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Formulation and Organoleptic Properties of Kamias-Gabi Sinigang MIX

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ABSTRACT
The study focuses on developing a dried soup base using kamias (Averrhoa bilimbi) and gabi (taro) to enhance the flavor profile of sinigang, a traditional Filipino dish. The research involved cleaning, drying, and grinding both kamias and gabi to create a powdered mix. The objectives included determining the optimal formulation, evaluating sensory qualities (taste, aroma, appearance, and texture), and assessing overall acceptability among participants. The study used an experimental research design in which five trained evaluators used a 9-point hedonic scale to determine the optimal formulation of kamias-gabi sinigang mix. Eighty participants rated the acceptability of three formulations, with formulation 2, which comprised 10 grams of powdered kamias, 7 grams of powdered gabi, and a blend of seasonings, achieving the highest mean acceptability score of 7.65, categorized as "Like Very Much." This formulation also scored highest in overall sensory attributes with a mean of 7.71. The study underscores the benefits of using locally sourced ingredients and the potential for creating innovative food products. The findings suggest that the developed soup base is not only flavorful but also cost-effective, providing a means to enhance various regional dishes. The study concludes with recommendations for further research, including nutritional analysis, microbial testing, shelf-life assessment, and considerations for labeling, packaging and cost analysis.

Keywords*: Experimental Research Design(Developmental Research), Formulation, Gabi, Kamias, Organoleptic Properties, Sinigang Mix, Philippines*

1. INTRODUCTION

One of the earliest forms of food preservation is drying, and sun-drying is perhaps the most common method used at home. Scientifically, preservation by drying involves the reduction of moisture in foods by up to 90% to delay or prevent the growth of harmful microorganisms. Moreover, the preservation of fruits and vegetables has been a centuries old practice to keep an ample supply of seasonal produce for long periods of time. Interestingly, there is a wide variety of fruits and vegetables that are categorized as underutilized crops, but which are likely to have substantial commercial value, if given enough attention to research. According to a study conducted by Kamboj, Vikrant, et al. 2020, in a global context, under-utilized crops refer to those that are neither cultivated commercially or on a large scale, and neither are they traded extensively.

The Philippine Kamias (*Averrhoa bilimbi)* and Gabi (*Colocasia esculenta)* are among these under-utilized crops. Numerous studies have suggested that under-utilized fruits such as *Averrhoa bilimbi* possesses medicinal properties that have great potential in the treatment of several illnesses, some of which include fever, mumps, pimples, inflammation of the rectum, diabetes, itches, boils, rheumatism, syphilis, bilious colic, whooping cough, hypertension, stomach ache, ulcer, and are used extensively as folk medicine in many Asian countries including Philippines (ref). Other studies were also conducted to prove that under developed crops have significantly contributed to food security, nutrition, rural employment and women participation. To date, some attempts have been made to improve and market Kamias-based products in the Philippines. In an article

published by The Manila Times, the Department of Agriculture – Quezon Agricultural Research and Experiment Station commissioned a local women's group called Kilos Unlad ng Mamamayan ng Real, Inc. (KUMARE) for its program entitled "Commercializing Kamias Production and Utilization" by training them on kamias production, field management, and product development. Some of the products like kamias soap and kamias sinigang are already marketed locally (The Manila Times, December 2017).

Averrhoa Bilimbi or Kamias as it is called in the Philippines, belongs to the family of Oxalidaceae and is a tropical fruit-bearing tree that reaches up to 5–10 meters in height. The Kamias fruit has a glossy outer skin that turns color from bright green to yellow green as it ripens while the flesh has a jelly-like firm texture, is juicy and very sour. The bilimbi tree is cultivated and grows well in most parts of the Philippines and is commonly found in backyards (Ramirez, C. et al., 2017). Bilimbi fruits are eaten raw, sometimes dipped in salt, or may be made into pickles, jams, jellies, vinegar, juice, and wine. When pulverized, bilimbi can be made into powdered drinks, mixed into curries, and other dishes (Nilugin, S. E. and Mahendran, T., 2016). In the Philippines, bilimbi or kamias is used as a condiment for some local dishes. The sour taste of the fruit is ideal to use in local dishes such as sinigang, paksiw, papaitan, and other soup preparations.

