

Acceptability of Food Products from Sweet Sorghum *Sorghum bicolor* L.Moench Grain Developed at Pampanga Agricultural College, Philippines

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Abstract— A total of twenty five sweet sorghum products were developed from the sweet sorghum grain at Pampanga Agricultural College, Magalang, Pampanga, Philippines. This products were grouped into soups and porridges (8 recipes); snacks and native delicacies (9 recipes), meals (8 recipes) and sorghum flour (2 recipes). In general, the sweet sorghum food products developed are “Like very much” in terms of taste and appearance but Moderately Like in terms of texture. Since the “pattern recipe” are popular the result of acceptability is high in terms of appearance and taste, however, the comment on texture is that there is a little rough or gritty taste and sometimes there is the presence of plastic like particles. As to level of acceptability, the food sorghum food products developed in this study were “Like very much” in terms of appearance, taste and over all acceptability but are “Moderately like” in terms of texture.

Keywords— sweet sorghum grain, sensory characteristics, acceptability, food processing

I. INTRODUCTION

The sweet sorghum (*Sorghum bicolor* L Moench) plant has been around Southern Africa for three thousand years and now in the 21st century it is tagged as the plant of the future. Amazing indeed because it has trilogy of function, namely; as bio-fuel, as animal feed and as human food.

The versatility of sweet sorghum resulted in Prof. Li Dajue (of the Chinese Academy of Sciences) and Peter Griffie (FAO) coining the name the "Four F's Crop" for sweet sorghum in 1997 at the first International Sweet Sorghum Conference. The "Four Fs" represent the four potential outputs from sweet sorghum, namely: Food, Fuel, Fodder, & Fiber [1].

In many parts of the world sorghum has traditionally been used in food products and various food items; porridge, unleavened bread, cookies, cakes, couscous and malted beverages are made from this versatile grain. Traditional food preparation of sorghum is quite varied. Boiled sorghums are one of the simplest uses and small, corneous grains are normally desired for this type of food product. The whole grain may be ground into flour or decorticated

before grinding to produce either a fine particle product or flour, which is then used in various traditional foods [2].

Sorghum has unique properties that make it well suited for food uses. Some sorghum varieties are rich in antioxidants and all sorghum varieties are gluten-free, an attractive alternative for wheat allergy sufferers [3].

Since its re-introduction to the Philippines via ICRISAT thru identified SUC's and selected DA-BAR satellites throughout the nation, herein are the food products produced; From other State Colleges and Universities in the Philippines, Isabela State University (ISU) and Mariano Marcos State University (MMSU) also have some sweet sorghum food products. At ISU their food products from sweet sorghum are as follows; Jam for pandesal, sweetener for binalay, organic vinegar, “basi” wine, toppings for ice cream and pop sorghum, polboron, chocolate cookies, muffin cake, banana cake, pineapple upside-down cake and syrup. Other notes they have for the sweet sorghum food products are as follows; Fine tuning of processing technologies on food and other by-products; Using of mother vinegar to hasten acidity and native guava leaves as flavour during fermentation; Using okra fruits to aid in removing scum for syrup making; employing fruit wine making to attain clean sorghum “basi”

wine while using syrup as sweetener and flavour to reduce the cost in adding sugar; Using 50:50 flour composites (sorghum and wheat) for bread and cookies; replacing 50-75% of the sugar with syrup as sweetener for “binalay” and 100% syrup as jam for pandesal; Fine tuning of processing technologies on food and other by-products; Using of mother vinegar to hasten acidity and native guava leaves as flavour during fermentation.

MMSU have vinegar and pandesal made from sweet sorghum. The Department of Agriculture Region 5 thru its BIARC station have also some food products from sweet sorghum; to wit: Puto Pao; Sorghum drop cookies; Chocolate chip cookies; Sorghum brownies; Sorghum battercakes; Sorghum noodles; Sorghum custard; Brewed grains (coffee-like); Sweet sorghum sauce; Sorghum polvoron; Sorghum peanut brittle; Sorghum catsup; Puffed sorghum and Sweet sorghum molasses [4].

