The formulation of sweet potato (*Ipomoea batatas*) bread

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ABSTRACT

This research aimed to formulate a sweet potato (*Ipomoea batatas*) bread enhanced with mashed sweet potato as to yeast bread. This utilized the experimental method of research employing the three treatment formulation that is: Treatment 1 (T₁) containing 175 g of mashed sweet potato with other ingredients; Treatment 2 (T₂) containing 250 g of mashed sweet potato with other ingredients and Treatment 3 (T₃) containing 350 g of sweet potato with other ingredients. This research employed the experimental method in which questionnaires and score cards were given to ten (10) bakers, ten (10) T.L.E. Teachers and twenty (20) consumers for sensory evaluation and the sweet potato bread was subjected to general acceptability. It was found out that the sensory analysis of sweet potato bread in terms of taste, Treatment 3 (T₃) was the most acceptable with the weighted mean of 5.0, described as highly palatable; in terms of appearance, Treatment 3 (T₃) was the most acceptable with the weighted mean of 4.78 described as most pleasant; in terms of color, T₃ was the most acceptable with the weighted mean of 4.93 described as golden brown and in terms of aroma, T₃ was the most acceptable with the weighted mean of 4.88 described as excellent. Based on the findings, it could be concluded that Treatment 3 (T₃) that contains 350 g of mashed sweet potato and 500 g all-purpose flour was the ideal formulation for sweet potato bread.

Key words: Sweet potato, bread, product innovation, experimental research, instruction guide.

INTRODUCTION

Some countries having advanced economies and also progressive countries have persuasive business in terms of baked products. Baked products businesses hand over conditionally to the people especially in products related to bread. Most families depend on the use of these economic goods such as bread; thus, the industry of baking prospers having a demand that is large and reliable.

The baking industry has propagated and flourished due to the increasing needs of this product especially the bread. The population from the Philippines demands the bakery products thus, it provides bigger working chances in central management and in bakeries. Bread is one of the many baked products that bakers can produce. There is a great number of the world’s regions and as a firm component of many traditional cuisines, “the staff of life” is widely regarded as untouchable thus, this is so called as the bread.

One of the various factors which renew consumers’ interest in baked goods is predicted to be the continuous innovation by companies. The upshot is that if bread makers want their product to regain its standing as a healthy food, they need to diversify their offering in a more unconventional manner than ever before. It is no longer enough to slightly lessen the level of salt, add a few whole grains and/or a dash of fiber, or develop a gluten-free version, what provides a solution on several fronts is the incorporation of vegetables. Most importantly, it helps to zap those pesky carbohydrates, while at the same time upping the fiber content. The most common strategy employed by individuals wanting to reduce their
carbohydrate intake is to replace the traditional carbohydrate component of a meal, such as rice, potatoes or pasta, either wholly or partly with vegetables.

These diversities of Veggie breads if publicize to the consumer as a healthy and comfortable practice of eating will surely benefit them due to its nutritive value. Moreover, these will help the Philippine farming industry and also assist the economy. Philippines, in the first place is an agricultural country with insular geographical location and ideal tropical climate blessed with lots of vegetables. This country is also rich with staple crops such as ube, taro, cassava and sweet potato “camote”. These root crops are perceived to be good suppliers of dietary fiber, vitamins and minerals. The potential of root crops in the baking industry is bright in view of the favorable climatic and soil conditions. They are high in minerals, vitamins and also fiber, and as they provide plenty of bulk filling, which makes them the dieter’s prime ally. In the country, the most important crop is the Sweet Potato (Ipomoea batatas) locally known as “camote”.

To Anero (2015) “Today’s lifestyle has changed along the way, from food production to food consumption. This shift is drifted by time. Time demands make people prefer instant foods available in food chains and other establishments, bringing little concern about the foods’ nutritional value. In effect, it increases more cases of malnutrition, which is one of the major problems in the Philippines today. The small consumption of vegetables can take its toll on one’s health. People who do not eat enough vegetables can suffer from micronutrient malnutrition or lack of the essential vitamins needed to function.

Oftentimes the existence of micronutrient malnutrition is undetermined. It can only be seen in the long run as the body deteriorates. Vegetable consumption should be practiced according to the FNRI because they are a perfect addition to the Filipino diet. Based on the institute’s Pinggang Pinoy, a daily meal guide for adult Filipinos, one healthy meal should have 33% vegetables to provide the proper amount of nutrients.

It is a fact that most children like to eat junk foods. Therefore, mothers are challenged to improve their menu for the family so that nutrients needed by the individual members of the family should be provided to have a healthy lifestyle.