Little attention has been given to under-utilized fruits like *Averrhoa bilimbi* as a rich source of antioxidants unlike other commercial fruits such as papaya, pineapple and guava. This may be due to the bilimbi's lack of popularity among local communities, the lack of information on its nutritional components, and the lack of promotion of this under-utilized fruit (Ikram, et al. 2009). Kamias is a seasonal and highly perishable fruit that has a short shelf life after harvest and only lasts for a few days when stored in a chiller. Basically, there arises an oversupply of perishable fruits and vegetables in the market when they are in season but which unfortunately becomes scarce when they are off-season. As a consequence, perishable fruits and vegetables become seasonal surpluses during certain times of the year and are likely to be wasted in bulk owing to the absence of facilities and knowledge in proper handling, distribution, marketing and storage. In this regard, conservation and better utilization of perishable and seasonal fruits and vegetables through food preservation can address the issue of unnecessary waste to avoid the glut and utilize the surplus during off-seasons (Nilugin, S. E.)

A root crop that is cultivated mainly for its starchy corm or underground stem, Taro [Colocasia esculenta (L.) Schott] is considered an important staple crop in the Pacific Islands and is extensively found throughout the

South Pacific, Asia, and Africa (Kreike et al., 2004). Stem cuttings or suckers of taro are customarily planted for propagation (Fukino et al. 2000). It takes from 8 to 10 months for the taro tuber to be planted until the time it is harvested, and usually yields about 5 to 10 tons per hectare. Further, its starch content varies from 12 to 20% (Moorthy. 2004).

The researchers have come up with a study on the development of Kamias-Gabi Sinigang Mix and its organoleptic properties (appearance, flavor, aroma and texture of soup) as a means of preserving and utilizing the kamias fruit (*Averrhoa Bilimbi*) and the gabi tuber (*Colocasia Esculenta*) into a flavorful and nutritious souring agent for local dishes. Both kamias and gabi were processed by means of drying and pulverizing to produce a spice that can be used as an ingredient in an assortment of food preparations. In a study published by Nilanthi Dahanayake. 2015, the new trend in fruit and vegetable product development is its value-adding ability, thereby providing increased convenience to consumers through a wide range of these ready to use products. With this value-added feature in mind, the researchers ultimately hope to introduce a product that is economical, nutritious, healthy, convenient, and marketable.

2. METHODOLOGY

The research focused on its product development and organoleptic properties.

The research made used of experimental research design wherein the best formulation of kamias- gabi sinigang mix was determined through organoleptic properties by the panelists.

Table 1: Composition of Kamias-Gabi Sinigang Mix

Ingredients	Weight in grams		
	F1	F2	F3
Powdered Kamias	10	10	10
Powdered Gabi	5	7	10
Salt	1	1	1
Sugar	1	1	1
Crushed Dried Onion	1	1	1
Pepper	0.5	0.5	0.5
Flour	1	1	1
Cornstarch	2	2	2
Msg	1	1	1
Citric acid	2	2	2

Preparation of Samples

1. Freshly harvested Kamias were washed and drained
2. Samples were transferred to fruit dryer machine until the moisture content is < 5%.
3. Dehydrated samples were cooled, pulverized and transfer immediately in glass bottle with cap.
4. Similarly, steps 1-4 were applied to gabi, a root crop from Region 2.

DATA ANALYSIS

This study made use of the following statistical tools, needed in the analysis of the data:

For the sensory evaluation of the product, the scale and verbal interpretation used is summarized in table 2 using the nine (9) point Hedonic scale.

