

Development and Sensorial Evaluation of Cookies from Selected Root Crops Flour



Jaimee M. Saladino

College of Education, Isabela State University Ilagan Campus, Philippines

ABSTRACT: The research focused on the development and sensorial evaluation of cookies using local root crops flour like cassava flour, potato flour, sweet potato flour and yam flour which are in the area widely available. This product development research included two major phases: (1) development of root crops flour, (2) making cookies with root crops flour as main ingredients. The evaluators consisted of children, adolescents, adults and experts. Results of the study revealed that on sample 1, described by the respondents as "highly acceptable" from cassava flour, sweet potato flour and yam flour. In contrast, the evaluators found the potato flour-based cookies to be "moderately acceptable." While sample 2 and 3, all cookies described by the respondents "highly acceptable". On the general acceptability of the different sample of root crops flour among varied age groups, the cassava cookies were on top followed by sweet potato cookies and yam cookies. The least was the potato cookies which was the grand mean of 4.55 though it was rated "highly accepted". But as evaluated by the evaluators, in the overall acceptability, significant difference is evident of cookies made with root crop flour in the four (four) criteria: appearance, aroma, taste, and texture. Moreover, more baked products should be made to determine the acceptability of root crops flour as main ingredients. Finally, research of this kind may be conducted to enrich the finding of the study.

KEYWORDS: Cassava flour, cookies, potato flour, sensorial evaluation, sweet potato flour, yam flour

INTRODUCTION

Cookies, often known as biscuits, are a common food that are eaten all over the world. In fact, in the majority of the world's regions, it is the greatest category of snack foods. Due to their abundance in fat, protein, and carbohydrates, cookies not only give you energy but are also a wonderful source of minerals. A common variety of cookie is the butter cookie. These cookies are made with butter, flour, and sugar. They classify into the "crisp cookie" due to their distinct texture, which is mainly due to the high butter and sugar content. Additionally, butter cookies, which are among the most basic varieties of cookies due to their lack of flavoring, are sometimes flavored with vanilla extract, desiccated coconut and chocolate or cocoa powder. Wheat flour is the primary ingredient of cookies. Given the high price, geographic scarcity, and high demand for wheat flour, efforts have been made to provide a locally available alternative source of wheat flour, which is the flour from root crops (cassava, potato, sweet potato and yam).

On the other hand, local climate conditions in tropical nations like the Philippines are unsuitable for productive wheat farming. The Philippines has therefore been totally dependent on imported wheat for its baking needs. The cost of importing wheat is high for importing nations. Since natural disasters sometimes wipe out wheat crops and because many farmers are starting to switch from cultivating wheat to "more lucrative" root crops that may be used to make flour, there is a pressing need to produce a suitable substitute for wheat. Flour having superior nutritional qualities to wheat would be widely desired in the search for a wheat alternative, especially in underdeveloped nations where malnutrition is common.

Cassava is the most important root crop and a substantial source of energy in tropical regions. It has a high calorific content related to most costly root crops. (Okigbo, 1980).

¹Potato on the other hand, it is the fourth-ranked significant food crop in the world (*Solanum tuberosum* L.) and is a staple diet for about half the world's population. It is essentially low in calories and a powerful antioxidant as well.

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Additionally, sweet potato (*Ipomoea batatas* (L.)) is one of the most important and underutilized root crops in the entire world. It is frequently referred to as poverty relief crops, food security crops, or subsistence crops. They are a vital supply of starch and other essential carbohydrates for humans, as well as a major source of protein for many cultures throughout the world (Srivastava et al., 2012).

Lastly, yam (*Discorea rotundata*) the majority of the yam plant is a tuber, which is turned into flour and used to make paste. Its chemical makeup, which includes alkaloids of saponin and sapogenin, is what accounts for its medical use as a cardiac stimulant (IITA, 2009). Yam often have a lower glycemic index than foods like potato products provide a more sustained form of energy and greater defense against diabetes and obesity. They additionally guard the body against heart disease and osteoporosis (Davidson, 1999).

