GLAZED AND UNGLAZED MUFFIN WITH VARYING PROPORTION OF PUEAWAN (Cyrtosperma Chamissomis) FLOUR AS AFFECTED BY METHODS OF COOKING

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ABSTACT

A study was conducted at the Aklan State University main Campus, Banga, Aklan on November 12,13,14.2012 to evaluate the sensorial attributes of Pueawan Muffin prepared with varying proportion, glazed and unglazed as affected by methods of cooking in terms of color, aroma, flavor, texture and general acceptability. Cost analysis was also determine to assist the sensory quality, five point hedonic scale was used. A factorial experiment in Randomized Complete Block Design (RCBD) with three replications was used. The study consisted of three factors: Factor A (proportion of pueawan flour) were: A1=640 grams all purpose flour (APF); A2=320 grams PF + 320 APF A3 =840 grams PF+160APF A4=640 grams PF. Factor B (Glaze concentration) was composed of B1=glazed and B2= unglazed. Factor C=method of cooking C1= baking C2= steaming method. To determine the significant difference between treatments, the data were subject to ANOVA at 5% level of significance. To further test the difference between treatment means, the Duncan Multiple Range Test (DMRT) was employed. In addition, to determine the two treatment means, T-test was employed. It was found out that the sensory attributes of muffins with varying proportions of pueawan flour as affected by glazing application differ significantly in terms of aroma and flavor but not in terms of color, texture and general acceptability. In addition the sensorial characteristics of muffins in terms of texture were significantly affected by methods of cooking. Proportion using 100% of all purpose flour had the greatest input cost and 100% of pueawan flour recorded the cheapest cost of production.

Keywords: cooking, color, glazed, cost analysis, unglazed

CHAPTER I

INTRODUCTION

Background of the Study

One of the Philippines' major thrusts for development is on agriculture and fishery sectors. To achieve this, the advocacy on agro-industrial development for industrialization as the government's vision for Philippine development in the next six years, was adopted. This vision calls for the adoption of strategies designed to harness the country's rich natural resources, human resources and potentials to ensure sustainable human resources by developing Filipino experts in food processing. There is an urgent call to discover more strategies in food processing using indigenous crops as partial or main ingredients (Habito, 2000). Production of indigenous crops for commercial purposes can help alleviate poverty among population. Increase utilization and production of these crops can promote economic opportunities, empowering the poor and enhancing social security to alleviate poverty and promote better nutrition. Improved nutrition is an integral component of the community's development potential for addressing food income needs of the poor. Knowledge on the use of these local plants is a part of the indigenous knowledge system and practices of indigenous people in the region, country, and the world over which they passed from one generation to the other (www.fao.org. 08/2012).

There has been a variety of starch producing crops which were tested as flour substitute. These include cassava, sweet potato, yam and ube. They have been found as good substitute but in some percentage only on the wheat flour. Total substitution has not been recommended yet.

Pueawan or giant swamp taro (Cyrtosperma chamissonis) is a native plant of the Philippines that has dozens of varieties thriving on most of the tropical islands in the Pacific. Swamp taro corms are prepared in several ways, from roasting to grating to baking the corm whole. It is more abundant on Pacific atolls than its better-known cousin, the taro (Colocasia esculenta), but it is much less commercially available. Its traditional cultivation is labor intensive and dependent upon a consistently saturated environment, which makes it practical to grow only in small, marshy plots (Isaac Hopkins. 02/2012).

Researchers consider the potential of giant swamp taro to be largely untapped, partly because it is not often studied by researchers and techniques for improving the plant's cultivation have not been developed. While the viability of export is very limited, the giant swamp taro may play a key role in feeding the inhabitants of dozens of Pacific islands.

As an answer to the government's major thrust in food and nutrition to discover and develop food items and recipes out of indigenous materials and the rising cost of imported flour, the use of pueawan flour as substitute in baking muffins will be considered. Pueawan muffins are not only nutritious but also affordable, and the root crop Pueawan is abundantly available locally. This study will be focused on the development of a food item that could help answer the nutritional needs especially in our community.

Its acceptability in terms of color, aroma, texture, flavor and general acceptability as affected by cooking methods will be investigated. The concept to utilize pueawan, an indigenous flour, as substitute for all purpose flour in making muffins is hereby introduced, hence the conduct of the study.

Objectives of the Study

Preliminary experiment conducted showed that "pueawan" is a good source of flour and can be good substitute to wet flour in making breads specially pandisal (calizo, et.al unpublished). With the huge importation of wet flour, the processing of "pueawan" corm can somehow help preserve foreign currency. At present, the shortage of wet foreign is felt internationally as well as locally and its price in the market is unstable. There is a need for a cheaper substitute, the reason why this study will be undertaken.

The general objective of the study is to determine the acceptability of glazed and unglazed muffin with varying proportions of Pueawan flour as affected by cooking methods. Specifically, it aims to:

1. assess the sensory quality of glazed and unglazed muffin with varying proportions of pueawan flour as affected by methods of cooking in terms of color, aroma, flavor, texture and general acceptability.
2. determine the effect of glazing to the quality of muffins with varying proportions of pueawan in terms of color, aroma, flavor, texture and general acceptability;
3. find out which method of cooking will give the best quality of muffins in varying proportions of pueawan flour in terms of color, aroma, flavor, texture and general acceptability;
4. determine the cost of production in making glazed and unglazed muffin mixed with varying proportions of pueawan flour.

Scope and Limitation of the Study

The study will be limited only to four treatments with three replications prepared from pueawan flour (PF) added to the control treatment. The study will be delimited to three factors such as: Factor A, proportion of pueawan flour (A_1 = 0 gm pueawan flour as control; A_2 – 50% pueawan flour; A_3 – 75% pueawan flour; A_4 – 100% pueawan flour); Factor B will comprised of the glazed concentration composed of two categories such as: B_1 (glazed), B_2 (unglazed) and Factor C – comprised of the methods of cooking (C_1 – baking; C_2 – steaming). The product to be evaluated will be delimited only to the use of a five-point Hedonic scale involving 30 respondents.

