

Processing and Evaluation of Batuan Fruits (*Garcinia binucao*) as Souring Agent

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Abstract: This study aimed to find out the organoleptic characteristics of batuan fruit powder in terms of appearance, aroma, flavor and general acceptability. It determine also the economic parameters of batuan fruit in terms of weight measurement during the time of harvest, after drying and weight as powder and proper storage. This study started from January 2017 to October 2018 conducted at West Visayas State University Pototan Campus, Pototan, Iloilo. Results of the study revealed that batuan fruit powder either ripe or green are highly acceptable to the evaluators through a sensory evaluation using a five point hedonic scale. However, green batuan was most preferred which got the highest mean when tested to fish and pork sinigang. ANOVA results revealed that on pork sinigang among the treatments, there is a significant difference in terms of appearance and no significant differences in terms of aroma, flavor and general acceptability. However, for fish sinigang significant differences existed in terms of appearance, aroma, flavor and general acceptability. In terms of economic parameters, both fruits weighted 1kg. upon harvest were subjected to method of sun drying for one week. However, green batuan has 50% yield which has a greater shrinkage maybe due to moisture content compared with ripe batuan with 60% yield when dried . Results revealed that ripe batuan was difficult to ground because of the hard flinty seeds considering the maturity of the fruits. Green batuan powder yield 50% weight when dried and decreased its weight by 50 % when processed into powdered form. However, ripe batuan fruits got 60% yield when dried and processed as powder probably because of the seed which added weight to the powder. Batuan fruits may be stored in either sealed bags and glass bottled container and can maintain their shelf-life from six to one year either at room temperature or under refrigeration. Results of the evaluation revealed that green batuan powder was most preferred by the respondents and was highly recommended as condiments with appropriate packaging for commercialization considering its high acceptability in terms of appearance, aroma, flavor and general acceptability , ease of preparation and processing.

Keywords: Green, Ripe, Batuan Powder, *Garcinia binucao*, Acceptability, Economic parameters, Storage.

1. INTRODUCTION

“Batuan”, *Garcinia binucao* (Blco.) Choisy, is one of the lesser-known, indigenous, seed-bearing fruit trees identified with export potential (de la Cruz, 2013). The fruit which is mainly used as souring agent in native dishes contains several (more or less 7) large, edible seeds (Quevedo, 2013; Florido and Cortiguerra, 2003). In the Philippines, a close relative of *Garcinia cambogia* called batuan (*Garcinia binucao*) is gaining economic significance. It is an indigenous, underutilized crop that is well-known in the Visayas region as a souring agent (dela Cruz, 2012). In Benguet, out of the 140 barangays, *Garcinia binucao* (*G. binucao*) belonging to Clusiaceae is the most abundant fruit found in Benguet (37 barangays), Chua-Barcelo, R. T. (2014).

Batuan is a wild fruits may be consumed during times when food source is scarce (Rasingam L., 2012, and Deshmukh B, et.al.,2011). The term wild refers to non-cultivated plants gathered in the field (Tardio J, et.al, 2006). Wild fruits make up the greatest percentage of wild food plants (Kenyatta C, et.al ,2013). Hence, many wild fruits are eaten worldwide (FAOUN, 2013). However, consumption of wild fruits has gradually decreased due to the introduction of exotic fruits (Rasingam L. ,2012, Deshmukh B, et.al.,2011).

Dried batuan fruits were used by ancient Indians in treating different types of diseases because of its medicinal properties. It contains anti-inflammatory properties, which can relieve inflammations in the body. Eating fresh batuan can reduce the cholesterol levels in the body, which is good and has beneficial effects for people who have hypertension. Irritated skin can be cured by resin that can be extracted from batuan by simply applying it on the skin. It also contains a lot of antioxidants, which fight free radicals from the body that can cause several types of diseases in the body. It is also rich in vitamin C, which can help to boost our immune system and to the overall body's health (<https://philnews.ph/2017>).

It is in this premise, batuan fruits (*Garcinia binucao*) considering its great economic importance or potentials that were identified , Binucao is one of the 300 species of fruits. Sources say that this unutilized species is useful as a home garden fruit tree and its fruits may be eaten raw. Just like any other *Garcinia* varieties, even *Binucao* can be preserved by slicing into thin pieces and then drying under the sun. They are used for making pickles. (<http://www.fruitsinfo.com/batuan-fruit.php>) .G. binucao fruit is commonly used for various purposes such as food, forage, processing/preservation and condiment/ingredient. (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4025321/>).

A condiment is a type of food that is rarely eaten as a principal food during a meal, but is instead often added to another prepared dish to provide increased flavor or texture.

There are just about as many different types of condiments as there are different types of food, with various cultures having versions that are unique or particularly important to the people of that culture (www.herbs.com, 2000).

Efforts must be given not only to protect and conserve wild fruits such as batuan but also to maintain and improve the state of their habitat. The study proposes the following: increasing one's level of awareness regarding the state of edible wild fruits through information dissemination campaigns to boost the current value of these fruits, additional declaration of protected areas, especially in the province of Iloilo where rare batuan fruits mentioned in this study are found, and promoting the sustainable use of edible wild fruits in the society (Chua-Barcelo, 2014).

