

# UTILIZATION OF DRIED KULITIS (AMARANTH) LEAVES FOR VARIED FOOD PRODUCTS

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**Abstract:** Drying is a mass transfer process consisting of the removal of water or another solvent by evaporation from a solid, semi-solid, or liquid. This process is often used as a final production step before selling or packaging products. Dried *Kulitis* leaves can be used as tea, use for cereal, and cookies too. This study determined the extent of the utilization of dried *kulitis* (*Amaranthus spinosus*) leaves for varied food products. The products were evaluated as to sensory qualities and acceptability in terms of appearance, aroma, taste, and texture. Significant differences in the sensory qualities and acceptability were also determined. Microbial and proximate analysis of the best treatment and the shelf-life were also studied. The study used the Experimental-Developmental method of research using a Completely Randomized Design (CRD). It was conducted in three (3) products with different treatments with three trials. The sensory qualities were evaluated by ten (10) semi-trained panelists and the acceptability of the products were evaluated by seventy (70) consumers. Scorecards with the Nine (9) Points Hedonic Scale was used to obtain the data. The mean and Analysis of variance (ANOVA) were used to analyze the data into alpha level set at a 0.01. The sensory qualities of the varied food products with dried *kulitis* leaves were evaluated by semi-trained panelists with three (3) different treatments. *Kulitis* tea with a combination of lemon and ginger for Product A got a very much clear and sparkling, very much pleasant, very much delicious, and very much smooth in terms of appearance, aroma, taste, and texture. *Kulitis* bar cookies with sweet potato for product B got very much appealing, extremely pleasant, extremely delicious, and very much crisp. *Kulitis* cereal with sweet potato for product C got a very much appealing, extremely pleasant, extremely delicious, and extremely soft and intact as evaluated by semi-trained panelists. The consumers' acceptability of varied food products with dried *kulitis* leaves considering the sensory qualities that all the products of dried *kulitis* leaves were Liked Very Much as evaluated by seventy (70) consumers, however, product C (*Kulitis* bar cookies) got the highest result in all quality attributes. There was no significant difference found in the sensory and consumers' acceptability of varied food products with dried *kulitis* leaves among the three treatments. Shelf-life of the varied food products with dried *kulitis* leaves when stored at room temperature could last for 2 weeks with no changes in the sensory attributes when sealed completely. Likewise, the microbial analysis of the best treatment of cereal flakes with dried *kulitis* got a result of Aerobic Plate Count <250 cfu/g sample, Total Coliform Count <1.8 MPN/g sample, and Molds and Yeast Count <10\* cfu/g sample based on the BFAD reference criteria. Moreover, cereal flakes with dried *kulitis* leaves were safe for human consumption as the results of microbial analysis of the product and based on the BFAD standard for microorganism tests for products belonging to the baked goods category.

**Keywords:** Drying, Dried *Kulitis* Leaves, Cereal Flakes, Cookies, and Tea

## I. INTRODUCTION

Drying is a mass transfer process consisting of the removal of water or another solvent by evaporation from a solid, semi-solid, or liquid. This process is often used as a final production step before selling or packaging products. Dried *kulitis* leaves can be used as tea, use for cereal, and cookies too.

*Kulitis* is a member of the Amaranth family, a group of edible plants that thrives in the hot regions of the world. The leaves are edible and are cooked similarly to spinach. It is one of the best ingredients to use as tea, cookies, and cereal because it has vitamins, which are good for the body and uses as medicine. The facts that, all of us are suffering from higher prices of our basic needs such as food, clothing, shelter, education, and most of all the essential needs in our daily life. This is a challenge on the part of the researcher and other people in the community to start searching for something which is presentable, acceptable, and useful. Through these, the researcher developed skills and abilities. This study minimized the economic problem of the country. By utilizing discovered ingredients abundantly found in the surroundings, it makes possible.

The purpose of the study is to educate the general public that there are numerous alternative approaches to problem-solving. Creating food from materials found in the environment can alter human perspectives and lead to more productive lives. This is the reason why the researcher conducted the study entitled “Utilization of Dried Kulitis Leaves for Varied Food Products”.

## **II. STATEMENT OF THE PROBLEM & LITERATURE REVIEW**

This study aimed to develop dried Kulitis Leaves into varied products such as tea, bar cookies, and cereal-flakes and determine its acceptability. Specifically, it has six objectives and two (2) hypotheses. These are (1) determining the sensory qualities of dried Kulitis Leaves as tea, bar cookies, and cereal flakes in terms of appearance, aroma, taste, and texture; (2) determining the acceptability of dried Kulitis Leaves as tea, bar cookies, and cereal flakes in terms of appearance, aroma, taste, and texture among three treatments; (3) finding out if there is a significant difference in the sensory qualities of dried Kulitis Leaves as tea, bar cookies, and cereal flakes in terms of appearance, aroma, taste, and texture; (4) finding out if there is a significant difference in the acceptability of dried Kulitis Leaves as tea, bar cookies, and cereal flakes in terms of appearance, aroma, taste, and texture among the three treatments; (5) determining the shelf-life of the products in terms of room temperature; and (6) determining the microbial and proximate analysis of the best product.

The two (2) hypotheses were:

1. There is no significant difference in the sensory quality of dried Kulitis Leaves as tea, bar cookies, and cereal flakes in terms of appearance, aroma, taste, and texture.
2. There is a significant difference in the level of acceptability of dried Kulitis Leaves as tea, bar cookies, and cereal flakes in terms of appearance, aroma, taste, and texture among the three treatments.

Cereals are the most important sources of food (FAO 2002), and cereal-based foods are a major source of energy, protein, B vitamins and minerals for the world population. Numerous chemical constituents of green tea, such as epigallocatechin 3-gallate, are claimed to have chemopreventive effects on a variety of health-related endpoints in humans. Green tea infusions are widely consumed as beverages (Wickremasinghe, 1978; Singh et al., 2011).