Significance of the Study

The data that will be generated from the study will give the end users valuable information on the potential of pueawan flour for processing. It will be beneficial to the following sectors:

Department of Agriculture. The gathered ideas from this study will help the agency to encourage, inspire and empower farmers of the locality to make use of their idle swampy area by planted to pueawan crop.

Entrepreneurs. The business enthusiasts will be given additional information on the utilization of pueawan flour as substitute for commercial flour which is costly.

Students. Through this study, students who are taking food-related courses will be motivated to conduct researches and discover new recipes using pueawan flour to enhance their skills in food product development.

Farmers. The information that will be gathered from this study will encourage the local farmers to plant pueawan crop in their idle swampy areas, thus creating income opportunities for the farmers which will help in the alleviating their standard of living.

Educators. The findings of the study will be significant to the educators, specifically those who are teaching food-related courses. This will give them relevant information on the possible adoption of technologies utilizing indigenous crops, such as pueawan corm that are abundant in their locality.

Researchers. The result of the study will provide future researchers new information in utilizing pueawan corm as raw material and for them to conduct further study on corm for industrial production.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter is a presentation of the literature and the results of related studies to which the present study has some similarity. This will give the researcher a systematic background in understanding the nature of the study.

Description of Pueawan

Puaewan (Cyrtosperma chamissonis) known as giant swamp taro is a very large, stemless (acaulescent) herbaceous plant, which by one account can reach a height of 5 m and is the largest in the Aroideae family. Vickers (1982) suggests that this species is the largest plant in the world that yields an edible corm. In some varieties, the corm can weigh as much as 100–120 kg if left to grow for a number of years (Untaman 1982). Cormels which send up leaves and develop into suckers are produced as side shoots on the parent corm after about three years. (http://www.fastonline.org) The plant has typically 6-8 huge leaves arising from a short subterranean stem. The leaves are large (reaching a length of 1 m), erect, and saggitate to hastate in shape with two long, acute basal lobes. The stem thickens rapidly at the base becoming a large corm, varying in shape from cylindrical to conical or almost spherical. Petioles are large, sometimes with prickles, spiny toward the base and reaching 3 m in length. The spathe is thick, yellowish with green veins while the spadix is yellow to orange (Smith 1979).

Giant swamp taro is the dominant aroid on the atoll islands of the Pacific. The primary product of this crop is the underground corm, which varies in characteristics with cultivar and age. This species is well adapted to moist tropical climates. It also does well in warm, seasonally moist climates that have a short dry season and variable precipitation. (Pursglove.1975) Giant swamp taro is a water loving plant (hydrophyte) adapted to fresh to brackish water conditions in coastal marshes, natural and man-made swamps, and pit depressions. Deep soils are preferable, as local taro experts stress that giant swamp taro grows both upward and downward in contrast to *Colocasia* taro which grows upward only (Englberger 2009).

Uses and Nutritive Value of Pueawan

Plucknett (1977) reports that the young leaves and inflorescences are eaten as vegetables and the petioles yield a fiber for weaving. Merlin and Juvik (1996) wrote that during WWII, starving Chuukese would eat the peeled and chopped stalks in soups. The leaf is used as a food wrapper and cover for the earth oven (*um, uhmw*) and the plant has been used in traditional medicine in many of the high and low islands of Micronesia. In Kiribati, Catala (1957) was told that specialists used a yellow mold from sliced and sun-dried corms to treat skin infections.

Dietary change in Micronesia has led to serious problems of vitamin A deficiency and other nutritionally-related health problems. Giant swamp taro (*Cyrtosperma chamissonis*) is important for food and culture on atoll and mountainous islands of Micronesia. There are many *Cyrtosperma* cultivars, but few have been analyzed for nutrient content. Samples were collected in the Federated States of Micronesia (Pohnpei, Chuuk and Yap) and the Republic of Palau, assessed for corm flesh color and other attributes, and analyzed for carotenoids (carotene, cryptoxanthin, lutein, zeaxanthin, and lycopene) and minerals (including iron, zinc, and calcium). Of 34 cultivars analyzed, carotene concentrations varied from 50 to 4486 ug/100 g. Yellow-fleshed cultivars generally contained higher carotenoid concentrations. Of the ten cultivars analyzed for mineral content (wet weight basis), substantial concentrations of zinc (5.4 to 46.1 mg/100 g), iron (0.3 to 0.8 mg/100 g) and calcium (121 to 305 mg/100 g) were found. All cultivars were acceptable for taste and production factors. These carotenoid- and mineral-rich cultivars should be considered for promotion in Micronesia and other areas for potential health benefits. (agro.biodiver.se/2007)

Post harvest handling and Processing of Pueawan

The corm needs to be eaten within 2–3 days of harvesting although corms can be stored in moist ground for up to 6 months (Untaman 1982; Koch 1986). A tuber or corm not cooked immediately after harvesting is said to form bitter spots called buyub in Yapese. These spots are cut out during the peeling process prior to cooking (Untaman 1982). In Kiribati, the corm is cut into small pieces (bwerebwere ni babai) or grated (i ni babai) and sundried for a week; in this form, it can be stored for half a year or longer (Koch 1986). The recent research by Englberger et al. (2008) has implications for storage of corms. Comparisons of frozen and dehydrated samples showed that frozen samples had a higher concentration of carotenes than dehydrated samples.

In Benguet, Philippines, starches were extracted from various roots, corms and tuber, including giant swamp taro, cassava, sweet potato, and arrowroot. These starches were then mixed with wheat flour at 25 and 50% formulations. Noodles made at the 25% formulation gave excellent results: "They exhibited smooth surface, white color dough, light yellow dry noodles, and very low cooking loss. The dough mixture was moderately soft, was easily hand extruded, and gave firm noodle strength during cooking and drying" (Benguet State University 2005)

Cyrtosperma is grown mainly for its starchy corms, which are prepared much like Colocasia. Corms can be peeled and boiled in water, or peeled, chopped, and cooked with coconut milk. They also may be roasted or steamed. Sometimes corms are peeled, scalded, chopped, sun-dried, and stored for a few months (Massal and Barrau 1956; De la Cruz 1973). Recipes and food uses are given in Owen (1973), Sproat (1968), De la Cruz (1973), Murai et al. (1958), and Gesmundo (1932).

