

**DEVELOPMENT AND ACCEPTABILITY OF JAM FROM YAM  
WITH CABBAGE (*BRASSICA oleracea*) AND LIME  
(*CITRUS microcarpa*)****Rian Louie B. Botin<sup>1</sup>, Jey Ann V. Medianero<sup>2</sup>, Rhenze L. Vigo<sup>3</sup>,  
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**ABSTRACT**

*The study produced jam that was combined with cabbage and calamansi juice. It calculated the amount of ingredients needed to make jam (10g calamansi juice and 15g chopped cabbage), as well as the product's acceptability in terms of appearance, aroma, taste, and texture. The items came from three treatments: Control (Treatment 1), 10g of calamansi juice in Treatment 2, and 10g of calamansi juice and 15g of chopped cabbage in Treatment 3. The t-test and ANOVA (Analysis of Variance) were used to analyze the data in order to find the treatment differences that were statistically significant. Experts' sensory evaluation of T1-Jam (Control), T2-Jam with calamansi juice, and T3-Jam with calamansi juice & Cabbage compared to T1-Jam (Control) showed that all three treatments had somewhat similar adjectival descriptions, despite differences in their means. Regarding T2-Jam with Calamansi Juice, it outperformed the other two treatments in terms of mean scores for appearance, aroma, and texture; however, texture received a lower score than the mean for all three quality attributes. Treatment 2 had the highest overall mean among the quality attributes, while treatment 3 had the lowest. When the acceptability of the jam was tested in three different treatments, treatment 3 had the lowest acceptability, while the jam with calamansi juice had the highest acceptability. The sensory evaluation conducted by experts taking gender into account revealed a significant difference in the treatments given to males and females in terms of the appearance, aroma, and taste of the jam made with calamansi juice and the jam made with calamansi juice and cabbage. Age differences could be seen in the appearance of T1—jam (control) and T3—jam with calamansi juice and cabbage. T1 - jam (Control) and T3 - jam with calamansi juice & cabbage differed from each other in terms of aroma, and T3 was clearly different in terms of texture. The sensory evaluation of experts based on income results revealed a significant difference in the quality of the jam. T1 - jam (control) and T3 - jam with calamansi juice & cabbage - had different appearances and aromas. There was a taste difference between T2-jam with calamansi juice and T3-jam with calamansi juice & cabbage; however, there was only a texture difference between the two jams. The sensory evaluation of experts on the quality of the jam revealed a significant difference in texture and aroma between T3 - Jam with calamansi juice & cabbage and T1 - Jam (Control). The results showed that there was a difference in appearance between T2 (jam with calamansi*

juice) and T3 (jam with calamansi juice and cabbage), as well as between the two groups overall. Age-related differences in taste were noticeable between T2-jam with calamansi juice and T3-jam with calamansi juice and cabbage. When comparing the acceptability of products based on income between treatments, the appearance, aroma, and texture of treatment 2 (jam made with calamansi juice) showed a significant difference. Treatment 2 (jam with calamansi juice) and Treatment 3 (jam with calamansi juice & cabbage according to taste) both showed variation. Overall, there was a noticeable difference in the products' quality attributes between Treatment 1-Jam (Control) and Treatment 2-Jam with calamansi juice. Similar differences were observed in the appearance, taste, aroma, and texture of the jam with calamansi juice and cabbage compared to the jam (control).

*Keywords: Yam jam development acceptability evaluation*

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## 1. Introduction

Malnutrition affects millions of people, with most having weight below average and one billion obese. Young children under five are undernourished and suffering from common illnesses. In Q1 2023, 2.7 million Filipino households experienced hunger, with involuntary hunger occurring at least once in the previous three months. The hunger rate for the first three months was slightly higher than for the following months, according to the social welfare service office.

Researchers conducted a study on jam to address malnutrition by focusing on its health benefits and cost-effectiveness. Jam, a purée made from fruit and vegetable flesh, is a popular and nutritious food source. It contains a variety of flavors and is easily spread. Jam is a universal favorite with a high moisture content, calories, carbohydrates, sugars, fiber, protein, fat, and ash. It also contains vitamin C, iron, copper, and vitamin B2 levels. Jam is a universal favorite with numerous uses, making it a cost-effective and nutritious food option.