Table 2: 9-Point Hedonic Scale

Scale Value	Mean Range	Descriptive Scale
9	8.12-9.00	Like Extremely
8	7.23-8.11	Like Very Much

7	6.34-7.22	Like Moderately
6	5.45-6.33	Like Slightly
5	4.56-5.44	Neither Like or Dislike
4	3.67-4.55	Dislike Slightly
3	2.67-3.66	Dislike Moderately
2	1.89-2.77	Dislike Very Much
1	1.00-1.88	Dislike Extremely

Food Quality Testing of Kamias and Gabi Mixture and Evaluation

Hedonic Rating Testing for Kamias and Gabi Mixture

Consumer acceptance and preference of food products are assessed using the Hedonic rating test. The panelists were asked to give the product an overall acceptability rating on a scale of 1 to 9, with 1 being "like extremely" and 9 being "dislike excessively." The data were analyzed to get the panelists' average ratings, from which the preference order can be determined.

Different amount of powdered kamias (KAM) and gabi (GAB) wwere mixed (w/w).

KAM:GAB

- 100 g : 50 g
- 100 g : 70 g
- 100 g : 100g

1. Mix well and dissolve in hot water
2. Taste the prepared mixture
3. Three (3) samples (KAM:GAB as in this test) were evaluated by 5 trained evaluators and 80 panelists evaluated the acceptability of the products, the following glasswares and other items were used.

- White saucer
- Teaspoons
- Evaluation card
- Hot water
- Slice of bread
- Food Dehydrator -for drying both Kamias and Gabi

Model No. SMX-01, Power:350 W and Voltage: 220V; Frequency:50Hz/60Hz

Made in China

SCALE	CODE 1.0	CODE 2.0	CODE 3.0
Like Extremely			
Like Very Much			
Like Moderately			
Like Slightly			
Neither Like or Dislike			
Dislike Slightly			
Dislike Moderately			
Dislike Very Much			
Dislike Extremely			

Each panelist received a set of three saucers (CODE 1-3) holding sample mixtures in addition to an evaluation card. It is recommended to drink water to rinse the mouth between tastings of two samples to remove the flavor of the previous sample. Similar to this, plain cubes of bread were offered for consumption for the same reason. The same was given if a panelist requests extra samples. The assessment cards were gathered after it is finished, and the data were analyzed as stated below.

Panelist	CODE 1.0	CODE 2.0	CODE 3.0
1			
2			
3			
4			
5			
TOTAL SCORE			
MEAN SCORE			

3. RESULTS AND DISCUSSION

Sensory Evaluation of the Three Formulations

Table 3.1 Sensory Evaluation of Formulation 1

Sensory Qualities	Item Mean	Descriptive Interpretation
Appearance	7.58	Like Very Much
Flavor	7.70	Like Very Much
Aroma	7.58	Like Very Much
Texture of soup	7.48	Like Very Much
Over-all Weighted Mean	**7.585**	**Like Very Much**

The table shows that this formulation was liked very much by the respondents as shown by its over-all weighted mean of 7.585. Rated highest, its flavor was very much liked by the respondents with an item mean of 7.70. Its appearance, aroma and texture of soup were also rated very much liked by the respondents with an item mean of 7.58, 7.58 and 7.48 respectively.

Table 3.2 Sensory Evaluation of Formulation 2

Sensory Qualities	Item Mean	Descriptive Interpretation
Appearance	7.71	Like very much
Flavor	7.68	Like very much
Aroma	7.56	Like Very Much
Texture of soup	7.65	Like very much
Over-all Weighted Mean	**7.65**	**Like very much**

The table shows that this formulation was very much liked by the respondents as shown by its over-all weighted mean of 7.65. Rated highest, its appearance was very much liked by the respondents with a weighted mean of 7.71 followed by its flavor, texture of soup and aroma was also very much liked by the respondents with a weighted mean of 7.68, 7.65 and 7.56 respectively.