Information to be gathered from this study may contribute to the strategies of the National Biodiversity Strategy and Action Plan of the Philippines that is to expand and improve knowledge on the extent, characteristics, uses and values of natural resources, specifically, batuan fruits. Results of this study may be used in developing sustainable natural resource use strategies, climate change adaptation plans and for improving agro-forestry systems. Hence, it aids also in maintaining and reinforcing links between communities and the environment by promoting a sustained acceptance of wild fruits as condiment to augment livelihood status of the community where these fruits can be found and their propagation as well.

Therefore, considering its seasonability , limited sources, and economic impact to the locality, the researcher ought to develop a souring product using batuan fruits (*Garcinia binucao*) and shall be the basis for packaging and commercialization purposes.

The general objective of this study is to develop a souring agent using batuan fruits (*Garciniabinucao*) when processed as food. Specifically the study aims to:

1. Compare the organoleptic qualities of batuan fruits (*Garcinia binucao*) as souring agent in terms of appearance, aroma, flavor , general acceptability when produced as batuan powder.
2. Identify the economic parameters in terms of weight measurement of batuan fruits (*Garcinia binucao*) as souring agent at harvest, before and after drying and weight when produce as powder.
3. Determine appropriate storage for batuan powder as souring agent.
4. Determine proximate analysis of batuan fruit (*Garcinia binucao*) as souring agent prepared from the process mentioned.

2. MATERIALS AND METHODS

Research Design

This study is an experimental research. Experimental research is a method in which investigators manipulates and controls one independent variable for the variations concomitant to the manipulation of the dependent variable (Caipang, 2002). In this study the Complete Randomized Design (CRD) was used.

Evaluators of this Study

There were 30 panel of evaluators composed of 10 BSHRST and Food Technology students, 10 Home Economics and Food Technology teachers, 10 cafeteria vendors within and outside the West Visayas State University Pototan Campus, Pototan, Iloilo.

They were purposively selected as panel of evaluators of the study because of their expertise and availability during the period of the study.

The study was conducted at West Visayas State University Pototan Campus, Pototan, Iloilo from January 2017 to October, 2018.

Sources of Data

The responses of the evaluators were the sources of data in this study. In this study evaluators compared and rated the organoleptic qualities of batuan fruits as souring agent in terms of appearance, aroma, flavor, general acceptability .

Legend:

Treatment A –Powdered Green batuan fruit

Treatment B – Powdered Ripe batuan fruit

Treatment C - Commercial sinigang mix

Each evaluator were given samples of soup (pork sinigang and fish soup) for every treatment. This means the evaluator were given a chance to assessed and evaluate the acceptability of the different treatment of batuan powder. Each preparation were rated based on a Five-Point Hedonic Scale. After the evaluation, the panel of evaluators were quested to do their remarks or comments about the product at the space provided in the score sheet.

Experimental Lay-out

In order to arrive at a reliable and meaningful result, the Complete Randomized Design (CRD) were used. This is the most appropriate for experiment with homogenous experimental units where environmental effect could be easily controlled. In this study, batuan powder as souring product were prepared in different stages of maturity. The experimental batuan powder were replicated five times.

Materials, Tools and Equipment

The researchers gathered and purchased batuan fruits along the nearest municipality where batuan fruits are abundant. The experimental study were conducted after the approval of the proposal.

1). Instrument

- | | |
|-------------------|-------------------|
| a. Mixing bowl | d. Knife |
| b. Dietetic scale | e. Chopping board |
| c. Utility tray | f. Grinder |

Data gathered are the following:

1. No. of days to dry batuan fruits (10%) moisture content
2. Weight of fresh batuan fruits at harvest
3. Weight of dried batuan fruits after drying

4. Weight of powdered batuan fruits after grinding
5. Proximate analysis of batuan fruit powder
6. Organoleptic characteristics of batuan fruit powder in terms of appearance, aroma, texture and general acceptability.

Data Gathering Instrument

The level of acceptability of batuan fruit as souring agent as to appearance, aroma, flavor and general acceptability was determined based on a Five-Hedonic Scale.

| Legend: | Scale | Interpretation |
|---------|------------|-----------------------|
| | 4.21- 5.00 | Highly acceptable |
| | 3.41- 4.20 | Moderately acceptable |
| | 2.61- 3.40 | Fairly acceptable |
| | 1.81- 2.60 | Fairly not acceptable |
| | 0.00 -1.80 | Not acceptable |

Data gathering Procedure

Phase 1- Preparation of batuan fruits into powder.

The following were the steps in preparing batuan fruits as powdered souring product.

1. Sort and wash batuan fruits.
2. Cut batuan fruits into thin slices.
3. Dry the fruits in a cookie sheets until 10% or no moisture left.
4. Pack dry batuan fruits in a sealable plastic container.
5. Freeze dried batuan fruits overnight.
6. Grind the fruits into smooth powder.
7. Pack and label.