The investigation was therefore carried out against this context. With root crop flour as a replacement for wheat flour, cookie products are intended to be developed. Hopefully, this will lessen our over reliance on wheat and the expensive cost of importing wheat. It will promote the consumption of inexpensive, locally available root crops that offer a variety of nutritional and health benefits. Furthermore, it would encourage people to cultivate root crops like yam, sweet potato, cassava, and potatoes.

METHODS

The finished products were subjected to sensory evaluation. One hundred twenty (120) evaluators among varied age group were purposely selected and properly oriented on what and how to evaluate the products using the score card depicting the sample code. Residents of barangay Malalam in Ilagan City, Isabela, first-year students majoring in Food and Service Management (FSM), Food Technology Teachers Isabela State University, Ilagan campus, and selected bakeries of City of Ilagan are among the people involved in the evaluation.

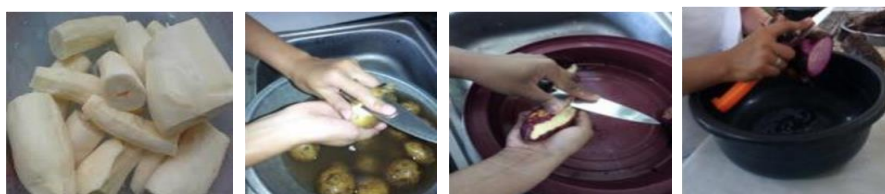
A score sheet that used a qualitative analytic method to evaluate the cookie products for data collection tool. Using a five-point Likert scale, responses were gathered regarding the degree to which the cookie products made from the various root crops (cassava, potato, sweet potato, and yam) were acceptable in terms of outcome appearance, crunchy texture, smell and taste. The results are summarized below:

Numerical Rating	Descriptive Rating
4.50-5.0	Highly Acceptable
3.50-4.49	Moderately Acceptable
2.50-3.49	Acceptable
1.50-2.49	Slightly Acceptable
1.00-1.49	Not Acceptable

PRODUCT DEVELOPMENT

A. Preparation of Root Crops Flour

1. Wash the major ingredients, peel and re - wash the tubers (cassava).



2. Place the peeled in a basin of clean water. Slice the tubers and arrange them on drying trays in a uniform thickness.



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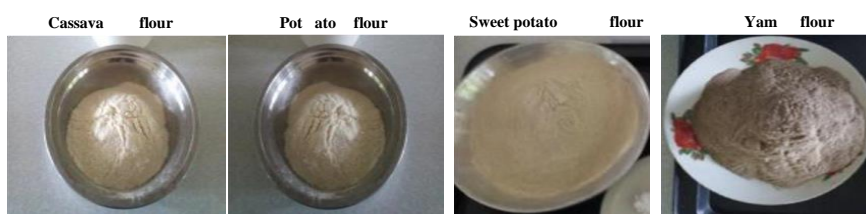
3. Place the drying trays direct to the sunlight. Continue drying the tuber slices until they snap cleanly and crisply. Allow the tuber slices to cool.



4. Grind the dried tuber slices into flour then sift to remove the coarse particles.



5. Store in clean, dry, airtight container.



B. Preparation of Cookie Products from the different Root Crops Flour

Ingredients:

- 2 cups root crops flour (cassava, potato, sweet potato and yam)
- 1 bar butter
- 1 cup. Sugar
- 1 whole egg
- 1 teaspoon cream of tartar
- 1 teaspoon vanilla

Procedure:

1. Cream shortening and together until smooth consistency.



2. Put whole egg, cream well.

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3. Sift together the dry ingredients (flour, cream of tartar, and baking soda) into the mixture.



4. Mix well, adding the vanilla with the last few stirs.



5. Press from the cookie press onto ungreased cookie sheet.



6. Bake at 370°F in a preheated oven until Fifteen (15) minutes until golden brown.



Cassava cookies



Potato cookies



Sweet potato cookies



Yam cookies

RESULTS

Table 1. Cookies with two (2) cups of Cassava Flour

Age Group	Mean	Qualitative Description
Children	4.78	Highly Accepted
Adolescents	4.88	Highly Accepted
Experts	4.50	Highly Accepted
Adults	4.93	Highly Accepted
Mean	4.77	Highly Accepted

It is shown above with two cups of cassava flour in cookies was appreciated by evaluators in different age groups. The overall mean of 4.77 indicates that all age groups thought the cookies to be highly acceptable or very satisfactory. This can be attributable to the cookies' excellent flavor. The expert group, on the other hand, was the least accepting because they thought the texture of the cookies made them break easily.