Homemade jam is a simple process of simmering fruit with sugar and lemon juice until it thickens. Popular fruits like strawberries, raspberries, and apricots can be used. Jams are rich in vitamins, minerals, probiotics, and vitamin A, which strengthen the immune system and aid in defense against viruses and illnesses. They also help restore youthful skin and provide dietary fiber, aiding in the removal of impurities. Proper skin care not only benefits health but also looks young and healthy.

This study explores the use of purple cabbage in making homemade purple jam, a popular and affordable root crop in Roxas City. The study suggests that purple cabbage can be used as a natural flavoring, providing additional vitamins and minerals to the jam. This could be beneficial for hotels and restaurants, as it offers unique flavors and versatility, making it an attractive option for customers. Likewise, the use of purple cabbage as an additive in homemade jam can provide valuable information for cooking enthusiasts and families. This method can be used to create healthy snacks and generate extra income by baking and selling jam with cabbage and lime. It also explores the acceptability of using purple cabbage in making healthy snacks which justify the conduct of the study.

### Statement of the Problem

The main objective of the study was to produce Jam with Cabbage and lime.

Specifically, this study aimed to:

1. Determine the proportion of the ingredients for purple yam, sugar, condense with the Cabbage and lime that would yield Jam with cabbage and lime comparable with the commercial jam.
2. Determine the acceptability of the product considering sensory quality attributes in terms of appearance, taste, texture, and aroma.
3. What is the level of sensory qualities of jam with cabbage and lime treatment (2) in terms of appearance, texture, taste, and aroma?

4. What is the level of sensory qualities of jam with cabbage and lime (treatment 3) in terms of appearance, texture, taste, and aroma?

5. Is there a significant difference in the sensory qualities in terms of appearance, aroma, taste and texture between:

- a. treatment 1 and treatment 2; and
- b. treatment 1 and treatment 3;

### Hypotheses

1. There is no significant difference in the sensory qualities of treatment 1 and treatment 2 in terms of the three (3) sensory qualities.
2. There is no significant difference in the sensory qualities of treatment 1 and treatment 3 in terms of the three (3) sensory qualities.

### Theoretical Framework

The study by Viswavidyalaya and Mondouri (2017) in India aimed to determine the best combination of two sweet potato cultivars for making jam. The study involved making jam samples, sterilizing them, and testing them for total sugar, ascorbic acid, hydrogen ion concentration, total soluble solids, reducing and non-reducing sugars, and total sugar content. The TSP-12-14 (100%) combination showed good overall acceptability and superior biochemical retentions even after 60 days of storage. The study suggests that adding jam with other ingredients might have similar effects.

Sweet potato, a dicotyledonous plant, is the most important food crop after rice, wheat, potato, maize, and cassava. Tubers from 80 sweet potato varieties have varying amounts of starch, crude fiber, protein, ash, and fat. Sweet potato tubers contain ascorbic acid, which reduces the 6-dichlorophenol indophenols dye to a colorless leuco-base, resulting in a pink color when oxidized to dehydro-ascorbic acid.

### Conceptual Framework

The conceptual framework used showed the independent dependent schematic diagram. As seen from figure 1, the independent variables were the three treatments namely Jam, Jam with 480g of cabbage and 28.6g of lime, and lastly Jam with 240g of cabbage and 14.3g of lime, while the dependent variable is the acceptability of the four sensory qualities such as appearance, texture, taste and aroma.