Phase 2- Try-out of the process

Batuan fruit were subjected to initial process of drying such as sun drying and tray drying. The weights of the fruit upon harvest, before and after drying and as powdered form were taken into considerations in grinding batuan fruit into powder.

Phase 3- Standardization of the process

After determination of the process product weight and yields were standardized.

Phase 4- Evaluation of the product (Score sheets)

In determining the acceptability of batuan powder as souring agent, a soup (pork and fish sinigang) evaluated by 10 students major in foods, 10 instructors and consumers. The different treatments (green, ripe, and controlled) were prepared for the evaluation of the products. The matrix for the criteria for judging the attributes mentioned were distributed to the panel of evaluators. Score sheets were rated by the evaluators based on the Five Point Rating Scale.

Phase 5- Data gathering , analysis and interpretation of results

After the sensory evaluation of the finished products, the score sheets were gathered, responses were recorded, tallied, summarized and prepared for computations and interpretations.

Phase 6- Proximate analysis (laboratory test) determination

Batuan fruit powder from green and ripe batuan were subjected for proximate analysis by the Department of Science and Technology. Results of the analysis were the basis for packaging and labeling of the product.

The following are the parameters for proximate analysis of batuan powder. Moisture, ash, crude protein, total fat, crude fiber, carbohydrate, and energy.(On process)

Processing Technique

The arithmetic mean were used to determine the level of acceptability of batuan fruits as souring agent in terms of appearance, aroma, flavor, and general acceptability.

To determine whether a significant difference existed in the level of acceptability of batuan fruits in different level of maturity as souring agent, the One Way Analysis of Variance were computed at 0.01 level of significance were used. A further test or a posteriori test were conducted if there is a significant difference existed.

3. RESULTS AND DISCUSSION

Sensory Evaluation

Table 3: Evaluation Results of Batuan Powder Used as Souring Agent in Fish Sinigang by Treatments in Terms of Appearance, Aroma, Flavor and General Acceptability.

| Category | N | SD | Mean | Interpretation |
|------------------------------|----|------|------|-----------------------|
| Appearance | | | | |
| Powdered Green batuan | 30 | .419 | 4.49 | Highly Acceptable |
| Powdered Ripe batuan | 30 | .398 | 4.32 | Highly Acceptable |
| Controlled | 30 | .417 | 3.47 | Moderately Acceptable |
| Total | 90 | .607 | 4.09 | Moderately Acceptable |
| Aroma | | | | |
| Powdered Green batuan | 30 | .475 | 4.43 | Highly Acceptable |
| Powdered Ripe batuan | 30 | .444 | 4.32 | Highly Acceptable |
| Controlled | 30 | .642 | 3.80 | Moderately Acceptable |
| Total | 90 | .607 | 4.09 | Moderately Acceptable |
| Flavor | | | | |
| Powdered Green batuan | 30 | .430 | 4.46 | Highly Acceptable |
| Powdered Ripe batuan | 30 | .491 | 3.95 | Moderately Acceptable |
| Controlled | 30 | .575 | 3.65 | Moderately Acceptable |
| Total | 90 | .599 | 4.02 | Moderately Acceptable |
| General Acceptability | | | | |
| Powdered Green batuan | 30 | .400 | 4.63 | Highly Acceptable |
| Powdered Ripe batuan | 30 | .473 | 4.38 | Highly Acceptable |
| Controlled | 30 | .492 | 3.75 | Moderately Acceptable |
| Total | 90 | .587 | 4.25 | Highly Acceptable |

Appearance of Fish Sinigang with Batuan Powder as Souring Agent.

As shown in Table 3, fish sinigang with young batuan powder has a mean of 4.49 (Highly Acceptable); fish sinigang with mature batuan powder has a mean was 4.32 (Highly Acceptable); and fish sinigang with commercial sinigang mix has a mean was 3.47 (Moderately Acceptable). This means that whether green or ripe batuan powder was used as souring agent to fish sinigang they were highly acceptable by the panel of evaluators in terms of appearance, while the fish sinigang with commercial souring agent was moderately acceptable by the evaluators. Among treatments, fish sinigang with green batuan powder was most preferred by the evaluators since it has the highest mean. It has a medium brown color, smooth powder which attracts the evaluators and give its attractive color.

Table 4: Mean Rating of Fish Sinigang with Batuan Powder as Souring Agent as to Appearance

| Treatment | Mean | Interpretation |
|--------------------------|------|-----------------------|
| A. Powdered Green Batuan | 4.49 | Highly Acceptable |
| B. Powdered Ripe Batuan | 4.32 | Highly Acceptable |
| C. Commercial | 3.47 | Moderately Acceptable |

Aroma of Fish Sinigang with Batuan Powder as Souring Agent.