Table 2. Cookies with 2 ½ cups of Cassava Flour

Age Group	Mean	Qualitative Description
Children	4.75	Highly Accepted
Adolescents	4.83	Highly Accepted
Experts	4.51	Highly Accepted
Adults	4.88	Highly Accepted
Mean	4.74	Highly Accepted

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In shown above, all age groups gave a rating of "highly accepted" in the level of acceptability of cookies with 2 ½ cups of cassava flour as indicated by the total mean of 4.74. The group of adults rated the cassava cookies with the highest mean of 4.88 while the group of experts rated the cassava cookies 4.51 which is the lowest mean. But, rated highly acceptable it implies that the evaluators accept very much the cookies using 2 ½ cups of cassava flour.

Table 3. Cookies with three (3) Cups of Cassava Flour

Age Group	Mean	Qualitative Description
Children	4.83	Highly Accepted
Adolescents	4.80	Highly Accepted
Experts	4.68	Highly Accepted
Adults	4.81	Highly Accepted
Mean	4.78	Highly Accepted

Table 3 indicates that all age groups of raters gave the cookies made with three cups of cassava flour the same acceptance rating of outstanding. Out of the four age groups, the adult group awarded the cookies the highest mean rating (4.81), though. The lowest rating from the experts, a mean of 4.68, was given to the cookies. However, a rating of highly satisfactory denotes that the group of reviewers found the cookies made with 3 cups of cassava flour to be very delicious. It gives the overall mean of 4.78.

Table 4. Cookies with two (2) cups of Potato

Age Group	Mean	Qualitative Description
Children	4.60	Highly Accepted
Adolescents	4.36	Moderately Accepted
Experts	4.26	Moderately Accepted
Adults	4.76	Highly Accepted
Mean	4.49	Moderately Accepted

Acceptability level of cookies made with two cups of potato flour. The overall evaluation was "moderately satisfactory," with ratings of "very accepted" coming from two age groups (children and adults) and "moderately accepted" (4.49) from the other two (adolescents and experts).

Table 5. Cookies with 2 ½ Cups of Potato Flour

Age Group	Mean	Qualitative Description
Children	4.76	Highly Accepted
Adolescents	4.65	Highly Accepted
Experts	4.26	Moderately Accepted
Adults	4.69	Highly Accepted
Mean	4.59	Highly Accepted

The three of the age groups of evaluators namely, children, adolescents, and adults rated the cookies with 2 ½ cups of potato flour "highly acceptable" while experts rated it "moderately acceptable". It is evident from the table that among the groups of evaluators, only the experts found the cookies using 3 cups of flour "moderately acceptable".

Generally, the product was rated highly acceptable. It is implied that the group of children with the highest mean of 4.76 found the cookies delicious. However, the group of experts gave the lowest mean (4.26) because the cookies using 2 ½ cups of potato flour has unpleasant flavour. With a grand mean of 4.59, the overall rating was "very acceptable".

Table 6. Cookies with three Cups of Potato Flour

Age Group	Mean	Qualitative Description
Children	4.63	Highly Accepted
Adolescents	4.57	Highly Accepted
Experts	4.47	Moderately accepted
Adults	4.67	Highly Accepted
Mean	4.58	Highly Accepted

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It shows on table 6 that three (3) age groups, namely children, adolescents, and adults rated cookies with three cups of potato flour "highly acceptable". Meanwhile, the group of experts gave a rating of "moderately acceptable". This indicates that the evaluated potato cookie was highly accepted by the group of adults with the mean of 4.67. It implies that the group of adults accept very much the finished products. However, the group of experts rated the potato cookies moderately acceptable which is the lowest mean of 4.47. This means that the finished products did not catch the eyes, smell, taste and gentle touch of the respondents. With a grand mean of 4.58, the overall rating for the sample was "very acceptable."