Bread can be regarded as a snack or a substitute food for any meal. It contains carbohydrates that can satisfy the hunger of an individual. Due to the reason that bread contains too high carbs, or has too much wheat, too much gluten or too much salt, some consumers try to lessen their bread intake, but, there is reinvention of this kind of bread which brings it into the line of the latest consumer preferences. These are demonstrated by bakers who create breads integrated with vegetables thus, this study is conducted.

The Food and Nutrition Research Institute (FNRI) of the Department of Science and Technology (DOST) has come up with a visual tool to guide Filipinos in consuming the right amount of food in every meal. The visual guide called Pinggang Pinoy answers the question of how much you should eat in one meal in order to be healthy. It also serve as a quick and easy guide for determining how much to eat per meal time. For the parents, they must improve the recipe for their families and must encourage their children to eat nutritious foods like fish and vegetables. It is a fact that vegetables have essential food nutrients just like fish and meat.

Good mental and physical health can only be achieved through good nutrition. Eating a balanced diet is a significant part of good health for everybody. The way you feel and how your body works depends on the kind and amount of food you eat.

Today’s industry has a variation of most delicious bread and pastries to please both the palate and the eyes. Here in the Philippines, this baking industry flourished from an undersized manufacturing to an outsized, known baking enterprise.

This study is anchored on the Presidential Decree (PD) No. 491 series of 1974, acknowledged as the Philippine Nutrition Act of the Philippines. This act is responsible for the planning and monitoring of nutritional status. According to a recent survey by the Food and Nutrition Research Institute (FNRI) of the Department of Science and Technology (DOST), the Philippine chronic malnutrition rate among children aged 0 to 2 was at 26.2%, the highest in 10 years. (http://www.rappler.com/move-ph/issues/hunger/130046-phillipines-chronic-malnutrition).

This simply illustrates that malnutrition retards not only the mental development of the children but also the physical aspect. Nearly prone to malnutrition are the young children, pregnant women and lactating mothers.

One of those which collaborates the NCC by implementing orders and memoandra in order to address this serious problem is the Department of Education (DepEd). This mandate acknowledges the significance of good nutrition and indirectly improves the learners’ academic performance in school. Thus, it is considered to be a good investment in education as it is associated with repetition reduction, decrease drop out or truancy, increased enrolment, improved attendance and most of all better performance in school. One of which is the DO 34, s. 2015 - Revisions to DepEd Order No. 33, s. 2015 (Implementation of the School-Based Feeding Program (SBFP) for School Year (SY) 2015 to 2016), which addresses the needs of public school children in terms of nutritional problem and short term hunger.

In order to address the cases of malnutrition, the School-Based Feeding Program is implemented. It is an efficient and important mediation which helps in battling habitual craving for food at the same time diminishing disparity and deficiency. It furnishes hot meals to the children.
securing a standardized recipe with the integration of any vegetable rich in vitamins and minerals.

For the implementation of these programs, public elementary and secondary schools nationwide are encouraged to enjoin. To avoid commodity burnout a diversity of vegetables from the garden produce is added in the menu. These are the reasons that schools are encouraged to establish vegetable gardens to serve as food baskets and have a prepared source of vegetable in schools. The problem of malnutrition among school children may be addressed by the Gulayun sa Paaralan project which serves as the main source of commodities to sustain supplementary feeding.

Moreover, in lieu with DepEd Order No. 14, s. 2005, school children should be advised to buy food, water and beverages only at the school canteen and be discouraged from going out of the campus. Food items for sale at the canteen should include natural or fortified food products that are rich in protein, energy, vitamins and minerals like root crops, rice and corn products in native preparations, fruits and vegetables in season and fortified foods bearing the “Sangkap Pinoy” seal. Beverages shall be limited to milk, shakes and juices prepared from fresh fruits and vegetables. School administrators should encourage parents through PTCA, to prepare packed snacks for their children to eat during recess time under the supervision of the class adviser. With this end, parents and teachers can ensure that children intake only nutritious, healthy and clean snacks.

Aside from helping end hunger and malnutrition, the Bureau of Agricultural Research (BAR) said that indigenous vegetables can help alleviate poverty among farmers. The planting of indigenous vegetables in convenient areas such as backyard gardens or family farms can be a great source of additional income. This alternative livelihood opportunity can increase the resources of impoverished households and may, in fact, help them crush poverty.