Table 3.3 Sensory Evaluation of Formulation 3

Sensory Qualities	Weighted Mean	Descriptive Interpretation
Appearance	7.70	Like Very Much
Flavor	7.64	Like Very Much
Aroma	7.40	Like Very Much
Texture of soup	7.64	Like Very Much
Over-all Weighted Mean	**7.595**	**Like Very Much**

The table shows that this formulation was very much liked by the respondents as shown by its over-all weighted mean of 7.595. Rated highest, its Appearance was very much liked by the respondents with a weighted mean of 7.70. Its Flavor, texture of soup and aroma were also very much liked by the respondents with a weighted mean of 7.64, 7.64 and 7.40 respectively.

Organoleptic analysis was conducted by 10 panelists to evaluate the acceptance of the product in terms of appearance, flavor, aroma and texture.

Table 4: Summary of the Sensory Evaluation of Kamias-Gabi Sinigang Mix

Organoleptic Properties	F1	F2	F3
Appearance	7.58	7.71	7.70
Flavor	7.70	7.68	7.64
Aroma	7.58	7.56	7.40
Texture of Soup	7.48	7.65	7.64
Mean	**7.585**	**7.65**	**7.595**

The table shows that formulation 2 got the highest mean of 7.65 with a descriptive scale of "Like Very Much" followed by formulation 2 with a mean of 7.595 with a descriptive scale of "Like Very Much" and formulation 1 got the lowest mean of 7.585 with a descriptive scale of "like very much". This implies further that the best formulation is in Formulation 2 which comprises of 10 grams of powdered kamias, 7 grams of powdered taro, 1 gram of salt, 1 gram of sugar, 1 gram of crushed dried onion, 0.5 gram of pepper, 1 gram of flour, 2 grams of cornstarch, 1 gram of msg, and 2 grams of citric acid.

The data further shows the organoleptic analysis of the said composition for, the best formulation that came out from the study is the ratio of 10:7 or 10 grams of powdered Kamias and 7 grams of powdered Taro.

Table 5: General Acceptability of Kamias -Gabi Sinigang Mix

Formulations	Mean	DS
Formulation 1	7.66	Like Very Much
Formulation 2	7.71	Like Very Much
Formulation 3	7.58	Like Very Much

The most acceptable formulation in terms of appearance, flavor, aroma and texture by the respondents is in formulation 2 which has a mean of 7.71

4. CONCLUSIONS AND RECOMMENDATION

Freshly harvested Kamias were washed and drained, samples were transferred to fruit dryer machine until the moisture content is < 5% then dehydrated samples were cooled, pulverized and transferred immediately in glass bottle with cap. The same process was applied to gabi, a root crop from Region 2.

Formulation 2 got the highest mean of 7.65 with a descriptive scale of "Like Very Much" followed by Formulation 3 with a mean of 7.595 with a descriptive scale of "Like Very Much" and Lot 1 got the lowest mean of 7.585 with a descriptive scale of "like very much". This implies further that the best formulation is in formulation 2 which comprises of 10 grams of powdered kamias, 7 grams of powdered taro, 1 gram of salt, 1 gram of sugar, 1 gram of crushed dried onion, 0.5 gram of pepper, 1 gram of flour, 2 grams of cornstarch, 1 gram of msg, and 2 grams of citric acid.

The composition for the optimum formulation identified by the study, according to an organoleptic analysis is the ratio of 10:7 or 10 grams of powdered Kamias and 7 grams of powdered Taro.

The most acceptable formulation in terms of appearance, flavor, aroma and texture by the respondents is in formulation 2 which has a mean of 7.71

The designed product is generally related to a dried soup base that contains kamias and gabi as raw materials. It is a flavorful soup base that enhances the taste of sinigang dishes and Economical alternative for souring numerous local dishes

Further study should be conducted by including the nutritional value of the said product, Microbial Analysis of the product should be tested, Shelf life of the product should be determined, Labeling and packaging should be conducted and Cost analysis should be determined.

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