As shown in Table 5, fish sinigang with green batuan powder had a mean of 4.32 (Highly Acceptable); fish sinigang with mature or ripe batuan powder was 4.35 (Highly Acceptable); and fish sinigang with commercial sinigang powder had a mean of 3.80 (Moderately Acceptable). This means that whether green or ripe batuan powder was used as souring agent to fish sinigang they were highly acceptable by the panel of evaluators in terms of aroma, while the fish sinigang with commercial souring agent was moderately acceptable by the evaluators. Green and ripe batuan powder were both highly acceptable since they were both from the same fruit “ batuan “, so therefore they have the scent or aroma. Among treatments, fish sinigang with green batuan powder was most preferred by the evaluators since it has the highest mean and probably the true aroma of batuan were highly manifested.

Table 5: Mean Rating of Fish Sinigang with Batuan Powder as Souring Agent as to Aroma

| Treatment | Mean | Interpretation |
|--------------------------|------|-----------------------|
| A. Powdered Green Batuan | 4.43 | Highly Acceptable |
| B. Powdered Ripe Batuan | 4.35 | Highly Acceptable |
| C. Commercial | 3.80 | Moderately Acceptable |

Flavor of Fish Sinigang with Batuan Powder as Souring Agent.

As shown in Table 6, fish sinigang with green batuan powder had a mean of 4.46 (Highly Acceptable); fish sinigang with mature or ripe batuan powder was 3.95 (Moderately Acceptable); and fish sinigang with commercial sinigang powder had a mean of 3.65 (Moderately Acceptable). This means that green batuan powder was highly acceptable as souring agent to fish sinigang as evaluated by the evaluators while ripe batuan powder and commercial souring agent were moderately acceptable by the panel of evaluators in terms of flavor. Treatments A was highly acceptable since the flavor was blended well with other ingredients and there was no after taste or bitterness, unlike with the ripe batuan powder since the seeds were already mature it causes bitterness on the flavor of sinigang.. Among treatments, fish sinigang with green batuan powder was most preferred by the evaluators since it has the highest mean and manifested the true flavor of the fruit and highly acceptable to the respondents because it was purely organic and no preservatives or additives were added to the batuan powder.

Table 6: Mean Rating of Fish Sinigang with Batuan Powder as Souring Agent as to Flavor

| Treatment | Mean | Interpretation |
|--------------------------|------|-----------------------|
| A. Powdered Green Batuan | 4.46 | Highly Acceptable |
| B. Powdered Ripe Batuan | 3.95 | Moderately Acceptable |
| C. Commercial | 3.65 | Moderately Acceptable |

General Acceptability of Fish Sinigang with Batuan Powder as Souring Agent.

As shown in Table 6, fish sinigang with young or green batuan powder had a mean of 4.63 (Highly Acceptable); fish sinigang with mature or ripe batuan powder was 4.38 (Highly Acceptable); and fish sinigang with commercial sinigang powder had a mean of 3.75 (Moderately Acceptable). This means that whether green or ripe batuan powder was used as souring agent to fish sinigang they were highly acceptable by the panel of evaluators in terms of aroma, while the fish sinigang with commercial souring agent was moderately acceptable by the evaluators. Green and ripe batuan powder were both highly acceptable since they were both from the same fruit “ bataun “, therefore they really manifested the original

scent or aroma of the fruit. Among treatments, fish sinigang with green batuan powder was most preferred by the evaluators since it has the highest mean and like most by the respondents. Though the fruit was in a powdered form but possesses the true sour flavor of batuan fruit and do not leave an after taste when added to the sinigang.

Table 7: Mean Rating of Fish Sinigang with Batuan Powder as Souring Agent as to General Acceptability

| Treatment | Mean | Interpretation |
|--------------------------|------|-----------------------|
| A. Powdered Green Batuan | 4.63 | Highly Acceptable |
| B. Powdered Ripe Batuan | 4.38 | Highly Acceptable |
| C. Commercial | 3.75 | Moderately Acceptable |

ANOVA for Appearance of Fish Sinigang with Batuan Powder as Souring Agent.

As shown in Table 8, the p value of 0.000 is lower than the alpha value of 0.01 this means significant. This means that there is significant difference in the level of acceptability of fish sinigang using batuan powder as souring agent in terms of appearance. This further means that the appearance of broth of fish sinigang differ with each other. Therefore the null hypothesis which stated that there is no significant difference in the acceptability of batuan powder as souring agent in terms of appearance was rejected.

The scheffe result showed that the difference lies between green batuan powder and commercial sinigang mix revealed that the appearance of batuan powder as souring agent differ from the commercial sinigang mix in terms of color. Batuan powder was a little bit darker in color (medium brown color) than commercial sinigang.

Table 8: ANOVA Table for Appearance of Fish Sinigang with Batuan Powder as Souring Agent

| Sources of Variance | Sum of Squares | df | Mean Sum of Squares | F-Value | p-Value |
|---------------------|----------------|----|---------------------|---------|---------|
| Between Groups | 18.123 | 2 | 9.061 | 53.362 | .000* |
| Within Groups | 14.773 | 87 | .889 | | |
| Total | 32.896 | 89 | | | |

Significant p 0.01

ANOVA for Aroma of Fish Sinigang with Batuan Powder as Souring Agent.