Sweet potato is considered to be a good tuberous plant which develops best in various cultivations. It has many varieties with skin colors from almost white to brown with shades of pink, copper, magenta and purple. Even the flesh colors vary from light yellow to pink, red and orange. It is the healthiest vegetable around, even the carrot can beat it and it would take 23 cups of broccoli to equal the benefits of one cup of sweet potato. Moreover, it has more fiber than a similar portion of oatmeal (Monahan and Joan, 2004).

Sweet potato is regarded as a vegetable. According to Rimando (2004), vegetables are “crops usually grown for culinary purposes”. Vegetables as crops are categorized into crucifers, root, pulses, leafy, cucurbits and solanaceous vegetables. These vegetables belong to either botanical or edible family. Therefore, sweet potato belongs to the family of root and bulb crops.

Moreover, vegetables can be categorized as edible or botanical. This category can be classified as: plants that are supplier with roots which are edible, this is so called the root vegetables with beets as common example. The second category is the stem vegetable that are supplier of botanical edible stems that are sometimes not mature yet juicy. Its common example is the rhizomes, corn and bamboo shoot. The next category is a plant that is a supplier of leaves that can be eaten and this is the so-called leafy vegetables.

Sweet potato is locally called “camote” with varieties of colors such as red, purple, yellow pink, beige, orange and white. They are great sources of manganese, micronutrients and vitamins B1, B3 and B6.

Among these significant crops such as rice, maize, cassava and barley that can be located in Nigeria, sweet potato ranks seven. It initiates a substantial source of carotene. Its production rose from 2.52 million metric tonnes in 2006 to 3.40 million metric tonnes in 2007 (Scrinivas, 2009). It can be grown three times a year and has a high yield potential, high nutritional value, resistance to production stress, environmentally friendly with diverse food forms among others (Ikewelle et al., 2001 and Kays, 2004).

The crop moved up from the minor status to a highly desirable position of being the fourth most important root and tuber crop in Nigeria after yam, cassava and cocoyam. It is a significant food crop in Nigeria that is valuable in the diet of rural crop rural poor in the tropics (Odebode, 2004). It is attractive to farmers and households due to its high nutritive value and performance under resource-poor condition (Njoku, 2007).

Sweet potato is a bulky and highly perishable root crop, hence, the most economical way to deal with this challenge is through adding value to the crop by processing it into different product forms such as sweet potato flour, sparri, sweet potato bread and sweet potato chips that will further initiate income to the farmers, increase consumers’ consumption and acceptability and also increases the shelf life of the crop. Therefore, processed sweet potato products through value addition that is targeted at all income groups would break the image of sweet potato as a poor man’s food. This root crop can be boiled, fried or roasted and can be innovated in different forms. In the semi-arid zone, its flour is commonly utilized for sweetening local food and beverages (kunu and burukutu) while in the urban markets of the humid south, the fried chips are developed and marketed as snacks (Odebode, 2004). They are a nutritional powerhouse which are ideal for cutting carbohydrates, losing weight, bulking up and building muscles. Aside from a taste like dessert, they also provide some surprising health benefits. There are many nutrient categories responsible for the health benefits of this underappreciated tuber. Among these categories are antioxidants, anti-inflammatory nutrients, and blood sugar-regulating nutrients (Emmanuel and Garry, 2014).

One of the vitamins that sweet potato is rich with is vitamin C. This vitamin which is present in Sweet potato aids to move away viruses, flu and cold. Moreover, this
significant vitamin has a crucial part in digestion, formation of teeth, bones and blood cells. This aids fast healing of wounds, produces collagen that aids and sustains skin’s youthful and glowing looks. Sweet potato that is rich in vitamin safeguards our immune system against poisonous substances which might be associated to cancer. It is also a source of Vitamin B₆ which aids our bodies to lessen the presence of chemical homocysteine.

Baking is a method of cooking food that uses prolonged dry heat, normally in an oven, but also in hot ashes or on hot stones. The most common baked item is bread but many other types of foods are baked (Anders, 2004). Heat is gradually transferred from the surface of cakes, cookies and breads to their center. As heat travels through it transforms batters and doughs into baked goods with a firm dry crust and a softer center.

The art of baking remains a fundamental skill and is important for nutrition, as baked goods especially breads, are a common but important food, both from an economic and cultural point of view. A person who prepares baked goods as a profession is called a baker.

