the bread and suggested that the texture of the Ghana bread might not be improved if higher amount of puree is added. In their studies the texture of the products developed out of camote or sweet potato got the lowest ratings among their panelists. Moreover, similar studies on the sensory characterization of cupcakes made of sweet potato showed that the texture of cupcake made of pure sweet potato flour were described as moderately moist and the product is heavier compared to the control of cupcakes made of all-purpose flour (Tucar, 2017). Significant effects are observed as to direct observations in the amount of camote flour added to the all- purpose flour in the formulation of the Crust in the Camote Pie.

Formulation of Fillings of Sweet Potato (Camote) Pie

The fillings of a pie served as the savory or sweet ingredients as it is covered by the crust. In the preparation of sweet potato pie, varied amount of sweet potatoes are added to the mixture with different amount of evaporated milk and water.

Table 5 presents the formulated camote pie in terms of preparation of camote fillings.

Table 2. Formulation of Camote Pie FILLINGS

Formulation of CAMOTE FILLINGS	
Constant amount of ingredients in all treatments	Sugar- 100 grams Camote flour- 60 grams Vanilla- 1 tsp Eggyolk – 5 pcs
Treatments	**Amount of cooked camote, evaporated milk and water**
1	Camote- 2 cups Evaporated milk- 1 cup
2	Camote- 2 ½ cups Evaporated milk- 3/4 cup Water- ¼ cup
3	Camote- 3 cups Evaporated milk- ½ cup Water- ½ cup
4	Camote- 3 ½ cups Evaporated milk- ¼ cup Water- ¾ cup

Fillings of the pie add taste to the product. It is the fillings that the total taste of the recipe felt. The formulation of camote fillings varied in the amount of cooked camote or camote meat, water and the evaporated milk. As presented in Table 5, treatment 1 has the least amount of camote meat but greater amount of evaporated milk without water added. Treatment 2 camote was increased into half cup (2 1/2) cup while evaporated milk is lessened to ¾ cup and ¼ cup is the water. Treatment 3 is contained 3 cups camote with ½ cup evaporated milk and ½ cup water while treatment 4 had the greatest amount of camote meat and lesser amount of evaporated milk (1/4 cup) but greater amount of water (3/4 cup).

Result showed that in the amount of the formulated preparations of camote filling, the lesser the camote meat added, the greater amount is the evaporated milk and less water and if the greater amount of camote, the lesser is the evaporated milk and the higher the amount of water added. There is the same proportion of the amount of camote flour added in the Camote Pie Crust formulation from treatments 1 to 4. The lesser camote flour in treatment 1 the lesser camote meat was added to camote fillings. Similarly, the greater amount of camote flour in treatment 4, the greater amount also of camote meat was added to camote fillings. This shows the important role of the amount of camote flour and cooked camote added to the mixture as it defined the texture as well as the taste of the camote pie.

Results showed further that the effect on the taste of increased amount of camote meat to Camote Pie fillings and camote flour to camote Pie Crust described as moderately liked than the lesser amount of camote added which is very much liked. Similarly the panelists liked very much the

Camote Pie when lesser amount of camote was added to the treatment. The product obtained scores of moderately moist for texture attribute (hand-feel) to the treatment with greater amount of camote added. Camote fillings of treatment 4 with the pure camote meat and small amount of milk made the product moderately moist and heavier compared to other treatments because of the moisture content found in Camote. Apparently, the pectin content also found in sweet potatoes is sufficient to produce a leathery texture product as cited by Okeh and Workneh (2013) in the production of sweet potato leather. In addition, a study conducted by Tucar (2017) that the presence of pure sweet potato flour in cupcakes was moderately light in weight than with the cupcakes with wheat flour added in the mixture that attributed to its light weight in volume due to gluten content. Results showed that in terms of odor, texture, flavor and general acceptability all the treatments for fillings were rated like very much while for crust the texture and flavor were rated like moderately. Analysis of Variance (ANOVA) showed that there is a high significant mean difference on the respondents' group/panelists' perception for crust and filling texture, odor, and flavor but no significant difference on camote pie general acceptability and the overall general acceptability of the food attributes of all treatments. At 5% level of significance, based on the one-way Analysis of Variance table, there is sufficient evidence to accept the null hypothesis.