Most traditional processing techniques are laborious, monotonous and carried out by hand. They are almost entirely left for women to do. To some extent, the methods that are used have been developed to make traditional foods to suit local tastes and are appropriate for these purposes. Traditional techniques that are commonly used include decorticating (usually by pounding followed by winnowing or sometimes sifting), malting, fermentation, roasting, flaking and grinding. These methods are mostly labour intensive and give a poor-quality product. Sorghum and millets would probably be more widely used if processing were improved and if sufficient good-quality flour were made available to meet the demand [5].

PAC is one of the identified SUC's wherein sweet sorghum was introduced in 2006, primary as a source of alternative fuel. The production of sweet sorghum was explored given the geographic location vis a vis some varietal trials and its other agronomic properties. But and since PAC is located in the acclaim locale of the Culinary Centre of the Philippines, we had us well included in our research work load on the aspect of sweet sorghum as human food. For fuel, the focus is on the juice extracted from the stalk of the sweet sorghum plant. Now, what will happen with the grain? The grains are now left for reproduction and for food. In this aspect, there is no competition for juice to fuel and for the grain to food. Each specific part of the sorghum plant has an identified role to play in its trilogy of function.

It is the general objective of this study to determine the acceptability of the develop food products from the sweet sorghum grain. Specifically, the objectives of the study are ; to develop procedure on how to prepare the sorghum grain for cooking recipes; and determine the acceptability of each sorghum food product develop .

II. METHODOLOGY

A. Conceptual Framework

This study was guided by the conceptual framework that uses the input-process-output approach. Using the input-process-output approach, this study limits itself to the utilization of sweet sorghum grain and sweet sorghum juice for food utilization for the inputs. The processes includes identification of food processing techniques and some popular Filipino recipes (as pattern in making sweet

sorghum based foods recipes. The output are the identified sweet sorghum based recipes that are acceptable and do-able at household level. (Figure 1)

B. Materials and Methods

Since it is the first time that the researcher was introduced to the sorghum grain, the logical action done was to read existing literature and interview people with previous knowledge on it. There were no persons to interview within PAC environs on the utilization of sweet sorghum grain for food and literature on steps how to process sorghum plant for food consumption vary for each locale or country.

The preparation of the sorghum grain for food utilization into specific recipe is a study by itself. The following page shows the step wise procedure for the processing of sorghum grain at household level.

The flow chart on the utilization of sweet sorghum grain for different food products is as follows. The steps include; (a) selection and preparation of the sweet sorghum grain for food processing as prescribed in the CODEX Standards (6), (b) soaking of sweet sorghum grain for 48 hours (c.1) dry milling the soaked grain, (c.2) wet milling the soaked grain.

Both milling step makes use of the household blender only. (c.3) the soaked grain are steam until grains are “sprouted” as in mungbean, (d) identification of specific recipe ,(e) testing the identified recipe with sorghum grain , (f) sensory evaluation follows.

In step c.1, the next step was drying, pounding, sieving and packaging. The end product is sweet sorghum powder/flour. This flour was tested in making cookies and butter cake.

In step c.2, the product produced here was called sweet sorghum batter. This mixture was tested in making different native delicacies popular in the locality.

In step c.3, the product produced was tested with popular viand and snack recipes in the locality.

The sweet sorghum grain utilized for the study were obtained and produced at ALIAS- Alternative Low Input Agricultural Center of Pampanga Agricultural College, Magalang, Pampanga, Philippines.

C. Research Design

This study made use of experimental and descriptive method of research.

D. Sensory Evaluation

After identification of the recipe to guide the study, sensory evaluation on the kitchen level , followed by semi-trained panelist and consumer level sensory testing. The respondents on the kitchen level testing was the researcher and her students, for the semi-trained were Third and Fourth Year BSHE major in food processing student and Faculty members of the IHST-PAC and for the consumer level panelist, the PAC community and those who are viewers of exhibits were the products were put on display. Sensory cards were constructed per recipe/procedure.

E. Score card

A sensory card was constructed for the purpose of the study. For descriptive rating, the panelist were given the direction of evaluating the specific sweet sorghum food

products according to a 5 point Hedonic Scale of Like Very Much to Dislike Very Much. As for rating score the panelist were given the choice from Excellent to Needs Improvement to describe each product.

The sensory parameters considered were appearance, texture, taste and over all acceptability.

F. Statistical Analysis

Constructed sensory cards for the purpose of the study were decoded and analyzed using ANOVA Level of significance was at 1 and 5% level of significance. Relationship of over all acceptability and the other sensory parameters was also analyzed using Pearson product moment of correlation. Shown in Table 1 are the different treatments in the study per sweet sorghum products produced.