The dry heat of baking changes the form of starches in the food and causes its outer surfaces to brown, giving it an attractive appearance and taste. The baking process does not require any fat to be used to cook in an oven. When baking, consideration must be given to the amount of fat that is contained in the food item. Baking needs an enclosed space for heating – typically in an oven. The fuel can be supplied by wood, coal, gas or electricity. Adding and removing item from an oven may be done by hand with an oven mitt or by a peel, a long handled tool specifically used for that purpose. Bakery products yield appetizing goods with eye-appeal and mouth-watering aromas. A wide range of savory and sweet foods can be produced. Baking ovens have effective manual or automatic controls. There is straightforward access for loading and removal of items.

Objectives of the study

The objectives of this study are to show greater awareness among bakers, home- makers, food processors, and entrepreneurs on the use of cheap but nutritious sweet potato in bread. Secondly, to provide a step- by- step procedures on how to prepare bread using sweet potato during cooking demonstrations in extension activities; introduce the importance of utilizing sweet potato flour in bakery products; and appreciate the role of baking using indigenous materials and its economic significance to the community.

MATERIALS AND METHODS

Research design

The study employed the experimental method of research to find out whether innovation in the process of making Sweet potato (I. batatas) bread using sweet potato produced a better quality with respect to its taste, appearance, color, aroma, and general acceptability of the product. With the aid of the identified sensory evaluation, thorough evaluation is done focusing specifically on possible changes in taste, appearance, color, aroma and general acceptability.

The descriptive method is used in the interpretation of the data and findings of the study reflecting the sensory analysis and acceptability the sensory analysis and acceptability levels of the product. The experiment covered a period of one month which started July, 2016. This study consists of the basic recipe of Sweet potato (I. batatas) bread using All Purpose Flour and mashed Sweet Potato.

Detailed procedure

The systems Approach of Input–Process–Output was used as the general procedure in the experiment. The input box contained the three (3) treatment formulations of sweet potato flour (I. batatas) and all-purpose flour in different levels. All of these recipe formulations were subjected to sensory evaluation for the acceptability level of the enhanced product. Analysis of Variance (ANOVA) was utilized to find out if the there were significant differences among the three (3) levels of formulations. To come up with the most acceptable output of the sweet potato bread, the outputs were subjected to two groups of evaluators namely, ten (10) trained TLE teachers, ten (10) Bakers and twenty (20) MAVED students represented as the consumer panelists. Analysis of Variance (ANOVA) was used to determine if there were significant differences among the varying levels of formulations of the improved recipe.

The laboratory environment

Specifically, this study focused at the Cebu Technological University–Main Campus located at M.J. Cuenco Avenue St., and R. Palma St., Cebu City. The experiments made by the researcher as well as the testing and evaluation made by the respondents were performed in the Graduate School Food Laboratory. The latter is located at the third floor of the Graduate Schools’ classrooms. It is equipped with tools and equipment needed in performing the experiment. Like any other laboratory activity, bread making needs important basic utensils to perform. It involved the following: measuring cup, measuring spoon, mixing bowls, sifter, wooden mixing spoon, rubber scrapper, rolling pin and noodle/pasta maker.

The three (3) treatments were formulated with the different levels of mashed sweet potato and all purpose flour. The basic ingredient used in the making of the bread
is the all purpose flour. Product innovation was applied to be able to create an innovative product coming from the available sources at the market stand. The following were the modified formulations. Treatment 0 was considered as the control composed of the following ingredients: (500 g all purpose flour, 1 teaspoon salt, 6 tablespoon sugar, 3 tablespoon yeast, ¾ cup shortening, 2 pieces eggs, 1 cup water). Treatment 1 composed of the following ingredients: 500 g all purpose flour, 175 g mashed sweet potato, 1 teaspoon salt, 6 tablespoon sugar, 3 tablespoon yeast, ¾ cup shortening, 2 pieces eggs, 1 cup water. The ratio was in the equilibrium to measure its strength. Treatment 2 had the following ingredients such as: 500 g all purpose flour, 250 g mashed sweet potato, 1 teaspoon salt, 6 tablespoon sugar, 3 tablespoon yeast, ¾ cup shortening, 2 pieces eggs, 1 cup water. The results showed that the dough was smooth and elastic. Breads are made soft and smooth but with its effectiveness on the different method of cooking. Treatment 3 had the following ingredients: 500 g all purpose flour, 350 g mashed sweet potato, 1 teaspoon salt, 6 tablespoon sugar, 3 tablespoon yeast, ¾ cup shortening, 2 pieces eggs and 1 cup water. This formulation was highly recommended according to the results presented. It showed that the higher composition of the mashed sweet potato creates very smooth, tasty and elastic properties. Allotted time preparation for the different formulations took about 0 to 1 h per treatment. Food testing and evaluation was made after cooking. With the responses made from the respondents, the researcher was able to make sweet potato bread.