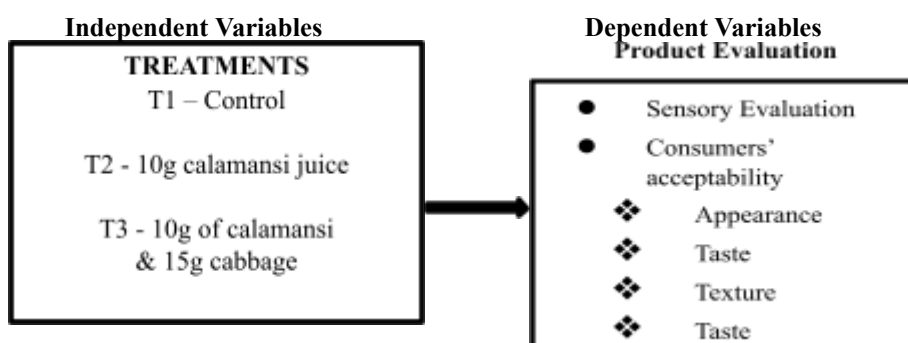


Figure 1. Conceptual Framework of the study.

## 2. Literature Review

### Foreign Literature

Purple sweet potato (PSP) is a functional food with health benefits due to its anthocyanins, which are found in fruits, vegetables, and flowers. However, anthocyanins can discolor during processing due to light intensity and temperature. PSP contains pectin, which is used as a gelling, thickening, and

stabilizing agent in foods like jam. PSP jams can be made from raw PSP and PSP flour, with different treatments impacting their physico-chemical characteristics. This study aimed to evaluate the physico-chemical properties and acceptability of PSP jams made from raw PSP and PSP flour with varying pectin levels.

Jam, made from crushed or finely chopped fruits, is a popular food preservation method in the US. Originating from the Middle East, jams were initially made with honey as a sweetener. Sugar quickly became the preferred sweetener for jams. The US introduced jam making and preserves to colonists who had tasted jam in their home countries. Jams became popular in Europe due to the sweet tooth of royal families who could afford sugar and required bakers to make them.

Jam production has grown globally, with individuals and businesses adding it to other ingredients and improving packaging. It is sterile, safe, and shelf-stable. However, the popularity of jam led to increased sugar prices in the 1970s, as companies added high-fructose corn syrup instead of sugar, making the produce unhealthy. This led to the artisan home-making movement. Jam is a result of sugar becoming more common in Europe, but the Romans laid the groundwork for its creation. Ancient humans used jams to preserve fruits during summer and winter, storing them in small jars with appropriate sweetness. Ancient humans also used honey liquids to coat fruits, making jam the first jam-like preserve. Today, jam is enjoyed by many people, but the Romans laid the groundwork for modern jam production.

Honey consumption began 2.5 million years ago, but with advancements in cultures, humans discovered that storing honey with fruits over time preserves the fruit and modifies its taste. This led to the development of jams, which are made by storing fruits over refrigeration and preserving quality for longer shelf life. Jams are made from canned and container fruits, which are convenient for travel. They provide vitamin C (ascorbic acid), which acts as antioxidants and boosts the immune system. Cooking lowers the vitamin C content but also reduces its volume, making jams a better source of vitamin C. Fruit jams are a valuable source of resistant nutrients and elements, including probiotic microorganisms, nutrients, natural fiber, and l-ascorbic acid, which have a long history of supporting immunity and defense against bacteria and viruses.

Jam is beneficial for digestion due to its nutritional fibers like folate and potassium, which help prevent constipation. It also helps reduce heart-related diseases and complications, as heart problems account for one-third of lost lives worldwide. Fruit jams, rich in vitamins, micronutrients, flavonoids, and dietary materials, can build a strong and healthy heart, reducing the risk of stroke, heart attack, and other coronary heart disease-related conditions. Consuming nutrient-rich jams is recommended for overall health.

Fruit jams are rich in micronutrients, which help make skin soft and smooth, restoring former glow and suppleness. Fruits are also a good source of natural fiber, aiding in cleansing the body from waste. Skin care is crucial for good health and youthful appearance. In the US, fresh fruit sales accounted for 45% of the produce segment's total sales in 2022, with an average CPI of 406.3. The Dietary Guidelines for Americans recommend consuming more fruits and vegetables, but fruit consumption per individual decreased from 117.25 pounds in 2020 to 116.8 pounds in 2021. Fresh bananas were consumed more than any other fruit.