TABLE I
THE TREATMENTS OF THE STUDY PER SWEET SORGHUM FOOD PRODUCTS

Sweet sorghum food product	Treatments
Sweet sorghum in salty taste	Tr 1 = addition of salt and msg Tr 2 = addition of ginisa mix Tr 3 = addition of dried shrimps (hibe)
Sweet sorghum in sweet taste	Tr 1 = added brown sugar Tr 2 = added brown sugar then rolled in sesame seeds Tr 3 = added brown sugar and condensed milk then rolled in sesame seeds
Sweet sorghum native delicacies	Factor A: sweet sorghum native cake Sample 1 = sweet sorghum cake (original) Sample 2 = sweet sorghum squash native cake Factor B : Kind of flour used Tr 1 = Rice flour Tr 2 = Glutinous flour Tr 3 = Cassava flour
Sweet sorghum suman	Factor A: Variants for the sweet sorghum suman Sample1= sweet sorghum suman in original variant Sample2 = Sweet sorghum suman in choco variant Factor B: Kinds of flour Flour 1 = Cassava flour Flour 2 = Rice flour Flour 3 = All purpose flour
Sorghum vinegar	Tr 1 = no added mother vinegar for mother vinegar Tr 2 = use of sugar cane vinegar for mother vinegar Tr 3 = use of palm vinegar for mother vinegar

G. Other Recipes

For the other recipes such as porridges, soups and dishes, popular Philippines recipe were identified based on the nearness of the raw material to sorghum grain and its preparation and final product. Plain replacement was done in whole or in parts of the basic raw material.

III. RESULTS AND DISCUSSION

Herein in this section of the study are the results of the experiments done and their discussion.

There are a total of twenty five (25) food products from sweet sorghum grain developed at Pampanga Agricultural College, Magalang, Pampanga, Nineteen 79.17% were processed using the wet method, and 20.83% were processed using the steam cooking method and 4.16% processed using the dry milling method.

The sorghum food products developed in the study were group into three category as follows; soups and porridges (32.00%), native delicacies (36.00%), meals (28.00%) and 4.00% for flour.

Following is the chart showing the different sweet sorghum food products developed in the study tracing the steps from the grain to the specific end product. (Figure 1).

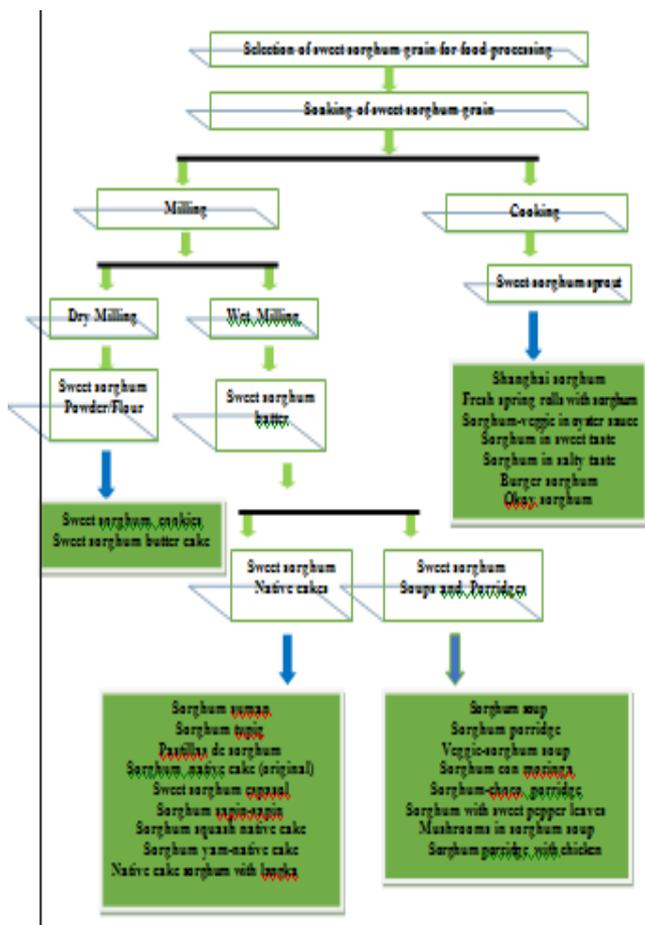


Fig. 1. Flow chart in processing of sweet sorghum grain into some popular Filipino food recipes