Similarly, in the study conducted by Okeh and Workneh (2013) in the formulation of Sweet Potato Jam, the amount of sugar added to the cooked sweet potato chunks is lesser than the amount of sugar due to high starch content of sweet potato roots as compared to fruits. The standard formula for fruit jams is 45% fruit and 55% sugar (Gross, 1979). Thus in the proportion of the amount of camote meat, the higher camote added the lesser is the evaporated milk due to high content of camote starch. It is already sweet.

Moreover, in the amount of water added to camote fillings as cited by Fellows (2000) that removing of water is destroying the enzymatic and microbial activities that inhibit deterioration of product. The formulation of treatment 1 as the much accepted treatment by the panelists, without the addition of water can lengthen the shelf-life of the Camote Pie. Processing by the application of heat like baking can be used in the product development of sweet potato (Doymaz, 2012).

Nutrition facts of camote pie for 900g content based on 2015 RENI PDRI adult requirements of 19-29 years old male showed that calories (kcal) is 13%, cholesterol (mg) is 30%, total carbohydrate is 15% and protein is 8%.

As indicated in the recommended energy and nutrient intakes for Filipinos 2002 revealed that the energy contained in Camote Pie can really be a good source of minerals, vitamins and other nutrients desirable in the human diet and recommended for being part of a healthy diet.

Cost analysis ofingredients showed that treatment 1 costs ₱201.00 for the production and expenses of ingredients and is the least of the expenses in all the treatments while treatments 3 to 4 got the same amount of ₱210.00 per whole price of the Pie. This means that among the treatments, treatment 1 had the less amount of cooked camote and camote flour the less is the cost and the cheaper is the price.

CONCLUSIONS

There are many prior culinary arts of sweet potato that includes sweet potato bread, sweet potato cupcakes, sweet potato jam, sweet potato puree and candied sweet potato. The most acceptable formulation of sweet potato pie is treatment 1 with a mixture of 210 g all-purpose flour (APF); 70g camote flour with fillings of2 cups cooked camote and 1 cup evaporated milk for both crust and fillings.

Evaluators rated like very much for treatment 1 both filling and crust with the composition of 210 g all-purpose flour (APF); 70g camote flour for the crust and with fillings of 2 cups cooked camote and 1 cup evaporated milk.There was an effect of moderately tender to very much tender of the sweet potato pie in terms of texture and moderately shiny surface for hands feel texture. The sweet potato pie is very much liked and moderately liked as perceived by the sensory panelist.

There was a significant difference in the level of acceptability of Camote Piein terms of flavor, texture and general acceptability of the Crust and Fillings of Pie for treatment 1 and only treatment aroma significantly differs for filling of the pie. Therefore, the hypothesis was not accepted. But on the general acceptability and the overall mean acceptability of the different attributes of camote pie both crust and fillings showed no significant difference in all the treatments, therefore, the hypothesis was accepted. The cost of the most acceptable Camote Pie was ₱201.00 with a net profit of ₱74.00. Nutritive value of Camote Pie indicates sufficient energy contained as good sources of minerals, vitamins and other nutrients desirable in the human diet and recommended for being part of a healthy diet.

RECOMMENDATIONS

The following are the recommendations:

- Extended study be conducted for shelf life and microbial analysis for storage process and packaging since it will be recommended as pasalubong product or delicacy in the Camotes Group of Islands;
- Patent application of the product for commercialization;
- Will be part of the extension project for business enterprise of local entrepreneurs of the Islands.

REFERENCES

A. BOOKS

Food and Culture Encyclopedia, (2003). The Gale Group Incorporated.