As shown in Table 9, the p value of 0.000 is lower than the alpha value of 0.01 this means significant. This means that there is significant difference in the level of acceptability of fish sinigang using batuan powder as souring agent in terms of aroma. This further means that the aroma of broth of fish sinigang differ with each other. Therefore the null hypothesis which stated that there is no significant difference in the acceptability of batuan powder as souring agent in terms of aroma was rejected.

The scheffe result showed that the difference lies between green batuan powder and commercial sinigang this was revealed that the aroma of batuan powder as souring agent differ from the commercial sinigang mix.

Batuan powder was most preferred by the respondents probably it possesses the pure and organic aroma of a true batuan fruit.

Table 9: ANOVA Table for Aroma of Fish Sinigang with Batuan Powder as Souring Agent.

| Sources of Variance | Sum of Squares | df | Mean Sum of Squares | F-Value | p-Value |
|---------------------|----------------|----|---------------------|---------|---------|
| Between Groups | 6.980 | 2 | 3.490 | 12.515 | .000* |
| Within Groups | 24.260 | 87 | .279 | | |
| Total | 31.24089 | | | | |

Significant p 0.01

ANOVA for Flavor of Fish Sinigang with Batuan Powder as Souring Agent.

As shown in Table 10, the p value of 0.000 is lower than the alpha value of 0.01 this means significant. This means that there is significant difference in the level of acceptability of fish sinigang using batuan powder as souring agent in terms of flavor. This further means that the flavor of broth of fish sinigang differ with each other. Therefore the null hypothesis which stated that there is no significant difference in the acceptability of batuan powder as souring agent in terms of flavor was rejected.

The scheffe result showed that the difference lies between treatment green batuan powder, ripe batuan powder and commercial sinigang mix. It was revealed that the flavor of batuan powder as souring agent differ from each other. Findings imply that green batuan powder was very apparent in terms of sourness and it does not leave a bitter after taste compared to ripe batuan powder.

Table 10: ANOVA Table for Flavor of Fish Sinigang with Batuan Powder as Souring Agent.

| Sources of Variance | Sum of Squares | df | Mean Sum of Squares | F-Value | p-Value |
|---------------------|----------------|----|---------------------|---------|---------|
| Between Groups | 9.974 | 2 | 4.987 | 19.739 | .000* |
| Within Groups | 21.981 | 87 | .253 | | |
| Total | 31.956 | 89 | | | |

Significant p 0.01

ANOVA for General Acceptability of Fish Sinigang with Batuan Powder as Souring Agent.

As shown in Table 11, the p value of 0.000 is lower than the alpha value of 0.01 this means significant. This means that there is significant difference in the level of acceptability of fish sinigang using batuan powder as souring agent in terms of general acceptability. This further means that as to general acceptability of broth of fish sinigang differ with each other. Therefore the null hypothesis which stated that there is no significant difference in the acceptability of batuan powder as souring agent in terms of general acceptability was rejected.

The scheffe result showed that the difference lies between treatment green batuan powder to commercial sinigang and ripe batuan powder to commercial sinigang. It was revealed that the general acceptability of batuan powder as souring agent differ from the commercial sinigang mix in terms of general acceptability. It is preferred most by the respondents considering its nutritive value, purely organic and no additives added.

Table 11: ANOVA Table for General Acceptability of Fish Sinigang with Batuan Powder as Souring Agent.

| Sources of Variance | Sum of Squares | df | Mean Sum of Squares | F-Value | p-Value |
|---------------------|----------------|----|---------------------|---------|---------|
| Between Groups | 12.515 | 2 | 6.257 | 29.929 | .000* |
| Within Groups | 18.189 | 87 | .209 | | |
| Total | 30.704 | 89 | | | |

Significant p 0.01

Acceptability of Pork Sinigang with Batuan Powder Souring Agent as to Appearance

As shown in Table 3, Pork Sinigang with ripe batuan powder has a mean of 4.43 (Highly Acceptable); Pork Sinigang with green batuan powder was 4.56 (Highly Acceptable); and Pork Sinigang with commercial souring agent was 3.06 (Moderately Acceptable). This means that pork sinigang with green batuan powder and pork sinigang with ripe batuan powder were highly acceptable to the evaluators while pork sinigang with commercial souring agent was moderately acceptable by the panel of evaluators. Among treatments, pork sinigang with green batuan powder was most preferred by the evaluators since it has the highest mean and it blended well with pork with light reddish color which added appeal to the broth of sinigang.

Table 12: Mean Rating of Pork Sinigang with Batuan Powder as Souring Agent as to Appearance

| Treatment | Mean | Interpretation |
|--------------------------|------|-----------------------|
| A. Powdered Ripe batuan | 4.43 | Highly Acceptable |
| B. Powdered Green batuan | 4.56 | Highly Acceptable |
| C. Commercial | 3.06 | Moderately Acceptable |

Acceptability of Pork Sinigang with Batuan Powder as Souring Agent as to Aroma

4.20 (Highly Acceptable); Pork Sinigang with Green Batuan powder was 4.45 (Highly Acceptable); and Commercial souring agent was 4.10 (Moderately Acceptable). This means that pork sinigang with Green and ripe Batuan powder and pork were highly acceptable to the evaluators while pork sinigang with commercial souring agent was moderately acceptable to the panel of evaluators. Results of the study revealed that Green Batuan powder was most preferred by the evaluators in terms of aroma probably because of the pleasant sour smell of batuan and resembles the true aroma of the fruit.