Following are some photos of the sweet sorghum food products developed in the study;



Fig. 2 Photo showing the shorghum soups and porridges



Fig. 3 Photo showing the shorghum soups and porridges



Fig. 3 Photo showing the okoy sorghum and sorghum burger



Fig. 4. Photo showing the different sorghum native cake

A. On sweet sorghum in salty and sweet taste

For the comparion among treatment means on the utilization of sweet sorghum grain for salty and sweet taste food products.

Treatment 2 for both salty and sweet taste sweet sorghum food products had the highest treatment mean. Treatment 2 which is addition of ginisa mix for salty taste and addition of brown sugar and rolling in sesame seeds for sweet taste had the Excellent sensory attributes.

In testing sorghum in salty and sweet taste, it was found out that sorghum in sweet taste is preferred and like very much by the respondents. Sorghum in sweet taste is associated with moche, one Filipino popular delicacy. However, sorghum in salty taste is preferred and like much by the male respondents because according to them it is a good appetizer for their “drinking session.

B. On sweet sorghum native cake

In making sweet sorghum native cake, Treatments 1 and treatment 2 are statistically the same. Cassava flour having the highest mean is the best for sweet sorghum cake for the sensory parameter of appearance.

C. On sweet sorghum suman

There is no significant relationship between over all acceptability and the other sensory parameter of appearance, texture and taste on the combination of cassava flour and without latik (T1) and in two variants .

In choco variant suman there are more high significant relationship between over all acceptability and the other sensory parameter of appearance , texture and taste. Also, rice flour and all purpose flour is the kind of flour used where high significant relationship is present.

D. On Sorghum Flour

In dry milling the 48 hours soaked sorghum grain followed by either oven or sun and sieving, the sweet sorghum flour is produced. As to appearance using microscope the sweet sorghum flour is brownish in color whereas the sweet sorghum flour dried in oven is reddish orange in color. According to the PAC chemist, the red orange in color maybe attributed to the oil content of the sorghum that was treated to high temperature during drying process. The color of the sorghum flour using sun drying method is similar to the color of commercially available flour. The color of the flour comes in different radiance of the brown color. In terms of color radiance and grain quality, sorghum flour is similar to glutinous rice flour and all purpose flour. As to texture, the sorghum flour using oven drying is the one that is the same as that of cake flour, cassava flour and corn starch. Initial experiment in making drop cookies and butter cake showed that at 50 to 75% combination with corn starch/rice flour and cassava powder, an acceptable product is produced.

The cookies and butter cake produced from the sorghum flour developed in the study were Like Very Much in all sensory parameters , however, the products become “oily” and no longer appealing and palatable to consumers. This is not present in commercially available flour.

E. Acceptability

As to over all acceptability, the soups and porridges and given rating of Like Very Much in all sensory parameters. In the meals category only sweet sorghum in salty taste was given rating of Moderately Like all the rest were given rating of Like Very Much. For snacks and native delicacies, pastillas de sorghum and sweet sorghum espasol were given rating of Like Very Much. All the rest were given rating of Moderately Like.

The cookies and butter cake using sorghum flour were given rating of Neither Like nor Dislike.

IV. CONCLUSIONS

A total of twenty five sweet sorghum products were developed from the sweet sorghum grain at Pampanga Agricultural College, Magalang, Pampanga, Philippines. This products were grouped into soups and porridgeges (8 recipes); snacks and native delicacies (9 recipes) , meals (8 recipes) and sorghum flour (2 recipes). In general, the sweet sorghum food products developed are “Like very much “ in terms of taste and appearance but Moderately Like in terms of texture. Since the “pattern recipe” are popular the result of acceptability is high in terms of appearance and taste, however, the comment on texture is that there is a little rough or gritty taste and sometimes there is the presence of plastic like particles. Since, the equipment used in the study were for household use, the problem on texture maybe solve if the blade for grinding and blending will more finer and soaking mixture of organic in nature may be identified to soften the cover of the grain or separate it all together before grinding. Also, maintaining the warmness of the sweet sorghum food may minimized the problem on texture.

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