A potluck staple, bar cookies (or bars) are made from a batter or stiff dough that is poured or pressed into a baking pan or baking dish, then baked, cooled, and cut into bars, squares or diamonds. Bars can be single-layered (like brownies) or multi-layered – with cake-like or chewy textures. These cookies raise the bar on delicious (quakeroats, n.d.). Preparations from them are used to create recipes for dietary supplements, functional food, and medicinal products. Recently, amaranth has become an area of increasing scientific and industrial interest. This is due to its valuable biological properties, rich phytochemical composition, and wide pharmacological activity. Amaranth is a pseudo-cereal crop with a dual character, combining the features of food and health-promoting product (Baraniak, J., & Kania-Dobrowolska, M., 2022). The leaves and grains of amaranth are considered a superfood because they are beneficial to nearly every organ in the body. They are simple to incorporate into the diet because they taste great in stir-fries and when combined with lentils. Amaranth contains more protein, calcium, iron, copper, essential vitamins, magnesium, zinc, and manganese than any other leafy green vegetable. Amaranth is used as a leaf vegetable in the majority of African countries where it is harvested from the wild as a culinary herb. It is recommended as a good food with medicinal properties for young children, lactating mothers, and patients with fever, hemorrhage, anemia, and kidney complaints due to its soft flavor (Grubbens and Denton, 2004). Utilization of PLR flakes in nutritious bars resulted in a highly crispy and crunchy texture, enhanced flavor, and taste as compared to the control. Extruded snacks (control and PLR) showed no microbial growth during the entire storage period. This study by Anitha and Rajyalakshmi (2014) signifies the utilitarian value of PLRVs in making products of convenience/commercial importance.

## **III. MATERIAL SELECTION AND EXPERIMENTAL WORK**

### **Research Design**

The experimental design used to generate the data in this study was the completely randomized design (CRD) (Stone et al, 2012). Samples for evaluation were coded and score card are utilized for randomization. The formulation of a product was performed prior to its evaluation in three trials that were replicated three times.

### **Tools and Equipment**

The following tools and equipment were used to conduct this study: one (1) unit 4x4 meters stainless working table, one (1) unit gas range, one (1) unit refrigerator, one (1) unit blender, two (2) pcs small basin, one (1) weighing scale, one (1) piece cooling rack, three (3) pieces medium size stainless mixing bowl, one (1) set measuring cup, one (1) set measuring

spoon, one (1) spatula, one (1) piece wire whisk, three (3) pieces baking sheet, one (1) pc pastry brush, ten (10) pieces utility bowls, three (3) pcs. utility trays, one (1) piece sieve, one (1) piece grater, one (1) pc knife, and one (1) pc peeler.

**Ingredients used in the study**

The ingredients used in the conduct of the study were the following: For tea, dried kulitis, dried lemon zest, and dried ginger. For bar cookies, flour, dried kulitis, brown sugar, glucose, eggs, butter, evaporated milk, cashew nuts, and baking powder. For cereal flakes, flour, dried kulitis, vegetable oil, water, and milk.

**Experimental Treatments**

The experiment was carried out in three (3) Products (tea, bar cookies, and cereal flakes) with treatments namely: Product A (Tea-Treatment A, B, C.), Product B (Bar Cookies-Treatment A, B, C.), and Product C (Cereal-Flakes-Treatment A, B, C.). The following proportions of ingredients were shown in the table below. Table 1 shows the proportions of ingredients in the making of tea which consists of dried kulitis, dried lemon zest, and dried ginger. The amount of dried lemon zest and ginger varies for every treatment and the dried kulitis remained constant throughout the treatments. The boiling water used during the sensory evaluation was 150 ml per treatment.

Ingredients	Treatment A	Treatment B	Treatment C
Dried Kulitis	5 grams	5 grams	5 grams
Dried Ginger	¼ tsp	-----	¼ tsp
Dried Lemon Zest	-----	¼ tsp	¼ tsp

**Table 1. Proportion of ingredients for Tea with dried kulitis leaves (Product A).**

Table 1.1 shows the proportions of ingredients in the making of bar cookies consists of flour, dried kulitis, milk, eggs, butter, brown sugar, cashew nuts, glucose and baking powder. The kind of flour used for every treatment was varied and the dried kulitis remained constant throughout the treatments.

Ingredients	Treatment A	Treatment B	Treatment C
Dried Kulitis	10 grams	10 grams	10 grams
Powdered Cassava	50 grams	----	----
Powdered Sweet potato	-----	50 grams	----
All-purpose Flour	-----	----	50 grams
Butter	50 grams	50 grams	50 grams
Brown sugar	20 grams	20 grams	20 grams
Egg	30 grams	30 grams	30 grams
Milk	2 tsp	2 tsp	2 tsp
Glucose	1 tbsp	1 tbsp	1 tbsp
Baking Powder	¼ tsp	¼ tsp	¼ tsp

**Table 1.1 Proportion of ingredients for bar cookies with dried kulitis leaves (Product B).**

Table 1.2 shows the proportions of ingredients in the making of cereal flakes consists of flour, dried kulitis, vegetable oil, powdered milk, and water. The kind of flour used for every treatment was varied and the dried kulitis remained constant throughout the treatments.

Ingredients	Treatment A	Treatment B	Treatment C
Dried Kulitis	10 grams	10 grams	10grams
Cassava flour	50 grams	----	25grams
Sweet potato flour	----	50 grams	25grams
All-purpose flour	2 tbsps	2 tbsps	2 tbsps
Evaporated milk	3 tsp	3 tsp	3 tsp
Egg	3 tsp	3 tsp	3 tsp
Vegetable oil	1 tsp	1 tsp	1 tsp
Water	3 tsp	3 tsp	3 tsp

**Table 1.2. Proportion of ingredients for Cereal-Flakes with dried kulitis leaves (Product C).**

**Experimental Procedure****Step 1. Preparation of Raw Materials**

The preparation of raw materials was on the dried kulitis, dried lemon zest, dried ginger, cassava flour, and sweet potato flour.