Table 7. Cookies with two (2) Cups of Sweet Potato Flour

Age Group	Mean	Qualitative Description
Children	4.71	Highly Accepted
Adolescents	4.67	Highly Accepted
Experts	4.45	Moderately Accepted
Adults	4.80	Highly Accepted
Mean	4.66	Highly Accepted

It shown on table that cookies with two cups of sweet potato flour were found "highly acceptable" by the evaluators from the age groups of children, adolescents and adults while the cookies were rated "moderately acceptable" by experts.

It is revealed that the four age groups, adults rated the cookies with the highest mean of 4.80 because they found the cookies very pleasing and very palatable. However, the group of experts obtained the lowest mean of 4.45 because the cookies are tough in texture. The grand mean for the overall rating was 4.66, which is considered to be "very acceptable."

Table 8. Cookies with 2 ½ Cups of Sweet Potato Flour

Age Group	Mean	Qualitative Description
Children	4.80	Highly Accepted
Adolescents	4.59	Highly Accepted
Experts	4.37	Moderately accepted
Adults	4.77	Highly Accepted
Mean	4.63	Highly Accepted

It is evident on the table that the three age groups, namely children, adolescents, and adults approved of cookies with 2 ½ cups of sweet potato flour, having rated it "highly acceptable" while the group of experts "moderately acceptable". It implies that the group of experts found the evaluated cookies just below ordinary compared to the other group of evaluators probably because they found the texture of the cookies tough and not crumbly. However, with a mean score of 4.63, it was still considered to be "very satisfactory".

Table 9. Cookies with 3 Cups of sweet Potato Flour

Age Group	Mean	Qualitative Description
Children	4.59	Highly Accepted
Adolescents	4.54	Highly Accepted
Experts	4.27	Moderately accepted
Adults	4.66	Highly Accepted
Mean	4.51	Highly Accepted

Revealed on the table were three age groups, namely children, adolescents, and adults found cookies with 3 cups of sweet potato flour "highly acceptable" while the group of experts rated it "moderately acceptable". It implies that the three groups of evaluators namely, children, adolescents and adults liked very much the cookies while the group of experts somehow accepted it because of its texture which was tough. The sample obtained as "highly accepted" with grand mean of 4.51.

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Table 10. Cookies with two (2) Cups of Yam Flour

Age Group	Mean	Qualitative Description
Children	4.74	Highly Accepted
Adolescents	4.70	Highly Accepted
Experts	4.41	Moderately accepted
Adults	4.81	Highly Accepted
Mean	4.66	Highly Accepted

Cookies made with two cups of yam flour were rated "very acceptable" by the age groups of children, adolescents, and adults and "moderately acceptable" by the group of experts, as can be seen on the table. It signifies that the expert group gave the cookies a slightly below average rating because they thought the cookies were slightly bitter, however the groups of children, adolescents, and adults found the cookies to be acceptable. This sample's grand mean of 4.66 was "very satisfactory."

Table 11. Cookies with 2 ½ Cups of Yam Flour

Age Group	Mean	Qualitative Description
Children	4.75	Highly Accepted
Adolescents	4.67	Highly Accepted
Experts	4.36	Moderately accepted
Adults	4.75	Highly Accepted
Mean	4.63	Highly Accepted

In table 11 indicates that while the experts' group gave the cookies with 2 ½ cups of yam flour a "moderately acceptable" rating, the age groups of children, adolescents, and adults gave them a "very satisfactory" rating. It is indicated that the groups of children, adolescents, and adults found the cookies as delicately crisp.

On the contrary, the group of experts rated the cookies below average because they found the cookies bitter. With a grand mean of 4.63, having the sample is evaluated as "very satisfactory".

Table 12. Cookies with 3 Cups of Yam Flour Sample 3

Age Group	Mean	Qualitative Description
Children	4.69	Highly Accepted
Adolescents	4.63	Highly Accepted
Experts	4.35	Moderately accepted
Adults	4.73	Highly Accepted
Mean	4.60	Highly Accepted

It shown above the rating of "very acceptable" was given by evaluators from the age groups of children, adolescents, and adults for the cookies made using three cups of yam flour. Meanwhile, experts group rated it "Moderately acceptable".