Table 13: Mean Rating of Pork Sinigang with Batuan Powder as Souring Agent as to Aroma

| Treatment | Mean | Interpretation |
|--------------------------|------|-----------------------|
| A. Powdered Ripe Batuan | 4.20 | Highly Acceptable |
| B. Powdered Green Batuan | 4.45 | Highly Acceptable |
| C. Commercial | 4.10 | Moderately Acceptable |

Acceptability of Pork Sinigang with Batuan Powder as Souring Agent as to Flavor

As shown in Table 5, Pork Sinigang with Ripe Batuan powder has a mean of 4.56 (Highly Acceptable); Pork Sinigang with Green Batuan powder was 3.58 (Highly Acceptable); and commercial Souring agent was 4.24 (Highly Acceptable). This means that Pork Sinigang with ripe and green batuan powder, and commercial souring agent were highly accepted by the evaluators. Study shows that among the treatments, treatment B,

Pork Sinigang with Green Batuan powder was highly accepted by the evaluators for its well-blended sour and pleasant taste and comparable to the existing flavor of commercial souring agent. It further added to acceptability of the respondents as to the flavor because it is purely organic.

Table 14: Mean Rating of Pork Sinigang with Batuan Powder as Souring Agent as to Flavor

| Treatment | Mean | Interpretation |
|--------------------------|------|-------------------|
| A. Powdered Ripe Batuan | 4.56 | Highly Acceptable |
| B. Powdered Green batuan | 4.58 | Highly Acceptable |
| C. Commercial | 4.24 | Highly Acceptable |

General Acceptability of Pork Sinigang with Batuan Powder as Souring Agent.

As shown in Table 6, Pork Sinigang with ripe batuan powder has a mean of 4.33 (Highly Acceptable); pork sinigang with green batuan powder was 4.50 (Highly Acceptable); and commercial souring agent was 4.13 (Moderately Acceptable). This means pork sinigang with ripe Batuan powder and pork sinigang with green Batuan powder were highly acceptable to the evaluators while pork sinigang with commercial souring agent was moderately acceptable to the evaluators. Results of the study shows that among the three treatments A,B,C, treatment B pork sinigang with Green Batuan powder was highly acceptable to the evaluators probably other ingredients blended well with sour and pleasant powder taste of batuan with no after taste felt on the mouth. Commercial souring agent was moderately acceptable to the evaluators thus the taste of sinigang was so apparent, that when commercial souring agent was added to cooked food the natural flavor, appearance, and aroma though enhance but evaluators most preferred a natural souring agent (batuan) with no additives added.

Table 15: Mean Rating of Fish Sinigang with Batuan Powder as Souring Agent as to General Acceptability

| Treatment | Mean | Interpretation |
|--------------------------|------|-----------------------|
| A. Powdered Ripe Batuan | 4.33 | Highly Acceptable |
| B. Powdered Green Batuan | 4.50 | Highly Acceptable |
| C. Commercial | 4.13 | Moderately Acceptable |

ANOVA for Appearance of Pork Sinigang with Batuan Powder as Souring Agent

As shown in Table 7, the P value of 0.003 is higher than the alpha value of 0.01 this means significant. This means that there is a significant difference in the level of acceptability of pork sinigang with ripe batuan powder, pork sinigang with green batuan powder and pork sinigang with commercial souring agent in terms of appearance. This further means that the appearance of pork sinigang with ripe batuan powder, pork sinigang with green batuan powder and pork sinigang with commercial souring agent were not similar. Therefore the null hypothesis which stated that there is significant difference in the acceptability pork sinigang whether it is flavored with ripe batuan powder, green Batuan powder and commercial souring agent as to appearance was rejected.

Table 16: ANOVA Table for Appearance of Pork Sinigang with Batuan Powder as Souring Agent

| Sources of Variance | Sum of Squares | df | Mean Sum of Squares | F-Value | p-Value |
|---------------------|----------------|----|---------------------|---------|---------|
| Between Groups | 3.939 | 2 | 1.969 | 6.140 | .003* |
| Within Groups | 27.905 | 87 | .321 | | |
| Total | 31.844 | 89 | | | |

significant p 0.01

ANOVA for Aroma of Pork Sinigang with Batuan Powder as Souring Agent

As shown in Table 8, the P value of 0.036 is lower than the alpha value of 0.01 this means no significant. This means that there is no significant difference in the level of acceptability of pork sinigang with ripe batuan powder, pork sinigang with green batuan powder and pork sinigang with commercial souring agent in terms of aroma. This further means that the aroma of pork sinigang with ripe batuan powder, pork sinigang with green batuan powder and pork sinigang with commercial souring agent were not similar. Therefore the null hypothesis which stated that there is no significant difference in the acceptability of pork sinigang whether it is flavored with ripe batuan powder, green batuan powder and commercial souring agent as to aroma was rejected. Results revealed that aroma of batuan powder is very comparable with commercial sinigang when used as souring agent.