As a food, the corm of the giant swamp taro can be roasted, boiled, or baked whole, or mashed or grated and combined with other starches for eating.

Pueawan as Flour Substitute

Processing will greatly increase the utilization of root crops. The flour can be used as a component of multimix baby foods and in composite flour for making bread. Research and development work on composite flour using root crops and other local products has advanced considerably in Colombia. Based on initial research in 1971-72, it was concluded that while rice and maize flours are preferable for use as non-wheat components in composite flours, cassava flour and starch also have good technical possibilities. The pilot work demonstrated that the production of bread from wheat flour diluted up to 30 percent with non-wheat components is possible on a commercial scale. But the large-scale introduction of such flours requires a concerted effort by both the public and private sectors to ensure the wide-spread availability at attractive prices of non-wheat raw materials. Expanded cassava production and lower prices are required if composite flour is to be economically attractive to millers and consumers (Goering, 1979).

Flour produced from sweet potatoes that can be used at 15 percent substitution level for wheat flour in bread can be used at higher rates for other bakery products. The flour can be made from unpeeled sweet potatoes by the use of a mild bleaching with 1 percent sodium metabisulphite. Pan-loaf and butter-bread had high consumer acceptability, and there is little obvious advantage in trying to produce the crusty type of loaf which is incompatible with the use of sweet potato flour without the additional use of other chemical additives. Yam flour can be used for production of acceptable bread at up to 25 percent substitution for wheat flour. Canning of sweet potatoes in brine can produce a very acceptable product. Pre-cooked yam flakes are another promising product. (http://www.istrc.org)

Bread baked with composite flour from local resources would reduce the foreign exchange cost of imported wheat. This cost is particularly high in the Philippines, where a processing plant has been set up to convert 5 000 kg of fresh sweet potato into flour every day. The bread from this flour will contain more calories and a higher content of vitamin A and lysine than wheat bread and will conserve foreign exchange. If it can be marketed at a reduced cost it may help to improve the nutritional status of the population. Taylor (1982) estimated that cash benefits to farmers producing raw material for this plant could substantially improve with a guaranteed market. Since the market and the financing of the crop are guaranteed, the promotion of sweet potato as a cash crop will be more easily accepted.

Most of the world's starch supplies are derived from grains (corn, sorghum, wheat, and rice), the major root crops (potato, sweet potato, cassava, arrowroot) or the pith of the sago palm. While starches from these various plant sources vary slightly in their physical and chemical properties, they can be substituted for each other across a wide spectrum of end users. Cassava starch must compete with other starches and relative prices, quality and dependability of supplies are basic considerations in the determination of market shares (Goering, 1979).

Cassava tubers can be processed as a source of commercial starch for use in the foodstuff, textile and paper industries. As a foodstuff the starch may be converted by acid and enzyme hydrolysis to dextrins and glucose syrups, but maize starch is often available at a lower price for these purposes. The bland flavour of cassava starch, its low amylose content, non-retrogration tendency and excellent freeze-thaw stability makes it suitable for use in food processing. Simple modification of Cassava starch by cross-bonding, or use of maize starch/cassava blends give properties ideally suited for use in a wide range of convenience foods. Starch from cocoyam has been recommended as a diluents in chemical and drug manufacturing and as a carrier in cosmetics such as face powder. It has a grain size similar to rice starch which is currently used for these purposes. (http://www.faoorg/docrep)

However, Soy sauce yield was not affected by the substitution of wheat flour with root crop flour as carbohydrate source for the fermentation microorganisms. The titratable acidity, pH and NaCl content were not significantly affected by flour substitution while the protein content and amino acid nitrogen of root crop-based soy sauce were lower than that of sauce produced from wheat flour. Sensory evaluation showed that when soy sauce was used in preparing beef steak or as dip for broiled fish, root crop-based soy sauce was comparable to one commercial brand based on general acceptability scores. Cooked sweet potato-based soy sauce was comparable to two commercial brands when served as pure soy sauce based on color, aroma, consistency and flavour. (http://agris.fao.org)

Castillo (Oct. 2011), national scientist and rural sociologist, batted for food security through crop diversification. She said, “People should not only grow rice. They should grow other crops and livestock at the same time.” She particularly mentioned the potentials of camote roots as well as its tender tops as source of a healthy diet. Other rootcrops include camote, taro, cassava, ubi, arrowroot, tugue, singcamas, yacon, potato, curcuma, amorphophallus, karot and other little known species. One of the products with commercial potential if it could be packaged attractively is the Camarind candy produced by Claire Basa of the Mayantoc Rural Improvement Club in Tarlac. This is made of a blend of cooked camote and ripe tamarind flesh used in coating a tamarind seed. It has a nice tamarind flavour with added nutritive value from the camote. The product could become a bestseller with a really attractive packaging. Percival de Villa of Albay presented a semi-processed ready-to-cook frozen sweet potato roots. The cubes are ready for mixing with rice for cooking. This will make it very convenient for those who want to add camote to their rice. They don’t have to peel and slice camote, which could be inconvenient or cumbersome for homemakers who are always rushing. Root and tuber crops are really very versatile. They are made into wine, tea, cakes and pastries, soup, noodle soup, chips, cassava gum, pasta, pearl sago and many others. (http://www.com.mb.ph)

CHAPTER III

METHODOLOGY

This chapter states the Materials and Methods used for the conduct of the study. It explains the procedures that sequently followed. It also illustrates the experimental design, lay out and treatments employed, cites the statistical tools or instrument used to evaluate and analyze the results of the study.

Materials

The materials and tools to be used in the study are as follows: muffin tin, wooden spoon, mixing bowl, utility tray, chopping board, measuring cups, kitchen knife, spatula, weighing scale, measuring spoon, hand towel, apron, record book, basins, shredder, strainer, oven and grinding machine.