It is implied that the groups of children, adolescents, and adults found the cookies easily cut but not crumbly or tough. The group of experts rated the cookies just below average because they found the cookies bitter as compared to the first two recipes of yam cookies. The grand mean of 4.66 made the sample attain an evaluation remark of "highly acceptable".

A. Analysis of the Difference of Level of General Acceptability of Cookies Across Different Age Groups

Table 13. Multiple Comparisons of Sample 1

Age Group	Age Group	Mean Difference	Sig.	Remark
Children	Adolescents	-.10833	.738	NS
	Experts	.27500	.052	NS
	Adults	-.15000	.495	NS
Adolescents	Children	.10833	.738	NS
	Experts	.38333*	.003	**

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	Adults	-.04167	.979	NS
Experts	Children	-.27500	.052	NS
	Adolescents	-.38333*	.003	**
	Adults	-.42500*	.001	**
Adults	Children	.15000	.495	NS
	Adolescents	.04167	.979	NS
	Experts	.42500*	.001	**
Legend: NS = Not Significant alpha = .05 * = Significant ** = Highly Significant				

As shown in the table above, the difference between following pairs of age groups is “highly significant”: 1) adolescents and food experts; and 2) adults and food experts. This means that the cookies with two cups of cassava flour are more highly acceptable to both the adolescents (M=4.88) and the adults (M=4.93), than to the experts (M=4.50).

Table 14. Multiple Comparisons of Sample 2

Age Group	Age Group	Mean Difference	Sig.	Remark
Children	Adolescents	-.07500	.893	NS
	Experts	.24167	.107	NS
	Adults	-.12500	.639	NS
Adolescents	Children	.07500	.893	NS
	Experts	.31667*	.017	*
	Adults	-.05000	.96 5	NS
Experts	Children	-.24167	.10 7	NS
	Adolescents	-.31667*	.017	*
	Adults	-.36667*	.004	**
Adults	Children	.12500	.639	NS
	Adolescents	.05000	.96 5	NS
	Experts	.36667*	.004	**
Legend: NS = Not Significant alpha = .05 * = Significant ** = Highly Significant				

In Table 14 above, a highly significant difference was observed between adults and experts, and there is a considerable difference in the level of acceptability between teenagers and experts. This means that the cookies with 2 ½ cups of cassava flour are more acceptable to adults (M=4.88) and adolescents (M=4.83) than to experts (M=4.51).

Table 15. Multiple Comparisons of Sample 1

Age Group	Age Group	Mean Difference	Sig.	Remark
Children	Adolescents	.24	.366	NS
	Experts	.34	.103	NS
	Adults	-.16	.710	NS
Adolescents	Children	-.24	.366	NS
	Experts	.10	.907	NS
	Adults	-.40*	.040	*
Experts	Children	-.34	.103	NS
	Adolescents	-.10	.907	NS
	Adults	-.50*	.006	**

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Adults	Children	.158	.710	NS
	Adolescents	.40*	.040	*
	Experts	.50*	.006	**
*. At the 0.05 level, the mean difference is significant.				

Table 15 above indicates a highly significant difference between adults and experts and a significant difference in the level of acceptability between adolescents and adults. This indicates that the cookies with two cups of potato flour are more acceptable to adults (M=4.76) and adolescents (M=4.36) than to experts (M=4.26). This means thus that adults and adolescents like the cookies with two cups of potato flour than the experts.

Table 16. Multiple Comparisons of Sample 2

Age Group	Age Group	Mean Difference	Sig.	Remark
Children	Adolescents	.11	.79	NS
	Experts	.50*	.00	**
	Adults	.07	.94	NS
Adolescents	Children	-.11	.79	NS
	Experts	.39*	.00	**
	Adults	-.04	.98	NS
Experts	Children	-.50*	.00	**
	Adolescents	-.39*	.00	**
	Adults	-.43*	.00	**
Adults	Children	-.07	.94	NS
	Adolescents	.04	.98	NS
	Experts	.43*	.00	**
*. At the 0.05 level, the mean difference is significant.				