B. JOURNALS/ PROCEEDINGS

Bonsi, Eunice, Elizabeth Chibuzo and Robert Zibawa (2014). The Preliminary Study of the Acceptability of Ghana Bread Made with Orange Sweet Potato Puree. Journal of Human Nutrition and Food Science 2333-6706

Giango, Wilma C. and Marjorie B.Añero (2017). Wonton wrapper in sweet potato (Ipomoea batatas) and durum four. Academia Journal of Agricultural Research 5(10):261-270.

Jenkins, M., Shanks, C. B., and Houghtaling, B. (2015)Orange-Fleshed Sweet

Potato: Successes and Remaining Challenges of the Introduction of a Nutritionally Superior Staple Crop in Mozambique. Food and Nutrition Bulletin., 36(3) 327-353

Low, Jehoshaphat W., Arimond M., Osman N., Cunguara B., Zano F., Tschirley D. (2007). A Food-Based Approach Introducing Orange-Fleshed Sweet Potatoes Increased Vitamin A Intake and Serum Retinol Concentration in Young Children in Rural Mozambique Nutrition Food Science 1320-1327

.

Nungo R.A., Ndolo P.J., Kapinga R &Agili S (2007): Development and promotion of sweet potato products in Western Kenya, Proceedings of the 13th ISTRC Symposium, pp. 90 – 794.

Oluwole, Oluwatoyin B., Sulaimon Babatunde Kosoko, Samuel Olusina Owolabi, Morufat Justina Salami, Gloria NwakaeghoElemo, and Samuel lakitan Akande Olatope (2012), Development and Production of Fermented Flour from Sweet Potato (Ipomoea batatas L) as a Potential Food Security Product. Journal of Food Science and Engineering 2(2012) 257-262.

Owori, C., and Hagenimana, V. 2001. Development of Sweet Potato snack products in rural areas: Case study of Lira district of Uganda. In: Root crops in the 21st century: Proceedings. 7. Triennial Symposium of the International Society for Tropical Root crops-Africa Branch (ISTRCAB) 699-707.

Sobowale, A.O., T.O. Olurin, O.B. Oyewole, (2007). Effect of lactic acid bacteria starter culture fermentation of cassava on chemical and sensory characterization of fufu flour, African Journal of Biotech. 6 (16) 1954-1958A.O.

Sanoussi A. F., Dansi A., Ahissou H., Adebowale A., Sanni L. O., Orobiyi A., Dansi M., Azokpota P. and Sanni A. (2016). African Journal of Biotechnology., 15(13), pp. 481 - 489

Tucar, MerlindaTabaldo., 2017. Sensory Characterization of Cupcakes Made of Sweet Potato (Ipomoea batatas) Flour with Turmeric (Curcuma longa), Asia Pacific Journal of Multidisciplinary Research, Vol. 5, No. 3.

Zegeye, Menen; Pragya Singh, Alemzewed Challa and YibeltalJemberu (2015).Development of Maize Based Orange-Fleshed Sweet Potato Flat Bread for Lactating Mothers at Hawassa Zuria Woreda, SNNPRS, Ethiopia. International Journal of Food Science and Nutrition Engineering 183-190

C. THESES/ DISSERTATION

FAO (Food and Agriculture Organization), 2006. FAOSTAT database Result.

Food and Agricultural Organization of the United Nation, Rome Italy

.

FAO (2007). Food Security Profiles. Food and Agriculture Organization, Nairobi, http://www.fao.org (Accessed on 17th July 2010).

Odondo A. J, (2013): Market structural characteristics, conduct and performance of sweet potato industry in Kenya; A case of Rachuonyo south district and its key market outlets, Un published PhD Thesis, Maseno University- Kenya

D. ELECTRONIC SOURCES

http://www.enwikipedia.org/wikiPie.com.//3/20/2018

http://www.enwikipedia.org/Sweet_potato_pie.//3/20/2018

http://www.enwikipedia.org/wiki_Crust_baking//3/20/2018