Table 17: ANOVA Table for Aroma of Pork Sinigang with Batuan Powder as Souring Agent

| Sources of Variance | Sum of Squares | df | Mean Sum of Squares | F-Value | p-Value |
|---------------------|----------------|----|---------------------|---------|---------|
| Between Groups | 1.971 | 2 | .985 | 3.466 | .036 |
| Within Groups | 27.905 | 87 | .284 | | |
| Total | 26.704 | 89 | | | |

not significant p 0.01

ANOVA for Flavor of Pork Sinigang with Batuan Powder as Souring Agent

As shown in Table 9, the P value of 0.018 is lower than the alpha value of 0.01 this means not significant. This means that there is no significant difference in the level of acceptability pork sinigang with ripe batuan powder, pork sinigang with green batuan powder and pork sinigang with commercial souring agent of terms of flavor. This further means that the flavor of pork sinigang with ripe batuan powder, pork sinigang with green Batuan powder and pork sinigang with commercial souring agent were all similar. Therefore the null hypothesis which stated that there is no significant difference in the acceptability of pork sinigang whether it is flavored with ripe batuan powder, green batuan powder and commercial souring agent as to flavor was accepted. Results of the study further revealed that in terms of flavor batuan powder was very much comparable with the existing souring agent in the market.

Table 18: ANOVA Table for Flavor of Pork Sinigang with Batuan Powder as Souring Agent

| Sources of Variance | Sum of Squares | df | Mean Sum of Squares | F-Value | p-Value |
|---------------------|----------------|----|---------------------|---------|---------|
| Between Groups | 2.273 | 2 | 1.136 | 4.184 | .018 |
| Within Groups | 23.633 | 87 | .272 | | |
| Total | 25.906 | 89 | | | |

no significant p 0.01

ANOVA for General Acceptability of Pork Sinigang with Batuan Powder as Souring Agent

As shown in Table 10, the P value of 0.033 is lower than the alpha value of 0.01 this means no significant. This means that there is no significant difference in the level of acceptability of pork sinigang with ripe batuan powder, pork sinigang with green batuan powder and pork sinigang with commercial souring agent in terms of general acceptability. This further means that in terms of general acceptability pork sinigang made with ripe batuan powder, green batuan powder and commercial souring agent were almost the same. Therefore the null hypothesis which stated that there is no significant difference in the acceptability of pork sinigang flavored ripe batuan powder, green batuan powder and commercial souring agent as to general acceptability was accepted. Results also showed that batuan powder can be a good souring agent in food dishes such as fish and pork sinigang.

Table 19: ANOVA Table for General Acceptability of Pork Sinigang with Batuan Powder as Souring Agent

| Sources of Variance | Sum of Squares | df | Mean Sum of Squares | F-Value | p-Value |
|---------------------|----------------|----|---------------------|---------|---------|
| Between Groups | 2.022 | 2 | 1.011 | 3.542 | .033 |
| Within Groups | 42.206 | 87 | .520 | | |
| Total | 49.856 | 89 | | | |

Not significant p 0.01

Economic Parameters of Batuan Fruits as Souring Agent

As shown in the table , with the same quantity of batuan fruits green or ripe , the weight decreases when the fruit is dried and processed into powder. The results revealed that the absence of moisture in the fruits through sun drying was a great factor in the decrease of weight and when it was grounded into powder.

It was further noted that green batuan fruits has greater shrinkage when compared to the ripe batuan fruits may be due to the amount of moisture present in it. However, ripe batuan fruits needs more than a week of sun drying may be due to the seeds which cannot be immediately penetrated by the heat of the sun. It was further revealed that it was very hard to ground ripe batuan probably because of its hard flinty seeds.

Table 20: Economic Parameters of Powdered Batuan Fruits in terms of Weight during the time of harvest, after Drying and Powdered.

| Green Batuan Fruits | | Ripe Batuan Fruits | |
|---|-----------------------------|--|---------------------------------------|
| Weight of fresh green batuan fruits in kilogram | 1 kilogram | Weight of fresh ripe batuan fruits in kilogram | 1 kilogram |
| No. of days to dry Green batuan fruits | 1 week with enough sunshine | No. of days to dry Ripe batuan fruits | more than 1 week with enough sunshine |
| Weight of dried green batuan | 750 grams | Weight of dried ripe batuan | 800 grams |
| Weight Powdered green batuan fruits | 375 grams or 50% | Weight Powdered ripe batuan fruits | 600 grams or 60% |