**A. Preparation of Dried Kulitis Leaves**

The kulitis leaves were gathered and sorted individually to ensure freshness. Then, the kulitis leaves were washed thoroughly using running water. Drained to remove the excess water. The kulitis leaves were placed in the tray and dried under the heat of the sun until it becomes crisp. The dried kulitis leaves were ground using an electric grinder until a fine texture was achieved. Set aside for later use.

**B. Preparation of Dried Lemon Zest**

The lemon fruit was gathered and sorted individually to ensure freshness. Then, the lemon was peeled to remove the zest and washed thoroughly using running water. Drained to remove the excess water. The lemon zest was placed in the tray and dried under the heat of the sun until it becomes crisp. The dried lemon zest was ground using an electric grinder until a fine texture was achieved. Set aside for later use.

**C. Preparation of Dried Ginger**

The ginger was gathered and sorted individually to ensure freshness. Then, the ginger was peeled and washed thoroughly using running water. Drained to remove the excess water. The ginger was sliced thinly and placed in the tray and dried under the heat of the sun until it becomes crisp. The dried ginger was ground using an electric grinder until a fine texture was achieved. Set aside for later use.

**D. Preparation of Cassava and Sweet Potato Flour**

One (1) kilo of cassava and sweet potato was bought from a well-known root crop dealer at the Bagong Lipunan Trade Center to ensure quality and food safety. The cassava was washed thoroughly and pared. Then, it was thoroughly soaked in water with one (1) tablespoon of baking soda for 30 minutes, drained the cassava, and grated. Using a clean cloth, the grated cassava was squeezed to remove the extract and dried under the heat of the sun for three (3) hours. The dried cassava was ground using an electric grinder into a fine flour texture. The prepared cassava flour was then placed in a clean container and set aside. While, the sweet potato was washed thoroughly and pared. Then, washed again and drained the sweet potato was grated and squeezed. And dried under the heat of the sun for three (3) hours. The dried sweet potato was ground using an electric grinder into a fine flour texture. The prepared sweet potato was placed in a clean container and set aside for later use.

**Step 2. Procedures in the making of the three varied products such as tea, bar cookies and cereal flakes****A. Preparation of Tea**

The powdered dried leaves, ginger, and lemon zest were sifted using a siever twice to remove coarse particles, and set aside. In a tea bag, put the needed amount of powdered dried kulitis leaves, ginger, and lemon zest. Then, add hot water to a cup. Served.

**B. Preparation of Bar Cookies**

The tools, equipment, and ingredients needed were prepared and gathered. The butter was creamed until soft. The egg was added one at a time until the mixture combined. Then, sugar was gradually added, and evaporated milk. All the dry ingredients were combined and the glucose was added. Lastly, the cashew nuts were added and the mixture was mixed thoroughly. The prepared mixture was placed in a greased baking pan. The bar cookies mixture was baked for 10 minutes or until golden brown. Baked bar cookies were placed on a cooling rack. Then, it was sliced into a bar. Served.

**C. Preparation of Cereal flakes**

In a mixing bowl, all the dry ingredients were combined. The eggs, evaporated milk, vegetable oil, and water were added and mixed thoroughly until the dough texture was achieved. The dough was placed in the refrigerator for three (3) minutes before it was flattened. Then, the dough was flattened using a rolling pin. The dough was baked for five (5) minutes in preheated oven until the texture becomes dried. Then, the dough was removed from the oven and was cut into small cube sizes, arranged in a baking tray, and baked for another ten (10) minutes until becomes crisp. The cereal flakes were removed from the oven and placed in the cooling rack before packing. The cereal flakes were best served with fresh milk.

**Collection of Data**

The instrument used in the study was an evaluation sheet. It addressed the quality attributes of the product as evaluated by ten (10) experts in research and Food Technology Professors of Capiz State University, Main Campus Roxas City for sensory qualities, while the seventy (70) consumers evaluated the product's general acceptability in terms of appearance, aroma, taste, and texture. After the evaluation of the finished products, the evaluation sheets were gathered, tallied summarized, and prepared for computations.

**Evaluation Process**

The jurors consisted of a home economics teacher, food technology professor, and the dean of the graduate school of Capiz State University main campus. The revised sensory evaluation sheet was photocopied and made ready for the final evaluation of the finished product by the respondents of the study. The panel of evaluators was invited and given instructions on how to evaluate dried kulitis for varied food products. Part 1 of the evaluation sheet was given to the respondents and their honest opinion were solicited they were instructed to evaluate the product using the nine-point rating scale as to appearance, aroma, taste, and texture. The evaluators also evaluated the acceptability of the three treatments to tea, bar cookies, and cereal flakes in terms of appearance, aroma, taste, and texture. Moreover, the shelf life was done through direct observation if there will be a build-up of mold from the subject which causes contamination.