Methods

Preparation of Pueawan Flour

The corm of mature puewan flour will be secured. It will be pared, washed and shredded. The shredded corm will be washed again and dried for 15 minutes until it will turn golden brown. This will be set aside to cool, and will be grinded with a grinding machine

Preparation of Muffin

The following recipe will serve as guide in preparing muffin for the study. It will comprise of the ingredients to be used and the procedures in preparing the muffin.

Ingredients:

640 grams all purpose flour

440 grams brown sugar

171 grams eggs

236 grams milk

307 grams butter

13 grams baking powder

Procedure in Preparing Muffin:

A. Baked Muffin
1. Measure and sift all dry ingredients. Set aside.
2. Measure the liquid ingredients. Set aside.
3. Cream the butter to soften. Add milk and sugar gradually creaming after its addition.
4. Add unbeaten eggs. Stir well.
5. Place in mixing bowl; make a well at the center.
6. Place the measured liquid ingredients at the center of the well.
7. Mix thoroughly using the wooden ladle until a smooth mixture is formed. Set aside.
8. Put bi-cups in muffin tin and place the muffin mixture.
9. Bake in a pre-heated oven at 325^{o} F for 20 minutes.
10. Remove the muffin tin from the oven.
11. Let it cool.

B. Steamed Muffin

For steam muffin, the same procedure will be followed as in baking except for the methods of cooking which is steaming.

Procedure in Glazing the Muffins:

The following recipe will serve as guide in preparing glazing for muffin. It will comprise of the ingredients to be used and the procedure to be followed.

Ingredients:

61 grams butter

236 grams milk

300 grams brown sugar

1 gram salt

Procedure:

1. Melt the butter and add the rest of the ingredients.
2. Mix thoroughly using the wooden ladle until it becomes smooth.
3. Brush the glaze on top of the muffin.
4. Let it cool.
5. Ready for serving.

Experimental Design and Lay-out

The study is a factorial experiment in Randomized Complete Block Design (RCBD) with the three replications. (Figure 1.0) The study will have three factors: Factor A, proportion of pueawan flour (A_1 = 100% all purpose flour as control; A_2 – 50% all purpose flour plus 50% pueawan flour; A_3 – 25% all purpose flour plus 75% pueawan flour; A_4 – 100% pueawan flour); Factor B is the glazing method: B_1 (glazed), B_2 (unglazed) and Factor C is the cooking method (C_1 – baking; C_2 – steaming).

Treatment combinations are the following:

T_1 – $A_1B_1C_1$ – 100% APF (Control); glazed; baked

$A_1B_1C_2$ – 100% APF (Control); glazed; steamed

$A_1B_2C_1$ – 100% APF (Control); unglazed; baked

$A_1B_2C_2$ – 100% APF (Control); unglazed; steamed

T_2 – $A_2B_1C_1$ – 50% APF + 50% PF; glazed; baked

$A_2B_1C_2$ – 50% APF + 50% PF; glazed; steamed

$A_2B_2C_1$ – 50% APF + 50% PF; unglazed; baked

$A_2B_2C_2$ – 50% APF + 50% PF; unglazed; steamed

T_3 – $A_3B_1C_1$ – 25% APF + 75% PF; glazed; baked

$A_3B_1C_2$ – 25% APF + 75% PF; glazed; steamed

$A_3B_2C_1$ – 25% APF + 75% PF; unglazed; baked

$A_3B_2C_2$ – 25% APF + 75%PF; unglazed; steamed

T_4 – $A_4B_1C_1$ – 100% PF; glazed; baked

$A_4B_1C_2$ – 100% PF; glazed; steamed

$A_4B_2C_1$ – 100% PF; unglazed; baked

$A_4B_2C_2$ – 100% PF; unglazed; steamed

Experimental Layout

Replication

I	II	III
$A_1B_1C_1$	$A_4B_1C_1$	$A_2B_1C_2$
$A\ _3B_1C_2$	$A_1B_2C_2$	$A_1B_2C_1$
$A_2B_2C_2$	A_3B_1C2	$A_3B\ _2C_2$
$A_1B_2C_2$	$A_1B_1C_1$	$A_1B_1C_2$
$A_3B_2C_1$	$A_4B_2C_1$	$A_3B_1C_1$
$A_2B_2C_1$	$A_3B_2C_1$	$A_2B_1C_1$
$A_4B_2C_1$	$A_2B_2C_1$	$A_4B_1C_2$
$A_3B_1C_1$	$A_4B_2C_2$	$A_2B_2C_2$
$A_4B_1C_1$	$A_2B_2C_2$	$A_4B_2C_2$
$A_2B_1C_2$	$A4B_1C_2$	A_2B2C_1
A_1B2C_1	$A_2B_1C_1$	$A_3B\ _2C_1$
$A_4B_1C_2$	$A_3B_1C_1$	$A4B_2C_1$
$A_1B_1C_2$	$A_1B_1C_2$	$A_1B_1C_1$
$A_2B_1C_1$	$A_3B\ _2C_2$	$A_3B_1C_2$
$A_4B_2C_2$	$A_1B_2C_1$	$A_1B_2C_2$
$A_3B_2C_2$	$A_2B_1C_2$	$A_4B_1C_1$

Figure 3.0 Experimental lay out of the three factor experiment in Randomized Complete Block Design (RCBD)

Legend:

Factor A	Factor B	Factor C
A_1 = 100% APF	B_1 = Glazed	C_1 = Baked
A_2 = 50% APF + 50% PF	B_2 = Unglazed	C_2= Steamed
A_3 = 25% APF + 75% PF		
A_4 = 100% PF		

Where: APF – all purpose flour; PF – Pueawan Flour

Experimental Composition

The experimental composition of the ingredients in the preparation of muffins using different proportions of pueawan flour will be composed of Treatment 1, identified as the control treatment with the following ingredients and corresponding weights: 640 grams all purpose flour (APF), 440 grams brown sugar, 171 grams eggs, 472 grams milk, 307 grams butter and 13 grams baking powder. Treatment 2, 3, and 4 will have the same weights of ingredients except for proportion of APF and pueawan flour (PF). For treatment 2, 320 grams or 50% APF will be used and the remaining 50% or 320 grams PF will be added. For treatment 3, 480 grams or 75% APF will be utilized and 160 grams or 25% will be PF, and lastly for Treatment 4, it will be 100% or 640 grams PF, and no APF will be used for this treatment.