India, a diverse nation with diverse agroclimatic conditions, is the second-largest producer of fruits and vegetables, accounting for 30% of global production. Fruits are rich in vitamins A and C and have high sugar content, making them essential for human nutrition. However, between 16 and 72% of fruits spoil during storage and transit, necessitating fruit preservation. Fruit jam, a food product made by crushing or chopping fruit, adding sugar, and heating to a specific temperature, is a common method.

Lawrence and Franklin described fruit jams as thick, sweet spread made by crushing or chopping fruits with sugar, pectin, water, and cooking. While Bloomfield, in 1998, used a mixture of fruits and sweetening agents brought to a gelled consistency with or without a other ingredients and called the product as jam. The fruit jam formulation constituted about 68.5% of total soluble solids, and the fruit composition was 45%. The study shows that 27% of essential nutrients were found in the fruit jam during the analysis using the AOAC (Association of Official Agricultural Chemists) method. The fruit jam provides a good source of biological compound (starches and cellulose) and energy whereas the sugar content lowers water activity and increases shelf life. There is a wide variety of fruit jams, like strawberry jam, raspberry jam, wild plum jam, strawberry jam, watermelon jam, mango jam, mixed fruit jam and

other jam products produced by different companies. It is also combined with different food products in making pancakes, ice cream, and toast.

Fruit jams are thick, sweet spreads made by crushing or chopping fruits with sugar, pectin, water, and cooking. Bloomfield's 1998 study used a mixture of fruits and sweetening agents, resulting in a gelled jam. The jam contains 68.5% of total soluble solids and 45% fruit composition. It contains 27% essential nutrients and is a good source of biological compounds and energy. There are various fruit jams, including strawberry, raspberry, wild plum, strawberry, watermelon, mango, and mixed fruit jam. They are also used in pancakes, ice cream, and toast.

### **Related Studies**

Calamansi juice has numerous benefits, including skin bleaching, cleansing, weight loss, diabetes control, and respiratory health benefits. It can also help with acid reflux, height gain, weight loss, skin lightening, body cleansing, cholesterol reduction, diabetes management, and respiratory health. Acid was extracted from lemon juice using a selective adsorption process, and the juice was mixed with citric acid and sucrose. The highest concentration of acid inhibited sweetness, while sucrose blocked citric acid intensity.

Lee's (2000) study found that cabbage fruit had a moisture content of 83.8%, a skin color range of 45.6 to 26.7, and a juice recovery of 35.8%. The juice had color, TTA of 5.8%, pH of 2.4, TSS of 8.5, and viscosity of 5.1 cP. The calamansi drink had product characteristics of 18.5 for color, 0.6% for TTA, 3.1 for pH, and 12.8 for TSS. Wennberg (2006) found that dietary fiber was impacted by storage and maturity, with early cultivar "Balbro" losing only 2% of its total dietary fiber after heat treatment.

Cheong (2012) studied the volatiles, physicochemical characteristics, and non-volatiles of citrus juices from Malaysia, the Philippines, and Vietnam. They extracted volatile components from manually squeezed calamansi juices using methanolic and headspace solid-phase microemulsion. Gas chromatography–mass spectrometry and flame ionization detector were used for analysis. The study identified several volatile compounds and trace level volatiles as the primary cause of variations in juices from different locations. Garg et al.'s 2019 study found that jamun-kiwifruit jam had the lowest amount of 5-hydroxymethyl-2-furaldehyde and the highest number of antioxidants, tartaric acid, ascorbic acid, lactic acid, and lactic acid.

Fruits are perishable and available in specific seasons, making them suitable for stable products like juices, pickles, jams, and jellies. Jam, a processed fruit product with intermediate moisture content, is produced by boiling fruit pulp with sugar, acid, and pectin. The Glycaemic Index (GI) measures how well the body reacts to carbohydrates in food, with high GI causing blood glucose levels to rise. A common foodservice concoction made from citrus fruit is thought to have no effect on blood sugar levels.