**Scoring Variables**

In scoring the variables, the Nine (9 Point Hedonic Scale) was used by the researcher. The method of scoring the variables required the respondents to rate the products based on their own judgment. The sensory qualities of tea in terms of appearance (clear and sparkling), aroma/fragrance (pungent (sharp/strong smell but pleasant), taste/flavor (ground ginger, citrus/lemon flavor), and texture (smooth) were scored weighted arithmetically and categorized as follows:

Score	Interval	Appearance based on color)	Aroma/Fragrance	Taste/Flavor	Texture
9	8.12 – 9.00	Extremely Clear and Sparkling	Extremely Pleasant	Extremely Delicious	Extremely Smooth
8	7.23 – 8.11	Very Much Clear and Sparkling	Very Much Pleasant	Very Much Delicious	Very Much Smooth
7	6.34 – 7.22	Moderately Clear and Sparkling	Moderately Pleasant	Moderately Delicious	Moderately Smooth
6	5.45 – 6.33	Slightly Clear and Sparkling	Slightly Pleasant	Slightly Delicious	Slightly Smooth
5	4.56 – 5.44	Neither Clear and Sparkling nor Not Clear and Sparkling	Neither Pleasant Not Pleasant	Neither Delicious Not Delicious	Neither Smooth Not Smooth
4	3.67 – 4.55	Slightly Not Clear and Sparkling	Slightly Not Pleasant	Slightly Not Delicious	Slightly Not Smooth
3	2.78 – 3.66	Moderately Not Clear and Sparkling	Moderately Pleasant	Moderately Delicious	Moderately Smooth
2	1.89 – 2.77	Very Much Not Clear and Sparkling	Very Much Not Pleasant	Very Much Not Delicious	Very Much Not Smooth
1	1.00 – 1.88	Extremely Not Clear and Sparkling	Extremely Not Pleasant	Extremely Not Delicious	Extremely Not Smooth

The sensory qualities of bar cookies in terms of appearance (light brown in color, and even shape), aroma (pleasant), taste (delicious), and texture (chewy or soft) were scored weighted arithmetically and categorized as follows:

Score	Interval	Appearance	Aroma	Taste	Texture
9	8.12 – 9.00	Extremely Appealing	Extremely Pleasant	Extremely Delicious	Extremely chewy or soft
8	7.23 – 8.11	Very Much Appealing	Very Much Pleasant	Very Much Delicious	Very Much chewy or soft
7	6.34 – 7.22	Moderately Appealing	Moderately Pleasant	Moderately Delicious	Moderately chewy or soft
6	5.45 – 6.33	Slightly Appealing	Slightly Pleasant	Slightly Delicious	Slightly chewy or soft
5	4.56 – 5.44	Neither Appealing Not Appealing	Neither Pleasant Not Pleasant	Neither Delicious Not Delicious	Neither chewy or soft Not chewy or soft
4	3.67 – 4.55	Slightly Not Appealing	Slightly Not Pleasant	Slightly Not Delicious	Slightly Not chewy or soft
3	2.78 – 3.66	Moderately Appealing	Moderately Pleasant	Moderately Delicious	Moderately Not chewy or soft
2	1.89 – 2.77	Very Much Not Appealing	Very Much Not Pleasant	Very Much Not Delicious	Very Much Not chewy or soft
1	1.00 – 1.88	Extremely Not Appealing	Extremely Not Pleasant	Extremely Not Delicious	Extremely Not chewy or soft

The sensory qualities of cereal flakes in terms of appearance (light brown in color, and even shape), aroma (pleasant), taste (delicious), and texture (crisp) were scored weighted arithmetically and categorized as follows:

Score	Interval	Appearance	Aroma	Taste	Texture
9	8.12 – 9.00	Extremely Appealing	Extremely Pleasant	Extremely Delicious	Extremely crisp
8	7.23 – 8.11	Very Much Appealing	Very Much Pleasant	Very Much Delicious	Very Much crisp
7	6.34 – 7.22	Moderately Appealing	Moderately Pleasant	Moderately Delicious	Moderately crisp
6	5.45 – 6.33	Slightly Appealing	Slightly Pleasant	Slightly Delicious	Slightly crisp
5	4.56 – 5.44	Neither Appealing Not Appealing	Neither Pleasant Not Pleasant	Neither Delicious Not Delicious	Neither crisp Not crisp
4	3.67 – 4.55	Slightly Not Appealing	Slightly Not Pleasant	Slightly Not Delicious	Slightly Not crisp
3	2.78 – 3.66	Moderately Appealing	Moderately Pleasant	Moderately Delicious	Moderately Not crisp
2	1.89 – 2.77	Very Much Not Appealing	Very Much Not Pleasant	Very Much Not Delicious	Very Much Not crisp
1	1.00 – 1.88	Extremely Not Appealing	Extremely Not Pleasant	Extremely Not Delicious	Extremely Not crisp

**Acceptability Qualitative Description**

Score	Mean Score	Qualitative Description
9	8.12 – 9.00	Liked Extremely
8	7.23 – 8.11	Liked Very Much
7	6.34 – 7.22	Liked Moderately
6	5.45 – 6.33	Liked Slightly
5	4.56 – 5.44	Neither Liked nor Disliked

4	3.67 – 4.55	Disliked Slightly
3	2.78 – 3.66	Disliked Moderately
2	1.89 – 2.77	Disliked Very Much
1	1.00 – 1.88	Disliked Extremely

### Statistical Tools and Analysis

The data were tabulated and statistically analyzed by SPSS software using the Arithmetic Mean and the Analysis of Variance (ANOVA). The Analysis of Variance (ANOVA) was used to determine the significant difference in the sensory qualities of the product in terms of appearance, aroma, taste, and texture as well as the differences among the three treatments (Larson, 2008) level of significance was set at a 0.01 alpha.

### Cost Analysis

Table 2 shows the product cost analysis of the ingredients used in making the dried kulitis tea.