Sensory Evaluation

According to Gatchalian and Brannan (2009), the complexities of commodities require the use of practically all human senses to analyze and/or evaluate them. As such, the tool to be used for analysis must be carefully selected. The evaluators therefore, will be assessed to verify if they are in good health, free of colds, and willing to serve as respondents.

The panelist will be composed of 30 respondents. Fifteen (15) of whom will be faculty members teaching food related courses, and fifteen (15) junior students who are taking BS Home Technology, BS in Hotel and Restaurant and other food-related course, from three campuses of Aklan State University.

To further breakdown the number of respondents, the researcher will get five faculty members and five students from each campus. Ten respondents will come from ASU-College of Industrial Technology – Kalibo Campus, 10 from Makato Campus, and the remaining 10 respondents will be from the Main Campus, Banga, Aklan.

Faculty members and students will be given the chance to become a respondent of the study; they will be assessed to verify if they are in good health, free of colds and willing to serve as evaluators. Their names will be written on a piece of paper and will be placed in separate boxes. The papers will then be drawn to identify who will qualify as respondents. Two extra names will be drawn from each group of respondents, from all campuses, as reserved respondents just in case any of the qualified respondents will not be able to make it on the evaluation day.

The conduct of the study is scheduled on November 12, 13 and 14, 2012.

Data Gathering Procedure

Endorsement letter from the President of Aklan State University will be secured to allow the researcher in tapping respondents from the three (3) campuses of the institution.

All members of the panel will be gathered in one room. They will be assembled to evaluate the product in HT Room 7 at the BSHT Bldg. of the Aklan State University in Banga, Aklan. Prior to the evaluation, a fifteen (15) minutes orientation will be conducted. Matters relevant to the parameters of hedonic will be discussed and explained in detail. Instructions will be given on how to evaluate the muffin in terms of corresponding range of points will be provided to the evaluators.

A scorecard will be used to gather data on the sensory characteristics of muffin. The descriptive testing method will be employed in evaluating the product to characterize and/or compare samples with respect to its specific characteristics. The numbers are not included on the score card so that the evaluators will use the adjective terms rather than numerical score (Penfield and Campbell, 1990).

The products will be evaluated using a five-point hedonic scale, five (5) as the most acceptable criteria and one (1) as the least acceptable. Evaluators will assess the samples as follows:

For Color:

Category	Score	Scale	Description
Very desirable	5	4.5 – 5.00	Golden brown
Desirable	4	3.5 – 4.49	Light golden brown
Moderately desirable	3	2.5 – 3.49	Light brown
Slightly undesirable	2	1.5 – 2.49	Dark brown
Undesirable	1	1.0 – 1.49	Dark Red brown

For Aroma:

Category	Score	Scale	Description
Very desirable	5	4.5 – 5.00	Like extremely
Desirable	4	3.5 – 4.49	Like much
Moderately desirable	3	2.5 – 3.49	Like moderately
Slightly undesirable	2	1.5 – 2.49	Neither like nor dislike
Undesirable	1	1.0 – 1.49	Dislike

For Flavor:

Category	Score	Scale	Description
Very desirable	5	4.5 – 5.00	Very sweet and umami
Desirable	4	3.5 – 4.49	Sweet and umami
Moderately desirable	3	2.5 – 3.49	Moderately sweet and umami
Slightly undesirable	2	1.5 – 2.49	Slightly sweet and umami
Undesirable	1	1.0 – 1.49	Neither sweet nor umami

For Texture:

Category	Score	Scale	Description
Very desirable	5	4.5 – 5.00	Extremely soft and smooth
Desirable	4	3.5 – 4.49	Soft and smooth
Moderately desirable	3	2.5 – 3.49	Moderately soft and smooth
Slightly undesirable	2	1.5 – 2.49	Slightly soft and smooth
Undesirable	1	1.0 – 1.49	Slightly hard and coarse

For General Acceptability:

Category	Score	Scale	Description
Very desirable	5	4.5 – 5.00	Highly acceptable
Desirable	4	3.5 – 4.49	Acceptable
Moderately desirable	3	2.5 – 3.49	Moderately acceptable
Slightly undesirable	2	1.5 – 2.49	Slightly acceptable
Undesirable	1	1.0 – 1.49	Unacceptable

The testing of products will be replicated three (3) times; each replication will be done one day at a time. Time of evaluation will be set from 8:30 to 9:30 in the morning. Evaluators will be requested not to take in between meals prior to evaluation.

Muffin samples will be properly coded and each sample will be placed on a white paper plate. To avoid bias, the samples will be assigned with a random, non-consecutive three-digit numbers. The samples will be presented in random order and the panelists will be asked to rate the product using a descriptive sensory evaluation score sheet. The evaluators will be provided with distilled water to rinse their mouths after tasting each product sample.

After the evaluation, the data that the panelists have reflected on the score cards will be gathered, recorded, tallied, computed, analyzed and will be interpreted.

Statistical Tools and Analysis

The study is a three factor experiment comprising of four treatments with three replications arranged in a Randomized Completely Block Design (RCBD).

To assess the sensory quality of glazed and unglazed muffin with varying proportions of pueawan flour as affected by methods of cooking in terms of color, aroma, flavor, texture and general acceptability, the 5-point hedonic scale will be established.

To determine the significant difference between treatments, the data that will be obtained will be subjected to one-way ANOVA at 5% level of significance. To further test the difference between treatment means, the Least Significant Difference (LSD) will be employed.

Cost Analysis

The cost of production for the treatments will be determined by recording all the expenses incurred. Prices of ingredients will be based on the price of the items as they will be purchased and not on the current price.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter presents the findings obtained from this study. The results are presented both in textual and tabular presentation.