### **Local Literature**

The Philippines Jam Jelly and Preserves Market experienced a CAGR decline of -1.4% in 2022 compared to 2017, but a 54.96% increase in value shipments compared to 2021, with a lower index number indicating more active business or exporting nations.

The Philippines has increased its reliance on domestic production to meet rising demand for jam, jelly, and preserves. In 2022, the market had an import factor of 0.8, compared to 0.56 in 2017. Leading countries in the market were China, Thailand, Vietnam, the United States, and other Asian nations. China had the highest share at 29.16%, with a shipment value of 5.26 million USD. This advantage was due to selling the product at less than the average market price. The rise in the jam, jelly, and preserves market in the Philippines can be attributed to consumers' growing awareness of health, demand for natural and organic food products, ethnic cuisine popularity, and investments in food processing industries.

The jam, jelly, and preserves market in the Philippines is dominated by four product lines: preserves, jams, jellies, and marmalade. The market's growth is attributed to the increasing popularity of Filipino food and the need for health-conscious jams and preserves. Major players in the market include Lucenzo's Inc., Dole Philippines Inc., Bangkok Grocery Co Ltd., Serenbe Foods Corporation, Nestle SA

(Thailand) Co Ltd., Jollibee Foods Corporation, SM Prime Holdings, Inc., Sinar Mas Agroindustrial Corp., and Ferrara Candy Company Inc.

Consuming jams can cause side effects such as energy crashes, fatigue, and increased risk of diabetes. High blood sugar levels indicate a high future risk of disease. Other factors contributing to health issues include high blood pressure, high LDL cholesterol, diabetes, smoking, obesity, poor diet, and lack of physical activity. Obesity is also a risk, as people consume more calories than they burn through activity. Therefore, it's crucial to monitor and manage sugar intake to prevent health issues.

### 3. Research Methods

The study aimed to develop jam with calamansi juice and cabbage, determining the proportion of ingredients, sensory attributes, and acceptability of the product. A completely randomized design (CRD) with three replications was used, with each experimental unit having equal chances of receiving any one treatment. The sensory characteristics were determined through experts' evaluation, with the 9-point Hedonic scale used as a measure of product quality. The sensory evaluation was conducted by ten pastry production experts and five CHTM teachers of Colegio De La Purisima Concepcion, while the acceptability evaluation involved 100 tasters/respondents. The data was analyzed using t-test and ANOVA to determine significant differences among treatments.

#### Product Formulation Matrix

The product development was done in three (3) treatments as illustrated.

**Table 1. Product Formulation Matrix of Ingredients per Treatment**

Treatment	Treatment 1	Treatment 2	Treatment 3
Sweet potato	325g,	325g,	325g,
Condensed milk	250g	250g	250g
Melted butter	50g	50g	50g
Sugar	30g	30g	30g
Vanilla extract	5g	5g	5g
Food coloring	5g	5g	5g
Calamansi juice	-	10g	15g
Chopped cabbage	-	15g	10g
<b>Total</b>	670g	670g	670g

#### Sensory Evaluation and Consumer Preference on the products

The sensory evaluation involved ten pastry production experts and five CHTM teachers from Colegio De La Purisima Concepcion. The consumers' acceptability evaluation involved 100 Hotel Management students and 90 respondents from different year levels. The products were replicated three times and evaluated on a 9-point Hedonic scale using a researcher-made questionnaire. Researchers used a score sheet and 9-point Hedonic scale to assess sensory acceptability of three Jam treatments, with experts rating samples and 100 tasters evaluating each treatment.

#### Ingredients

The score on each item was interpreted based on the results of the computation as to taste, texture, odor, flavor, and general appearance using the following scoring interval and verbal interpretation.