Ingredient	Quantity	Unit Price	Total
Kulitis	15 grams	20.00/tumpok	30.00
Lemon	9 grams	30.00 per kilogram	9.00
Ginger	9 grams	25.00 per kilogram	9.00
<b>Sub-Total</b>			<b>48.00</b>
<b>Labor Cost (40%)</b>			<b>19.20</b>
<b>Total Cost</b>			<b>67.20</b>

**Table 2. Product Cost of Product 1 (Tea).**

#### A. Labor

Labor is equal to 40% of the cost of materials

$$\begin{aligned} \text{Labor} &= \text{Php } 48.00 \text{ (cost of materials)} \\ &= .40 \times \text{Php } 48.00 \\ &= 19.20 \end{aligned}$$

If the labor consists of 40% of the cost of materials, the total product cost of Treatment A, B, and C therefore was:

$$\begin{aligned} \text{Labor} &= \text{Php } 19.20 \\ \text{Cost of Materials} &= 48.00 \\ \text{Product Cost} &= 67.20 \end{aligned}$$

#### B. Summary of Expenses of Treatment A, B, and C

The above data shows the cost of all the materials used in making Treatment A, B, and C. Hence, if the 40% is labor and it was added to the cost of materials for treatment, and the product cost of the product therefore was:

$$\begin{aligned} \text{Labor} &= 19.20 \\ \text{Cost of Materials} &= 48.00 \\ \text{Product Cost} &= 67.20 / 13 \text{ tea bag} \\ \text{Cost per tea bag} &= 5.17/ \text{ per 5 grams} \end{aligned}$$

Table 2.1 shows the product cost analysis of the ingredients used in making the bar cookies with dried kulitis.

Ingredient	Quantity	Unit Price	Total
Cassava	50 grams	40.00 per kilogram	10.00
Sweet Potato	50 grams	30.00 per kilogram	15.00
Butter	100 grams	56.00 per 150g	37.00
Evaporated milk	28 grams	28.00 per 250g	3.50
Glucose	3 T	120 per bottle	15.00
Brown sugar	33 grams	80.00 per kilogram	2.50
Egg	60 grams	8.00 per piece	6.00
Baking powder	10 grams	14.00 per 100 grams	1.50
Cashew nuts	20 grams	150.00 per 250 grams	12.00
Kulitis	9 grams	20.00/tumpok	10.00
<b>Sub-Total</b>			<b>112.50</b>
<b>Labor Cost (40%)</b>			<b>45.00</b>
<b>Total Cost</b>			<b>157.50</b>

**Table 2.1. Product Cost of Product 2 (Bar Cookies).**

**A. Labor**

Labor is equal to 40% of the cost of materials  
 Labor = Php 112.50 (cost of materials)  
 = .40 x Php 112.50  
 = 45.00

If the labor consists of 40% of the cost of materials, the total project cost of Treatment A, B, and C therefore was:

Labor = Php 45.00  
 Cost of Materials = 112.50  
 Product Cost = 157.50

**B. Summary of Expenses of Treatment A, B, and C**

The above data shows the cost of all the materials used in making Treatment A, B, and C. Hence, if the 40% is labor and it is added to the cost of materials for treatment, and the project cost of the product therefore was:

Labor = 45.00  
 Cost of Materials = 112.50  
 Product Cost = 157.50 / 57 pieces  
 Cost per piece = 2.76 piece

Table 2.2 shows the product cost analysis of the ingredients used in making the cereal flakes with dried kulitis.

<b>Ingredient</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Total</b>
Cassava	50 grams	40.00 per kilogram	10.00
Sweet Potato	50 grams	30.00 per kilogram	15.00
Butter	100 grams	56.00 per 150g	37.00
Powdered milk	30 grams	54.00 per 100 grams	18.00
Brown sugar	33 grams	80.00 per kilogram	2.50
Egg	60 grams	8.00 per piece	6.00
Kulitis	9 grams	20.00 per tumpok.	10.00
Cashew nuts	20 grams	150.00 per 250 grams	12.00
Cornstarch	7 grams	21.00 per 250 grams	.50
<b>Sub-Total</b>			<b>111.00</b>
<b>Labor Cost (20%)</b>			<b>40.40</b>
<b>Total Cost</b>			<b>151.40</b>

**Table 2.2. Product Cost of Product 3 (Cereal Flakes).**

**A. Labor**

Labor is equal to 40% of the cost of materials  
 Labor = Php 111.00 (cost of materials)  
 = .40 x Php 111.00  
 = 44.40

If the labor consists of 40% of the cost of materials, the total project cost of Treatment A, B, and C therefore was:

Labor = Php 44.40  
 Cost of Materials = 111.00  
 Project Cost = 155.40

**B. Summary of Expenses of Treatment A, B, and C**

The above data shows the cost of all the materials used in making Treatment A, B, and C. Hence, if the 40% is labor and it is added to the cost of materials for treatment, and the project cost of the product therefore was:

Labor = 44.40  
 Cost of Materials = 111.00  
 Product Cost = 155.40/29 pack  
 Cost per pack = P5.36 per 10 grams

**IV. DISCUSSION OF THE RESULTS**

**Sensory qualities of varied products with dried Kulitis Leaves as evaluated by semi-trained panelists**



Sensory Qualities	TREATMENTS					
	A (KL Tea)		B (KG Tea)		C (KLG Tea)	
	Mean	AD	Mean	AD	Mean	AD
Appearance	7.50	VMCS	7.60	VMCS	8.00	VMCS
Aroma	7.30	MP	7.60	VMP	8.20	EP
Taste	7.40	VMD	7.50	VMD	8.30	ED
Texture	7.40	VMS	7.60	VMS	7.70	VMS

Table 3. Sensory qualities of Kulitis Tea.

**Legend:** AD – Adjectival Description  
 VMH - Very Much Clear & Sparkling  
 VMP - Very Much Pleasant  
 VMD-Very Much Delicious  
 KL – Kulitis and Lemon Tea  
 KG – Kulitis and Ginger Tea  
 KLG – Kulitis, Lemon and Ginger Tea  
 VMSD- Very Much Smooth

Table 3 shows the sensory qualities of Kulitis Tea in terms of appearance, aroma, taste, and texture. The kulitis tea in terms of appearance showed that the kulitis tea with lemon was “Very Much Clear and Sparkling” as supported by the 7.50 mean. Kulitis Tea with Ginger was “Very Much Clear and Sparkling” as supported by the 7.60 mean and the Kulitis tea with a combination of Lemon and Ginger was “Very Much Clear and Sparkling” as supported by the 8.00 mean. In general, the appearance of kulitis tea with lemon ranked first followed by taste, texture, and lastly aroma. The appearance of kulitis tea with ginger also ranked first followed by aroma, texture, and lastly taste. The taste of kulitis tea with a combination of lemon and ginger ranked first followed by aroma, appearance, and lastly texture.