Sensory Evaluation

Color

Table 1 presents the sensory quality of glazed and unglazed muffin with varying proportions of pueawan flour as affected by methods of cooking. As indicated in the table, the highest mean score of 4.50 describe as golden brown was obtained from proportion 100% all purpose flour (APF), glazed and baked while the mean score 4.02 depicted a light golden brown color was recorded in 100% all purpose flour, unglazed and baked. Muffins with 50% APF + 50% PF unglazed, and steamed were found to have a light brown color which is slightly comparable to the standard color of muffins that is golden brown. The lowest mean score of 1.56 described as dark brown was noted in the proportion of 100% pueawan flour (PF), glazed and baked. The standard color of muffins is golden brown but based on the physical characteristics of pueawan flour, the color is dark brown in as much as the pueawan flour has not undergone treatment.

Table 1. Mean Sensory score for color of glazed and unglazed muffin with varying proportions of pueawan flour as affected by methods of

Treatment	Types of Frosting							
	Glazed				Unglazed			
	Methods of Cooking				Methods of Cooking			
	Baked		Steamed		Baked		Steamed	
	Mean	Description	Mean	Description	Mean	Description	Mean	Description
T1 – 100% APF	4.50 g	Golden brown	3.41 e	Light brown	4.02 f	Light golden brown	3.29 e	Light brown
T2 – 50% APF + 50% PF	1.79 a	Dark brown	2.40 c	Dark brown	1.77 a	Dark brown	3.02 d	Light brown
T3 – 25% APF + 75% PF	1.82 a	Dark brown	2.30 bc	Dark brown	1.58 a	Dark brown	2.39 c	Dark brown
T4 – 100% PF	1.56 a	Dark brown	2.22 bc	Dark brown	2.07 b	Dark brown	2.19 bc	Dark brown

Significant at 5% level. Means in column with similar letter superscript are not significantly different from each other.

The analysis of variance using F-test showed that the color of muffins was significantly affected by glazing and methods of cooking. Based on Duncan Multiple Range Test (DMRT) results, the mean score from the proportions were significantly different from each other. This means that the color of muffins prepared in different proportions of pueawan flour changes even with glazed application and varying methods of cooking. This means further that the three factors are dependent of each other in the determination of color muffins.

Table 1.1 Analysis of Variance Table for Color Mean Score

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	35.085 (a)	15	2.339	110.559	.000
Intercept	304.870	1	304.870	14410.380	.000
T	26.829	3	8.943	422.715	.000
F	.020	1	.020	.927	.343
C	.835	1	.835	39.457	.000
T*F	.711	3	.237	11.203	.000
T*C	5.980	3	1.993	94.220	.000
F*C	.117	1	.117	5.531	.025
T*F*C	.593	3	.198	9.350	.000
Error	.677	32	.021		
Total	340.632	48			
Corrected Total	35.762	47			

a R Squared = .981 (Adjusted R Squared = .972)

Aroma

The mean scores for aroma of muffins as influenced by the methods of cooking and glazed concentration are presented in Table 2. The data revealed that the highest mean score of 4.49

Table 2.1 Mean scores for aroma of glazed and unglazed muffin with varying proportions of pueawan flour as affected by methods of

Treatment	Types of Frosting							
	Glazed				Unglazed			
	Methods of Cooking				Methods of Cooking			
	Baked		Steamed		Baked		Steamed	
	Mean	Description	Mean	Description	Mean	Description	Mean	Description
T1 – 100% APF	4.49 f	Like much	3.86 bcd	Like much	3.87 bcd	Like much	3.41 a	Like much
T2 – 50% APF + 50% PF	4.28 ef	Like much	3.98 cde	Like much	3.58 ab	Like much	3.77 abcd	Like much
T3 – 25% APF + 75% PF	3.98 cde	Like much	4.09 de	Like much	3.54 ab	Like much	3.61 abc	Like much
T4 – 100% PF	3.98 cde	Like much	4.08 de	Like much	3.97 cde	Like much	4.00 de	Like much

Significant at 5% level. Means in column with similar letter superscript are not significantly different from each other.

Table 2.1 Analysis of Variance Table for Aroma Mean Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3.429 (a)	15	.299	15.277	.000
Intercept	731.719	1	731.719	48903.520	.000
T	.219	3	.073	4.870	.007
F	1.639	1	1.639	109.547	.000
C	.142	1	.142	9.485	.004
T*F	.476	3	.159	10.598	.000
T*C	.729	3	.243	16.235	.000
F*C	.076	1	.076	5.080	.031
T*F*C	.149	3	.050	3.313	.032
Error	.479	32	.015		
Total	735.627	48			
Corrected Total	3.908	47			

a R Squared = .877 (Adjusted R Squared = .820)

Flavor

The mean sensory score of muffins prepared with varying proportions of pueawan flour and all purpose flour, with glazed concentration, and cooked in two different methods is reflected in Table 3. As indicated the highest mean score of 4.46 was obtained by treatment containing 100% APF, glazed and baked with sweet and umami flavor as rated by the panel of tasters; followed by 100% PF, unglazed and baked and with mean score of 3.73 described as sweet and umami flavor; this was closely followed by the proportion of 100% APF, unglazed and baked with a mean score of 3.60 described as sweet and umami.

Table 3.1 Mean scores for flavor of glazed and unglazed muffin with varying proportions of pueawan flour as affected by methods of cooking

Treatment	**Types of Frosting**							
	Glazed				**Unglazed**			
	Methods of Cooking				**Methods of Cooking**			
	Baked		**Steamed**		**Baked**		**Steamed**	
	Mean	**Description**	**Mean**	**Description**	**Mean**	**Description**	**Mean**	**Description**
T1 – 100% APF	4.46	Sweet and umami	3.57	Sweet and umami	3.60	Sweet and umami	2.84	Moderately sweet & umami
T2 – 50% APF + 50% PF	3.19	Moderately sweet & umami	3.30	Moderately sweet & umami	2.40	Slightly sweet and umami	2.92	Moderately sweet & umami
T3 – 25% APF + 75% PF	2.60	Moderately sweet & umami	3.18	Moderately sweet & umami	2.49	Slightly sweet and umami	2.51	Moderately sweet & umami
T4 – 100% PF	2.81	Moderately sweet & umami	3.51	Sweet and umami	3.73	Sweet and umami	3.10	Moderately sweet & umami

The analysis of variance in Table 3.1 revealed that the flavor of muffins was affected by glazing concentrations and methods of cooking. Duncan Multiple Range Test (DMRT) result further show that the highest mean obtained from treatment containing 100% APF, glazed and baked was different from proportions of 100% PF, unglazed and baked and with mean score of 3.73 and 100% APF, unglazed and baked with a mean score of 3.60 with sweet and umami flavor. This shows that 100% PF, glazed and baked is comparable to 100% APF, glazed and baked and 100% APF, unglazed and baked.