The level of acceptability differs significantly between these age groups when they are paired with experts:

(1) children and experts; (2) adolescents and experts; and (3) adults and experts (see Table 18 above). This means that the cookies with 2 ½ cups of potato flour are more acceptable to children (M=4.76), adults (M=4.69) and adolescents (M=4.65) than to experts (M=4.26).

Table 17. Multiple Comparisons of Sample 1

Age Group	Age Group	Mean Difference	Sig.	Remark
Children	Adolescents	.04	.985	NS
	Experts	.26	.138	NS
	Adults	-.09	.868	NS
Adolescents	Children	-.04	.985	NS
	Experts	.22	.269	NS
	Adults	-.133	.678	NS
Experts	Children	-.26	.138	NS
	Adolescents	-.22	.269	NS
	Adults	-.35*	.020	*
Adults	Children	.09	.868	NS
	Adolescents	.13333	.678	NS
	Experts	.35000*	.020	*
*. The 0.05 level of significance for the mean difference.				

The level of acceptability between group of experts and adults differs significantly, as seen in Table17 above. It reveals highly significant difference in the level of acceptability between these pairs of age groups: (1) children and experts, and (2) adults and experts. This means that the cookies with 2 ½ cups of sweet potato flour are more acceptable to both children (M=4.80) and adults (M=4.77) than to experts (M=4.37).

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Table 18. Multiple Comparisons of Sample 2

Age Group	Age Group	Mean Difference	Sig.	Remark
Children	Adolesce	.21	.093	NS
	Experts	.43*	.000	**
	Adults	.03	.982	NS
Adolescents	Children	-.21	.093	NS
	Experts	.23	.060	NS
	Adults	-.18	.204	NS
Experts	Children	-.43*	.000	**
	Adolescents	-.23	.060	NS
	Adults	-.40*	.000	**
Adults	Children	-.03	.982	NS
	Adolescent s	.18	.204	NS
	Experts	.40*	.000	**

*. The 0.05 level of significance for the mean difference.

Table 18 above indicates a significantly significant difference between these age group: (1) children and experts, and (2) adults and experts in terms of acceptability. This means that the cookies with 2.5 cups of sweet potato flour are more acceptable to both children (M=4.80) and adults (M=4.77) than to experts (M=4.37).

Table 19 Multiple Comparisons of Sample 3

Age Group	Age Group	Mean Difference	Sig.	Remark
Children	Adolescents	.05	.967	NS
	Experts	.33*	.017	*
	Adults	-.07	.927	NS
Adolescents	Children	-.05	.967	NS
	Experts	.28	.060	NS
	Adults	-.12	.705	NS
Experts	Children	-.33*	.017	*
	Adolescents	-.28	.060	NS
	Adults	-.39*	.003	**
Adults	Children	.07	.927	NS
	Adolescents	.12	.705	NS
	Experts	.39*	.003	**

*. The 0.05 level of significance for the mean difference.

Children and experts' levels of acceptance differ significantly from one another, as seen in Table 19 above, whereas adults and experts' levels of acceptability differ significantly from one another.

This would mean that the cookies with 3 cups of sweet potato flour are more acceptable to adults (M=4.66) and children (M=4.59) than to experts (M=4.27). Adults and children like the cookies more than the experts.

Table 20. Multiple Comparisons of Sample 1

Age Group	Age Group	Mean Differenc e	Sig.	Remark
Children	Adolescents	.04	.990	NS
	Experts	.33	.069	NS
	Adults	-.067	.960	NS
Adolescents	Children	-.042	.990	NS
	Experts	.29	.139	NS
	Adults	-.11	.852	NS
Experts	Children	-.33	.069	NS
	Adolescents	-.29	.139	NS

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	Adults	-.40*	.019	*
Adults	Children	.07	.960	NS
	Adolescents	.11	.852	NS
	Experts	.40*	.019	*
*. The 0.05 level of significance for the mean difference.				

The level of acceptability between adults and experts differs significantly, as seen in Table 20 above. This would imply that adults (M=4.81) would find the two cups of yam flour in the cookies to be more appealing than experts (M=4.41).