Sensory Qualities	TREATMENT					
	A(Kulitis Bar Cookies-Cassava)		B (Kulitis Bar Cookies- Sweet Potato)		C(Kulitis Bar Cookies-All purpose flour	
	Mean	AD	Mean	AD	Mean	AD
Appearance	7.60	VMA	8.10	VMA	7.60	VMA
Aroma	7.60	VMP	8.50	EP	7.40	VMP
Taste	7.10	MD	8.30	ED	7.70	VMD
Texture	7.50	VMC	8.10	VMC	7.80	VMC

Table 3.1. Sensory qualities of Kulitis Bar Cookies.

**Legend:** AD – Adjectival Description  
 EA- Extremely Appealing  
 ED- Extremely Delicious  
 VMC-Very Much Chewy or Soft  
 VMA - Very Much Appealing  
 VMD-Very Much Delicious  
 VMP- Very Much Pleasant  
 EP- Extremely Pleasant

The appearance of Kulitis bar cookies with Cassava ranked first followed by aroma, texture, and lastly taste. The aroma of kulitis bar cookies with sweet potato ranked first followed by taste, appearance, and lastly texture. The texture of kulitis bar cookies with all-purpose flour ranked first, followed by taste, appearance, and lastly aroma.

Table 3.2 shows the sensory qualities of Kulitis Cereal in terms of appearance, aroma, taste, and texture. The kulitis Cereal in terms of appearance showed that the kulitis cereal with sweet potato was “Very Much Appealing” as supported by the 8.40 mean. Kulitis cereal with Cassava was “Very Much Appealing” as supported by the 7.90 mean and the Kulitis cereal with all-purpose flour was “Very Much Appealing” as supported by the 7.80 mean.

Sensory Qualities	TREATMENTS					
	A (Kulitis Cereal-Cassava)		B (Kulitis Cereal-Sweet Potato)		C (Kulitis Cereal-All purpose flour	
	Mean	AD	Mean	AD	Mean	AD
Appearance	7.90	VMA	8.40	VMA	7.80	VMA
Aroma	7.70	VMP	8.50	EP	7.70	VMP
Taste	7.60	VMD	8.60	ED	7.70	VMD
Texture	8.20	VMC	8.60	EC	7.90	VMC

Table 3.2. Sensory qualities of Kulitis Cereal Flakes

**Legend:** AD – Adjectival Description

- EA- Extremely Appealing      VMA - Very Much Appealing      EP- Extremely Pleasant
- ED- Extremely Delicious      VMD-Very Much Delicious      EC- Extremely Crisp
- VMP - Very Much Pleasant      VMC- Very Much Crisp

The texture of Kulitis cereal with Sweet potato ranked first followed by taste, aroma and lastly appearance. The texture of kulitis cereal with cassava ranked first followed by appearance, aroma and lastly taste. The texture of kulitis cereal with all-purpose flour ranked first, followed by appearance, aroma, and lastly taste

As evaluated by 10 semi-trained panelists, kulitis tea with a combination of lemon and ginger ranked no. 1 in terms of aroma and taste, while Kulitis tea with lemon has a poor texture compared to the Kulitis tea with Ginger and Kulitis tea with a combination of lemon and ginger. Kulitis bar cookies with sweet potato ranked no. 1 in terms of aroma and taste, while kulitis bar cookies with cassava has a poor taste compared to kulitis bar cookies with sweet potato and kulitis bar cookies with all-purpose flour. Kulitis cereal with sweet potato ranked no.1 in terms of taste and texture, while kulitis cereal with all-purpose flour has a poor appearance compared to kulitis cereal with sweet potato and kulitis cereal with cassava.

**General acceptability of varied products with dried Kulitis leaves as evaluated as evaluated by consumers**

QUALITY ATTRIBUTES	TREATMENTS					
	A (Kulitis tea-lemon)		B (Kulitis tea-ginger)		C (Kulitis tea-combi)	
	Mean	QD	Mean	QD	Mean	QD
Appearance	8.19	LE	8.06	LVM	8.23	LE
Aroma	8.11	LVM	7.87	LVM	8.06	LVM
Taste	8.07	LVM	8.03	LVM	8.10	LVM
Texture	7.99	LVM	7.69	LVM	8.07	LVM
Acceptability	<b>8.09</b>	<b>LVM</b>	<b>7.91</b>	<b>LVM</b>	<b>8.11</b>	<b>LVM</b>

Table 4. General acceptability of Kulitis Tea.

**Legend:**

- |                       |                                |
|-----------------------|--------------------------------|
| <b>Scale of Means</b> | <b>Qualitative Description</b> |
| 8.12 – 9.00           | Liked Extremely                |
| 7.23 – 8.11           | Liked Very Much                |
| 6.34 – 7.22           | Liked Moderately               |

Table 4 revealed the results in the general acceptability of kulitis tea. Consumers’ choice towards dried kulitis leaves used for varied food products was from the seventy (70) participants, assessment of appearance, aroma, taste, and texture showed that the Kulitis tea with lemon was Liked Very Much as supported by the 8.09 mean. Kulitis tea with ginger was Liked Very Much as supported by the 7.91 mean and Kulitis tea with a combination of lemon and ginger was Liked Very Much as supported by the 8.11 mean.