Statistical analysis

The data gathered from the results of the sensory evaluation as perceived from the panelists were treated statistically using average weighted mean, in order to determine the mean scores from the formulations. Analysis of Variance (ANOVA) was used to determine the significant mean differences between each formulation that were subjected to P-value and F-critical value.

RESULTS AND DISCUSSION

In order to encourage students, as consumer panelists in developing awareness for the basic tastes such as sweet, sour, salt and bitter, they were given test questionnaires to fill. Likewise, they were encouraged to discriminate between formulations.

Results on taste

Each of the panelists given is exposed to different formulations to determine the taste of the recipe. The treatment formulations for sweet potato bread is made through mixing all its ingredients (T₁ to T₃), which varies only in the amount of mashed sweet potato + all purpose flour added to other ingredients are held constant. Figure 1 shows the results of the descriptive test of the respondents on taste, Treatment 3 350 g mashed sweet potato and 500 g all purpose flour had the highest

![Figure 1: Taste attribute of the treatments.](image-url)
weighted mean of 8.3 with verbal description of "like extremely" from the panelists. This was followed by T₂ and T₁ with the weighted mean of 5.0, and 3.97 respectively. It revealed that the T₃ formulation was approved by the panelists considering the levels of concentration per ingredients. It increased their interest in eating out and the quality of food. It implied that respondents appreciated more of the nutritive value of the product. Based on the Shepherd's Model of Frewer and Risvik (Rimando, 2004) what we choose to eat is based upon on three main factors: (1) the food itself and its nutrient content regulate hunger; (2) the person and his sensory perception of the food in combination with personality, previous experiences, mood, etc and (3) economic and social factors such as choice, brand and attitudes toward other health factors.

Results on appearance

Figure 2 shows the results of the descriptive test as perceived by the panelists on appearance; it revealed that T₁ and T₂ formulation had a mean score of 5.3 and 5.8 respectively, described as they “Neither Like or Dislike”; T₃, with 500 g all purpose flour and 350 g mashed sweet potato had a mean score of 8.83 which had a “like
extremely” rating. The nutritional content of sweet potato (*I. batatas*) aids in the appearance of the formulated recipe. With the appearance the food product made of all purpose flour and mashed sweet potato, it produced a smooth and elastic appearance. It was subjected to different cooking methods to test the fineness of the product.

**Results on color**

The data revealed that the color acceptability of sweet potato bread becomes more appealing to the panelists when the dough are prepared by mixing 500 g all purpose flour with 350 g mashed sweet potato. The Treatment 3 is more accepted when the dough is smooth and elastic with an average weighted mean of 4.05, Treatment 1 was with the verbal description of Dislike Slightly, Treatment 2 with the weighted mean of 5.95 and verbal description of Like Slightly, while Treatment 3 has a 8.7 weighted mean with the verbal of Like Extremely in the given scale.

**Results on aroma**

The aroma of sweet potato bread with different treatment formulation Treatment 1 was described as Dislike Moderately with the weighted mean of 4.35, Treatment 2 obtained the average weighted mean of 5.65 described as Like Slightly, while Treatment 3 that has 500 g all purpose
flour and 350 g mashed sweet potato obtained the highest weighted mean of 8.08 described as Like Very Much.

**Descriptive test on the general acceptability**

The most acceptable treatment formulation is the mixture of Treatment 3 which had a 500 g all purpose flour and 350 g mashed sweet potato. Color, taste, appearance, color, and aroma with the average weighted mean of 5.0, 4.78, 4.93 and 4.88. The average weighted mean of this treatment is 4.69 or like extremely.

**Conclusion**

Based on the findings of the study, mashed sweet potato was tested to be a good ingredient in making bread production. The mixture of 350 g mashed sweet potato and 500 g all purpose flour was derived as the most acceptable treatment formulation.

**RECOMMENDATION**

It is recommended that sweet potato bread must be formulated using 350 g mashed sweet potato and 500 g all purpose flour for the bread. It is also highly recommended that techno-guides in this study be used as a guide to everyone like those who engage in extension work to prepare nutritious bread.

**REFERENCES**


DepEd Memorandum (2014). School-Based Feeding Program. 37.


Grant V. Gardner B (2003). Select markets for taro, sweet potato and yam, A Report for the Rural Industries Research and Development Corporation RIRDC. Publication No. 03/052 RIRDC project no. UCQ-13A.


Jaime Bender I (2015). A great way to eat your veggies: Turn them into bread.

Kristiansen Kate (2014). I love Me Some Sweet Potato , Canada.


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