Economic Parameters as to Approximate Market Price of Batuan Powder

| | Unit Price/Kg | Weight | Weight in Powder | Weight /Pack | Price/pack |
|------------------------|---------------|--------|------------------|--------------|------------|
| Green Batuan Powder | Php. 40.00 | 1 kg. | 375 g. | 25 g./pack | Php.15.00 |

No. of packs made for 1 kg. batuan powder : 15 packs
 Approximate amount per pack : Php.15.00
 Total amount for 15 packs : Php. 225.00
 Approximate profit /375g. powder : Php. 185.00
 Less :
 Grinding : 10.00
 Packaging (Approx.2.00/pack) 30.00
 Profit / 375g powder : Php. 145.00

Storage for Batuan Powder

Batuan powder when properly sealed and kept on appropriate storage conditions like sealed plastic bags and bottles extends its shelf-life from six months to one year under refrigeration for about 40 degree Celsius. However, if the powder will be exposed to air and excessive humidity the characteristics tend to become lumpy which causes the staling of the powder and loses its aroma in just a week. It was further noted that dried batuan fruit if properly sealed and kept in the refrigerator has a shelf-life of more than one year. The batuan powder was tested for acceptability after one year for fish and pork sinigang and results revealed that batuan fruit powder got the highest mean and very much comparable in terms of organoleptic characteristics as to appearance, aroma, flavor, and general acceptability compared to the commercial souring agent sold in the market.

Table 21: Storage /Shelf-life of Batuan Fruit Powder

| Forms of batuan fruit | Container | Shelf-life | Remarks |
|---|--------------------|----------------------|-------------------------|
| Batuan powder (G&R) (Room temperature) | Sealed plastic bag | 6 months or more | Stable (not opened) |
| | Sealed Bottle | 6 months to one year | Stable (not opened) |
| | Food Keeper | 2-3 months | Unstable (opened often) |
| Dried batuan (Room temperature) | Sealed plastic bag | 6 months or more | Stable (not opened) |
| | Sealed Bottle | 6 months to one year | Stable (not opened) |
| | Food Keeper | 2-3 months | Unstable (opened often) |
| Batuan powder(G&R) (Refrigerated) | Sealed plastic bag | 1 year | Stable (not opened) |
| | Sealed Bottle | 1 year | Stable (not opened) |
| | Food Keeper | 6 months | Stable (if not opened) |
| Dried batuan (Refrigerator) | Sealed plastic bag | 1 year | Stable (not opened) |
| | Sealed Bottle | 1 year | Stable (not opened) |
| | Food Keeper | 3-6 months | Stable (if not opened) |

4. CONCLUSIONS

Based on the findings of the study the following conclusions were made:

Ripe batuan powder and green batuan powder was generally acceptable to be processed as a condiment to be used as souring agent for food preparation.

Pork and Fish Sinigang made with Green Batuan powder was highly acceptable compared with twoother treatments , ripe batuan powder and commercial since it has the highest mean in terms of appearance, aroma, nflavor and general acceptability.

Pork and Fish Sinigang with commercial souring agent were rated with lowest mean among the treatments in terms of aroma, appearance, flavor and general acceptability probably because the evaluators preferred the organic characteristics of batuan powder.

It was found out that there is significant difference in terms of appearance but no significant difference in terms of aroma, flavor and general acceptability as evaluated by the evaluators for pork sinigang.

It was found out that there were significant difference in terms of appearance, aroma, flavor and general acceptability when batuan was used as souring agent for fish sinigang.

Minimum required length to dry batuan fruit is one week, with enough sunshine for green batuan and more than one week for ripe batuan fruit probably of its hard flinty seeds which could not be easily penetrated by heat.

Batuan fruit decreases its weight from fresh to dried and when processed from dried to powder.

Batuan powder maintain its shelf-life longer when stored on sealed bags and glass bottled either room temperature or under refrigeration.

5. RECOMMENDATIONS

Based on the findings and conclusions made the following are hereby recommended:

Batuan as souring powder (Green and Ripe) are highly acceptable as souring agent and can be recommended as a healthy condiment for food preparation.

Further studies on Batuan powder in different processes specifically on cost nutritive value is considered.

The product maybe disseminated to the public through seminars, trainings, demonstrations in order to ensure the utilization of pork sinigang with Batuan powder in different processes.

For the industry is encouraged to produce batuan powder for additional choices for consumer and provide a market with new condiments made from indigenous ingredients.

Introduction of chili and taro powder as additional flavor enhancement is recommended.

The result of the study will be disseminated to Food Technology and HRST Teachers that they will use batuan in their laboratory activities to make students aware and appreciate its importance.

Utilized batuan fruit powder in the demonstrations during training and extension program in the form of livelihood activities and provide a sustainable market with new products.

Food technologist and nutritionist are encouraged to improve the quality of the product which will be more acceptable and palatable to the consumer and will consider their health benefits.

Follow up studies be conducted to ascertain the validity of the results and to determine the nutritive value in different proportions.

Other researchers are encouraged to further investigate the usefulness of batuan powder not as condiment only but for other purposes as well.

Appropriate packaging materials is recommended for the next study to ascertain the product quality for the purpose of product commercialization.

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