QUALITY ATTRIBUTES	TREATMENTS					
	A (Kulitis bar cookies-cassava)		B (Kulitis bar cookies-sweet potato )		C (Kulitis bar cookies-all purpose flour)	
	Mean	QD	Mean	QD	Mean	QD
Appearance	8.16	LE	8.26	LE	8.51	LE
Aroma	8.00	LVM	8.01	LVM	8.14	LE
Taste	8.16	LE	8.13	LE	8.34	LE
Texture	8.21	LE	8.06	LVM	8.30	LE
Acceptability	<b>8.13</b>	<b>LE</b>	<b>8.11</b>	<b>LVM</b>	<b>8.33</b>	<b>LE</b>

Table 4.1. General acceptability of Kulitis Bar Cookies.

**Legend:**

- |                       |                                |
|-----------------------|--------------------------------|
| <b>Scale of Means</b> | <b>Qualitative Description</b> |
| 8.12 – 9.00.          | Liked Extremely                |
| 7.23 – 8.11           | Liked Very Much                |
| 6.34 – 7.22.          | Liked Moderately               |

Table 4.1 revealed the results in the general acceptability of kulitis bar cookies. Kulitis bar cookies with cassava was Liked Extremely as supported by the 8.13 mean. Kulitis bar cookies with sweet potato was Liked Very Much as supported by the 8.11 mean and kulitis bar cookies with all-purpose flour was Liked Extremely as supported by the 8.33 mean.

**Difference in the Sensory Qualities of Varied Products with Dried Kulitis Leaves as evaluated by Semi-Trained Panelists**

Table 5 revealed that there was no significant difference in the sensory qualities of the kulitis tea in terms of appearance, taste, and texture.

Results showed that there was a significant difference in the aroma of the kulitis tea (f-value = 7.000, p-value = 0.004). This implies that the aroma differs in all treatments. It can also understand that the aroma has comparable qualities.

SENSORY QUALITIES	SUM OF SQUARE	Df	MEAN SQUARE	F-VALUE	P-VALUE	REMARKS
Appearance	1.400	2	.700	1.000	.381	ns
	18.900	27	.700			
	20.300	29				
Aroma	4.200	2	2.100	7.000	.004	s
	8.100	27	.300			
	12.300	29				
Taste	4.867	2	2.433	4.380	.023	ns
	15.000	27	.556			
	19.867	29				
Texture	.467	2	.233	.333	.719	ns
	18.900	27	.700			
	19.367	29				

**Table 5. Difference in the sensory qualities of Kulitis tea.**

Legend: p-value > .01, not significant at p-value < 0.01, significant at .01 alpha

Table 5.1 revealed that there was no significant difference in the sensory qualities of the kulitis bar cookies among the three treatments in terms of appearance, taste, and texture.

Results showed that there was a significant difference in the aroma of the kulitis bar cookies (f-value = 7.514, p-value = 0.003). This implies that the aroma differs in all treatments. It can also understand that the aroma has comparable qualities.

SENSORY QUALITIES	SUM OF SQUARE	Df	MEAN SQUARE	F-VALUE	P-VALUE	REMARKS
Appearance	1.667	2	.833	1.271	.297	ns
	17.700	27	.656			
	19.367	29				
Aroma	6.867	2	3.433	6.970	.004	s
	13.300	27	.493			
	20.167	29				
Taste	7.200	2	3.600	5.089	.013	ns
	19.100	27	.707			
	26.300	29				
Texture	1.800	2	.900	1.429	.257	ns
	17.000	27	.630			
	18.800	29				

**Table 5.1. Difference in the sensory qualities of Kulitis Bar Cookies.**

Table 5.2 revealed that there was no significant difference in the sensory qualities of the kulitis cereal among the three treatments in terms of appearance, aroma, and texture.

Results showed that there was a significant difference in the taste of the kulitis cereal (f-value = 7.514, p-value = 0.003). This implies that the taste differs in all treatments. It can also understand that the taste has comparable qualities.

Findings also revealed that there was a significant difference in the aroma of the two treatments (kulitis tea and kulitis bar cookies), kulitis tea (f-value = 7.000, p value = .004) kulitis Bar Cookies (f-value = 6.970, p-value = .004).

There was also a significant difference in the taste of kulitis Cereal (f-value = 7.514, p value = .003). The result signifies that there was a distinguishing taste when different type of flour is used in making the kulitis cereal.

The results also revealed that there was no significant difference in texture among the three treatments, kulitis tea (f-value = .333, p value = .719), kulitis Bar Cookies (f-value = 1.429, p value = .257), kulitis Cereal (f-value = 4.826, p value = .016).

SENSORY QUALITIES	SUM OF SQUARE	Df	MEAN SQUARE	F-VALUE	P-VALUE	REMARKS
Appearance	2.067	2	1.033	2.568	.096	ns
	10.900	27	.404			
	12.967	29				
Aroma	4.267	2	2.133	4.535	.020	ns
	12.700	27	.470			
	16.967	29				
Taste	6.067	2	3.033	7.514	.003	s
	10.900	27	.404			
	16.967	29				
Texture	2.467	2	1.233	4.826	.016	ns
	6.900	27	.256			
	9.367	29				

Table 5.2. Difference in the Sensory Qualities of Kulitis Cereal Flakes.

Legend: p-value > .01, not significant at p-value < 0.01, significant at .01 alpha

The results also revealed that there was no significant difference in appearance among the three treatments, kulitis tea (f-value = 1.000, p value = .381), kulitis Bar Cookies (f-value = 1.271, p value = .297), kulitis Cereal (f-value = 2.568, p value = .096).

Kulitis bar cookies and kulitis cereal were found more delicious by the panel of experts and consumers who evaluated the product than the kulitis tea.

Generally, the null hypothesis forwarded before the experimentation was rejected since the sensory qualities showed a significant difference among the three treatments.

**Difference in the consumers' acceptability of varied food products with dried Kulitis leaves**

Consequently, the outcomes on the test of difference among the products in terms of taste showed no significant difference (F-value = .835, p-value = .435). This implies that the three treatments with varying type of flour used in making kulitis cereal has an incomparable taste. This result prompted the rejection of the null hypothesis.