**Figure 6. Scoring Guide**

**Score Interval**  
8.12-9.00

**Verbal Interpretation**  
Like extremely

7.23-8.11	Like very much
6.34-7.22	Like moderately
5.45-6.33	Like Slightly
4.56-5.44	Neither like or slightly like
3.67-4.43	Dislike slightly
2.78-3.66	Dislike moderately
1.89-2.77	Dislike very much
1.00-1.88	Dislike extremely

#### 4. Results and Discussion

##### 4.1 Summary on experts' sensory evaluation of Jam with calamansi juice and cabbage

Presented in table 1d is the summary on experts' sensory evaluation of Jam with calamansi juice and cabbage. Findings revealed the three treatments have similar adjectival description which is like moderately though there was variation in their means.

Treatment 2 outperformed treatment 1 in appearance, aroma, and texture, while treatment 1 was better in taste. Treatment 2 was better overall, with treatment 3 least. The combination of calamansi extract and cabbage in jam production negatively affected taste and aroma.

**Table 1d. Summary on experts' sensory evaluation of Jam with Lime juice and calamansi**

Treatments	Appearance	Aroma	Taste	Texture	Mean	Verbal Interpretation
T1 - Jam (Control)	6.26	6.39	6.99	6.04	6.42	Like moderately
T2 - Jam with Calamansi Extract	7.62	6.78	6.97	6.54	6.98	Like moderately
T3 - Jam with Calamansi Extract & Cabbage	6.99	6.44	5.37	6.38	6.30	Like moderately
Mean	6.96	6.54	6.44	6.32	6.56	Like moderately
8.12 – 9.00 LE	7.23 – 8.11LVM	6.34 – 7.22 LM	5.45 – 6.33	LS	4.56 – 5.44 NL/SL	

##### 4.2 Acceptability of Jam in three Treatments

The study categorized jam into three products: T1, T2, and T3. The results showed that T1 had a good taste, moderate aroma, appearance, and slightly textured texture. However, it was lower in quality attributes compared to T2, but higher than T3. This suggests variation in consumer preferences. The study also found that consumers' preferences influenced factors such as attractiveness, quality, price, convenience, and personal taste. The trend of online shopping has slightly changed consumer preferences, with health consciousness, price, and availability being more important factors.

##### 4.3 Jam with Calamansi juice.

Table 2a shows consumer evaluation of calamansi juice jam. Four quality attributes were rated moderately: appearance, aroma, taste, and texture. Taste was the highest, while texture was the lowest. The texture was slightly unsatisfactory, but aroma and appearance met consumer expectations.

##### 4.4 Jam with Calamansi juice and cabbage.

The study evaluated the jam with calamansi juice and cabbage, revealing that the appearance was moderately attractive, while the texture was slightly rough. The results showed that taste was the highest quality attribute, while texture was the lowest. The texture was slightly rough, suggesting that the cabbage's properties did not blend well with the jam's properties. The study suggests that taste plays a significant role in food choice, individual taste preferences, and intakes. Nutrient-poor foods tend to have

a sweet, salty, and fatty mouthfeel, while taste profiles of nutrient-rich foods are diverse. The study suggests that the product's texture may not meet consumer expectations.

**Table 2. Acceptability of Jam in different treatments**

Attributes	Mean	Verbal Interpretation
<b>T1 - Jam as control</b>		
Appearance	6.26	Like moderately
Aroma	6.39	Like moderately
Taste	6.99	Like moderately
Texture	6.04	Like slightly
Mean	6.42	Like moderately
<b>T2 -Jam with Calamansi juice</b>		
Appearance	7.62	Like Very Much
Aroma	6.78	Like moderately
Taste	6.97	Like moderately
Texture	6.54	Like moderately
Mean	6.98	Like moderately
<b>T3 - Jam with Lime juice and Cabbage</b>		
Appearance	6.99	Like moderately
Aroma	6.44	Like moderately
Taste	5.37	Neither like or slightly like
Texture	6.38	Like moderately
Mean	6.30	Like slightly
8.12 – 9.00 LE 7.23 – 8.11LVM 6.34 – 7.22 LM 5.45 – 6.33 LS 4.56 – 5.44 NL/SL		

#### 4.5 Summary on Acceptability of Jam in different treatments

The study analyzed the acceptability of jam in various treatments, with the highest mean of 6.98 for jam with calamansi juice, followed by the control with 6.42. The mean for jam with calamansi juice and cabbage was 6.30. The results suggest that the control has better quality attributes than treatment 3, suggesting the need for improvement.