Table 21. Multiple Comparisons of Sample 2

Age Group	Age Group	Mean Difference	Sig.	Remark
Children	Adolescents	.08333	.838	NS
	Experts	.39167*	.001	**
	Adults	.00000	1.000	NS
Adolescents	Children	-.08333	.838	NS
	Experts	.30833*	.013	*
	Adults	-.08333	.838	NS
Experts	Children	-.39167*	.001	**
	Adolescents	-.30833*	.013	*
	Adults	-.39167*	.001	**
Adults	Children	.00000	1.000	NS
	Adolescents	.08333	.838	NS
	Experts	.39167*	.001	**
*. The 0.05 level of significance for the mean difference.				

Table 21 above shows a highly significant between adolescents and experts and a highly significant difference between children and experts and adults and experts. This would indicate that the cookies with 2 ½ cups of yam flour are more acceptable both to adults and children (M=4.75) and adolescents (M=4.67) than to experts (M=4.36).

Table 22. Multiple Comparisons of Sample 3

Age Group	Age Group	Mean Difference	Sig.	Remark
Children	Adolescents	.06	.931	NS
	Experts	.34*	.003	**
	Adults	-.04	.973	NS
Adolescents	Children	-.06	.931	NS
	Experts	.28*	.022	*
	Adults	-.10	.732	NS
Experts	Children	-.34*	.003	**
	Adolescents	-.28*	.022	*
	Adults	-.38*	.001	**
Adults	Children	.04	.973	NS
	Adolescents	.10	.732	NS
	Experts	.38*	.001	**

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*. The 0.05 level of significance for the mean difference.

Legend:

Note: ** = Highly Significant;

NS = Not Significant

* = Significant;

Table 22 above reveals significant difference among adolescents and experts and a high significant difference between children and experts and adults and experts. This denotes that the cookies with three cups of yam flour are more acceptable to adults (M=4.73), children (M=4.69) and adolescents (4.63) than to experts (M=4.35).

Shelf – life of the cookies in normal temperature.

After having produced root crops flour and cookie products, the following were observed:

A. The following were observed in the preparation of cookie flour using root crops:

The cookie flour namely: cassava flour, potato flour, sweet potato flour and yam flour put in an air tight container. The same observation was made regarding the cookie flour after one month of storage as it was during the first week. Particularly noticeable was the presence of weevils in the flour after six months.

B. The following were observed in the preparation of cookies using the different root crops flour at normal temperature:

1. After baking, the cookies using the different root crops flour has a delicious taste, delightful aroma and perfect size and texture.
2. But in the five days, the cookie products are slightly delicious. Its aroma decreases. Also, its appearance is slightly appealing, and the texture is not crumbly.
3. In the seventh day there is sign of spoilage and molds are seen on top of the cookie products. The crispness of the cookie products decreases. Therefore, the shelf – life of cookies products using the different root crops flour lasted for five (5) to seven (7) days in normal temperature.

CONCLUSION AND FUTURE WORKS

Based on the study's findings, it can be concluded that all four local root crops—cassava, potato, sweet potato, and yam—are very suitable for use as an ingredient of cookie products. The color, texture, aroma, and taste of cookie products made using cassava flour, potato flour, sweet potato flour, and yam flour varied greatly from one another. The color of the cookies made with yam and cassava flour is superior to that of the cookies made with potato and sweet potato flour. Similar to how sweet potato flour and potato flour have different textures, to cassava and yam flour. Additionally, the taste of cookies made with cassava flour was distinct from that of the three other local root crops. It is possible to enhance or improve the quality of cookie products by using flour made from locally grown root crops.

Such studies could be used to determine how to make cookies using sweet potato flour more tender and to minimize the bitterness of those made with yam flour. To determine the best and most appropriate packaging for the root crops flour and the cookies made with it, more research may be done. It was recommended that you consume the cookie items made with root crops flour not later than five days in order to get the best taste, aroma, appearance, and texture.

ETHICAL CONSIDERATIONS

To ensure that the researchers perform their duties effectively. The research was conducted with consideration for all parties concerned, including the participants and anyone else who might be interested.

The research methodology had an impact on the measures that were taken, which were carried out in accordance with the policies and guidelines of the university where the panelist was involved.

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