Likewise, the results revealed that there was no significant difference in the texture of kulitis cereal with varying kinds of flour used as treatments, (f-value = .716, p-value = .498). Texture of kulitis cereal using cassava flour is the same with that of using sweet potato flour and all-purpose flour.

The result implies that the null hypothesis was accepted. Among the three treatments, Treatment C (Kulitis cereal) got an extremely crisp texture compared to Treatment B (Kulitis bar cookies) and Treatment A (Kulitis tea).

**Shelf-life of the varied food products with dried Kulitis leaves at Room Temperature**

Variant	One-week Mold Formation	Two-weeks Mold Formation	Three-weeks Mold Formation
Product A (Kulitis tea)	0	0	+
Product B (Kulitis bar cookies))	0	0	+
Product C (Kulitis cereal)	0	0	+

Table 7. Observed Shelf Life of Varied Food Products with Dried Kulitis Leaves at Room Temperature

Legend: Negative (-) no molds formation

Positive (+) molds formation observed

The kulitis cereal stayed only fourteen (14) days or two (2) weeks. The first two weeks of storage showed no changes in the products' qualities. However, on its 15<sup>th</sup> day, the three (3) treatments were noticed to have undergone changes like mold formation, staleness, and unpleasing smell.

Further, cereal mold growth rate depends on several factors, the temperature being the most important one

**Microbial analysis of cereal flakes with dried Kulitis**

Sample Description	Parameter	DOST	FDA Standards	
			m	M
Cereal Flakes with Kulitis, 150g  (3 packs @ 20g/pk; MFD:10/09/2022 EXP: 10/14/2022)	Aerobic Plate Count	<250 cfu/g sample (estimated)	10 <sup>3</sup>	10 <sup>4</sup>
	Molds and Yeast Count	<10* cfu/g sample (estimated)	10	10 <sup>2</sup>
	Total Coliform	<1.8 MPN/g sample	10	10 <sup>2</sup>

**Table 8. Microbial Analysis of Cereal Flakes with Dried Kulitis.**

As shown in the result above, the cereal flakes with dried kulitis has the Aerobic Plate Count of <250 cfu/g sample based on the BFAD reference criteria for aerobic plate count which M in level of rejection and m for an acceptable level. For molds and yeast count it had the result of <10\* cfu/g sample with the BFAD criteria which was both acceptable in m and M. The Total Coliform of <1.8 MPN/g sample. The result given in this report was during the time of examination and referred only to the particular sample submitted.

**Proximate Analysis of Cereal Flakes with Dried Kulitis**

Cereal Flakes with Dried Kulitis had the moisture content of 2.73 gram/100 g. For ash, it got the result of 1.17 gram per 100 g, the crude protein the result of 7.65\* gram per 100 g. The result given in the report were those obtained at the time of examination and referred only to the particular sample submitted.

**V. CONCLUSION AND RECOMMENDATION**

Dried kulitis leaves can be used as tea with a combination of lemon and ginger. It can be used as added ingredients to enhance the flavor, taste and nutritional value of tea, bar cookies, and cereal. Cassava, Sweet Potato and All-purpose variety of flour can be utilized as main ingredients in making bar cookies and cereal. Among the three (3) treatments of the varied dried kulitis leaves products, the Kulitis cereal (product C) has the best quality attributes. It has the best quality when prepared with 5 grams of dried kulitis leaves. The Kulitis bar cookies (treatment B) was very liked by the evaluators in terms of its aroma and taste as evaluated by semi-trained panelists. The consumers' acceptability of the three varieties of dried kulitis leaves products were all "Liked Very Much", therefore, the three (3) products were acceptable. Further, Kulitis Cereal (product C) was the most preferred by consumers based on sensory attributes. There was no significant difference found in the sensory qualities of the utilization of dried kulitis leaves for varied food products among the three products in terms of appearance, aroma, taste, and texture. There was no significant difference found in the consumers' acceptability of the utilization of dried kulitis leaves for varied food products among the three products considering the sensory qualities. Shelf-life of the three products of varied dried kulitis leaves when stored at room temperature could last for two (2) weeks with no changes in the sensory attributes, but when stored at chilling temperature the products could last for 3 weeks with no changes in the sensory attributes.

Therefore, the utilization of dried kulitis for varied food products was safe for human consumption as the results of proximate and microbial analysis of the product and based on the BFAD standard for microorganism test for products belonging to the baked goods category.

Further, it is recommended that dried kulitis leaves can be additive ingredients in making kulitis tea, kulitis bar cookies, and kulitis cereal to have its unique taste and flavor and be more nutritious. The three varieties of flour are recommended in making bar cookies and cereal. Based on the sensory qualities and acceptability of the three varieties of flour, all-purpose flour was best recommended in making kulitis bar cookies and kulitis cereal with dried kulitis leaves considering its quality attributes as evaluated by both semi-trained panelists and consumers. Kulitis bar cookies and kulitis cereal made from Cassava, Sweet Potato, and All-purpose flour with dried kulitis leaves is recommended to everyone since it is cheaper, healthier, and more nutritious than the commercial. With the best sensory qualities achieved by the cereal made from Cassava, Sweet Potato, and All-purpose flour with dried kulitis leaves, it is suggested that the cereal is consumed most especially by children and health-conscious individuals.

The product can be exhibited to more consumers to discover the new and unique taste of cereal using root crops infused with kulitis leaves. Kulitis bar cookies and kulitis cereal made from Cassava, Sweet Potato, and All-purpose flour will be more loved by the consumer with a crispier, soft and intact texture. Varied dried kulitis leaves products must be undergone a vacuum sealing process to prolong its shelf-life and limit the higher molds and yeast formation. Other researchers may try other variants/factors not covered in the current study.

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