Table 3.1 Analysis of Variance Table for Flavor Mean Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	13.703 (a)	15	.914	69.460	.000
Intercept	472.759	1	472.759	35945.524	.000
T	5.842	3	1.947	148.059	.000
F	1.710	1	1.710	130.023	.000
C	.022	1	.022	1.648	.208
T*F	1.863	3	.621	47.226	.000
T*C	2.561	3	.854	64.912	.000
F*C	.347	1	.347	26.368	.000
T*F*C	1.358	3	.453	34.425	.000
Error	.421	32	.013		
Total	486.883	48			
Corrected Total	14.124	47			

a R Squared = .970 (Adjusted R Squared = .956)

Table 4.1 Mean scores for texture of glazed and unglazed muffin with varying proportions of pueawan flour as affected by methods of cooking

Treatment	Types of Frosting							
	Glazed				Unglazed			
	Methods of Cooking				Methods of Cooking			
	Baked		Steamed		Baked		Steamed	
	Mean	Description	Mean	Description	Mean	Description	Mean	Description
T1 – 100% APF	3.69	Soft & smooth	4.11	Soft & smooth	3.18	Moderately soft & smooth	3.62	Soft & smooth
T2 – 50% APF + 50% PF	2.23	Slightly soft & smooth	3.13	Moderately soft & smooth	2.16	Slightly soft & smooth	3.09	Moderately soft & smooth
T3 – 25% APF + 75% PF	2.12	Slightly soft & smooth	2.94	Moderately soft & smooth	2.17	Slightly soft & smooth	2.51	Moderately soft & smooth
T4 – 100% PF	2.23	Slightly soft & smooth	2.84	Moderately soft & smooth	2.21	Slightly soft & smooth	3.04	Moderately soft & smooth

Table 4.1 Analysis of Variance Table for Texture Mean Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	17.841 (a)	15	1.189	291.278	.000
Intercept	384.710	1	384.710	94214.756	.000
T	11.094	3	3.698	905.601	.000
F	.332	1	.332	81.225	.000
C	5.260	1	5.260	1288.225	.000
T*F	.552	3	.184	45.030	.000
T*C	.395	3	.132	32.235	.000
F*C	.009	1	.009	2.290	.140
T*F*C	.199	3	.066	16.278	.000
Error	.131	32	.004		
Total	402.682	48			
Corrected Total	17.971	47			

a R Squared = .993 (Adjusted R Squared = .989)

Table 5.1 Mean scores for general accepatbility of glazed and unglazed muffin with varying proportions of pueawan flour as affected by methods of cooking

Treatment	Types of Frosting							
	Glazed				Unglazed			
	Methods of Cooking				Methods of Cooking			
	Baked		Steamed		Baked		Steamed	
	Mean	Description	Mean	Description	Mean	Description	Mean	Description
T1 – 100% APF	4.58	Highly acceptable	4.32	Moderately acceptable	4.24	Moderately acceptable	4.06	Moderately acceptable
T2 – 50% APF + 50% PF	3.52	Moderately acceptable	3.80	Moderately acceptable	3.10	Slightly acceptable	3.61	Moderately acceptable
T3 – 25% APF + 75% PF	3.39	Moderately acceptable	3.83	Moderately acceptable	3.23	Slightly acceptable	3.72	Moderately acceptable
T4 – 100% PF	3.58	Moderately acceptable	3.89	Moderately acceptable	3.68	Moderately acceptable	3.60	Moderately acceptable

Table 5.1 Analysis of Variance Table for General Acceptability Mean Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6.995 (a)	15	.466	74.758	.000
Intercept	678.454	1	678.454	108770.24	.000
T	4.899	3	1.633	6	.000
F	.525	1	.525	261.824	.000
C	.422	1	.422	84.170	.000
T*F	.107	3	.036	67.635	.003
T*C	.882	3	.294	5.726	.000
F*C	.000	1	.000	47.115	.800
T*F*C	.159	3	.053	.065	.000
Error	.200	32	.006	8.505	
Total	685.649	48			
Corrected Total	7.194	47			

a R Squared = .972 (Adjusted R Squared = .959)

Sensory Attributes	Methods of Cooking				P-Value	Decision
	Baked		Steamed			
	Mean	Description	Mean	Description		
Color	**2.388**	Light brown	**2.652**	Light brown	p-value = Sig.≈ 0.300 ≤ 0.05	Failed to reject the null hypothesis
Aroma	**3.958**	Like much	**3.850**	Like much	p-value = Sig.≈ 0.300 ≤ 0.05	Failed to reject the null hypothesis
Flavor	**3.159**	Moderately sweet and umami	**3.117**	Moderately sweet and umami	p-value = Sig.≈ 0.792 ≤ 0.05	Failed to reject the null hypothesis
Texture	**2.500**	Moderately soft and smooth	**3.162**	Moderately soft and smooth	p-value = Sig.≈ 0.000 ≤ 0.05	Reject the null hypothesis
General Acceptability	**3.665**	Acceptable	**3.853**	Acceptable	p-value = Sig.≈ 0.097 ≤ 0.05	Failed to reject the null hypothesis

Sensory Attributes	Types of Frosting				P-Value	Decision
	Glazed		Unglazed			
	Mean	Description	Mean	Description		
Color	**2.500**	Light brown	**2.540**	Light brown	p-value = Sig.≈ 0.874 ≤ 0.05	Failed to reject the null hypothesis
Aroma	**4.089**	Like much	**3.719**	Like much	p-value = Sig.≈ 0.000 ≤ 0.05	Reject the null hypothesis
Flavor	**3.327**	Moderately sweet and umami	**2.949**	Moderately sweet and umami	p-value = Sig.≈ 0.015 ≤ 0.05	Reject the null hypothesis
Texture	**2.914**	Moderately soft and smooth	**2.747**	Moderately soft and smooth	p-value = Sig.≈ 0.357 ≤ 0.05	Failed to reject the null hypothesis
General Acceptability	**3.864**	Acceptable	**3.655**	Acceptable	p-value = Sig.≈ 0.063 ≤ 0.05	Failed to reject the null hypothesis

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of the study. Likewise, the conclusions drawn from the findings and recommendations are reflected in this section.

Summary

This study was conducted to assess the sensorial characteristics of muffin prepared with varying proportion of pueawan in terms of color, aroma, flavor, texture and general acceptability as well as the profitability of the resulting product. The effect between the different proportions of pueawan, frosting application, methods of cooking was also determined.

The study was undertaken at ASU-Banga Aklan on November 12-14, 2012. A factorial experiment using RCBD with three replications was used in the study. The sensory evaluation score sheet based on a Five-point hedonic scale was used for evaluating the muffin samples. Thirty (30) panelists were selected to evaluate the sensory attributes of the product. The study consisted of three factors: Factor A (Proportion of pueawan flour: A_1 = 100% APF; A_2= 50% APF + 50% PF ; A_3= 25% APF + 75% PF ; A_4 = 100% PF) , Factor B (B_1 = Glazed ; B_2 = Unglazed) and Factor C (C_1 = Baked; C_2 = Steamed). Analysis of variance (ANOVA) using F-test was employed in the analysis of data. DMRT was used as confirmatory test.

Findings

The findings of the study were as follows:

1. The sensory attributes of muffins with varying proportions of pueawan flour as affected by glazing application differ significantly in terms of aroma and flavor but not in terms of color, texture and general acceptability.
2. The muffin samples containing varying proportions of pueawan flour, namely, Treatment 1 (100% APF), Treatment 2 (50% APF + 50% PF), Treatment 3 (25% APF + 75% PF) and Treatment 4 (100% PF) were not affected significantly by methods of cooking (baking/steaming) in terms of color, aroma, flavor and general acceptability. In addition, the sensorial characteristic of muffin in terms of texture was significantly affected by the methods of cooking.
3. The mean score for the color attribute of glazed and unglazed muffins with varying proportion of pueawan flour as affected by methods of cooking in terms of color differ significantly from each other. In terms of aroma, Treatment 2 (50% APF + 50% PF), glazed and baked was found to be comparable to the control (Treatment 1) containing 100% APF, glazed and baked. For flavor, Treatment 4 (100% PF), unglazed and baked was found to be insignificantly different to Treatment 1(100% APF), glazed and steamed and Treatment 1 (100% APF), unglazed and baked. Moreover, in terms of texture, it was found out that muffin samples containing 100% APF, glazed and baked did not differ significantly from 100% APF, unglazed and steamed. For general acceptability, muffin samples containing 100% APF, glazed and baked was different from all treatment samples. Furthermore, muffin samples containing 100% APF, glazed and steamed did not differ significantly from samples containing 100% APF, unglazed and baked. In addition, muffin samples with 100% PF; glazed; baked and 100% PF; unglazed; steamed were comparable to muffin samples using 50% APF+ 50% PF; glazed; baked and 50% APF+50% PF unglazed; steamed.
4. Among the four treatments of glazed and unglazed muffin, proportion using 100% all purpose flour had the greatest input cost and 100% pueawan flour recorded the cheapest cost of production.

Conclusions

Based on the data gathered during the conduct of the study, the following conclusions were drawn:

1. Application of glazing has an effect on the quality of muffins with varying proportions of pueawan flour in terms of aroma and flavor. On the other hand, glazing application has no effect on the quality of muffins in terms of color, texture and general acceptability.
2. The methods of cooking, either baking or steaming has no effect on the quality of muffins with varying proportions of pueawan flour in terms of color, aroma, flavor and general acceptability but not texture.
3. The inclusion of Pueawan flour in muffin preparation was possible. Generally, in terms of color muffin samples containing pueawan flour were evaluated as having a dark brown color. In terms of aroma, all treatment samples including the control regardless of glazing application and methods of cooking were described as "like much" or desirable. Moreover, in terms of flavor, among the muffin samples, the control which used 100% all purpose flour (glazed; baked and steamed; unglazed and baked) and 100% pueawan flour (glazed and steamed) were evaluated as having a "sweet and umami" flavor. Furthermore, for texture, muffin samples using 100% APF (glazed, baked and steamed; unglazed and steamed). Also, the inclusion of 50%, 75% and 100% pueawan flour in the preparation of muffin yield a slightly soft and smooth product when it is baked regardless glazing application. However, when it is steamed, the resulting product gave a "moderately soft and smooth" muffin. With regards to general acceptability, muffin samples using 100% all purpose flour, glazed and baked were perceived by panel of tasters as highly acceptable and the rest of the proportions except muffin products containing 50% and 75% pueawan flour, unglazed unglazed baked were evaluated as moderately acceptable or moderately desirable.
4. The inclusion of pueawan flour in the preparation of muffin decrease the cost of production by 9.50% for Treatment 3 (50% PF), 14.25% for Treatment 3 (75% PF) and 19.0% for Treatment 4 (100% PF).

Recommendations

In view of the conclusions drawn, the following are the recommendations:

1. Conduct further studies on the following:
   - Exploration on other products that can be processed using pueawan flour.
   - Development of premix product by incorporating pueawan flour to other ingredients in the preparation of muffin.
   - Studies on different packaging materials/ techniques and storage conditions which can help lengthen the shelf life of pueawan muffin and conduct further analysis for the presence of vitamins and minerals in the product.
2. The experimental products can be subjected to proximate and specific nutrient analyses to determine their actual nutrient contribution.
3. Muffin products with pueawan flour can be subjected to glycemic index analyses to determine their health and wellness benefits particularly for nutrition-related lifestyle diseases like diabetes and android obesity.

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