**Table 3a. Summary on Acceptability of Jam in different treatment**

Treatments	Appearance	Aroma	Taste	Texture	Mean	Verbal interpretation
T1 - Jam (Control)	6.26	6.39	6.99	6.04	6.42	Like moderately
T2 - Jam with calamansi juice	7.62	6.78	6.97	6.54	6.98	Like moderately
T3 - Jam with calamansi juice & Cabbage	6.99	6.44	5.37	6.38	6.30	Like slightly
Mean	6.96	6.54	6.44	6.32	6.56	Like moderately
8.12 – 9.00 LE 7.23 – 8.11LVM 6.34 – 7.22 LM 5.45 – 6.33 LS 4.56 – 5.44 NL/SL						

#### 4.6 Significant difference between Treatment

The study reveals a significant difference in the quality of jam between a jam with calamansi juice and cabbage and a control product. The aroma and texture of the jam were different, suggesting that the ingredients likely made a difference. However, other variables showed no significant difference. The study highlights the difficulty in generalizing food quality cues among products, as consumers' value systems, beliefs, and food behaviors are hard to generalize. Different food quality evaluations reflect consumers' beliefs and attitudes, which are crucial factors in their decision-making process, including product selection and dietary patterns.

**Table 4. Significant difference between treatments**

Variables	t	Sig. (2-tailed)	Probability
<b>Appearance</b>			
T1 -Jam (Control) vs T2 -Jam with calamansi juice	-2.073	.057	ns



T3 - Jam Jam with calamansi juice & Cabbage vs T1 -Jam (Control)	1.827	.089	ns
<b>Aroma</b>			
T1 -Jam (Control) vs T2 -Jam with calamansi juice	-.739	.472	ns
T3 - Jam with calamansi juice & Cabbage vs T1 -Jam (Control)	-2.792	.014	s
<b>Taste</b>			
T1 -Jam (Control) vs T2 -Jam with calamansi juice	-1.870	.083	ns
T3 - Jam with calamansi juice & Cabbage vs T1 -Jam (Control)	-2.938	.011	s
<b>Texture</b>			
T1 -Jam (Control) vs T2 -Jam with calamansi juice	-.757	.461	ns
T3 - Jam with calamansi juice & Cabbage vs T1 -Jam (Control)	.152	.881	ns

#### 4.7 Significant difference on acceptability of the product as to treatments

The study found significant differences in the quality of jam between treatments, with differences in appearance, aroma, taste, and texture. The hypothesis was rejected, indicating variations in product properties. The study also found differences in Jam (Control) vs Jam with calamansi juice and Jam with calamansi juice & Cabbage vs Jam (Control). However, further comparisons showed insignificant differences, indicating similarities in product qualities. The study suggests that consumer perception is the primary factor for food marketing and technological development, while environmental factors affect acceptability.

**Table 4d. Significant difference on acceptability of the products as to treatment**

Variables	t	Sig.	Probability
<b>Evaluation (As a whole)</b>			
T1 Jam (Control) vs T2 - Jam with calamansi juice	-3.770	.002	s
T3 - Jam with calamansi juice & Cabbage vs Jam (Control)	2.054	.058	ns
<b>Appearance</b>			
T1 - Jam (Control) vs Jam with calamansi juice & Cabbage	-.238	.815	ns
T1- Jam (Control) vs T2 - Jam with calamansi juice	-4.038	.001	s
T3 - Jam with calamansi juice & Cabbage vs T1 - Jam (Control)	3.257	.005	s
<b>Aroma</b>			
T1- Jam (Control) vs T2 - Jam with calamansi juice	-1.815	.089	ns
T3 - Jam with calamansi juice & Cabbage vs T1- Jam (Control)	2.030	.040	s
<b>Taste</b>			
T1- Jam (Control) vs T2 - Jam with calamansi juice	-2.070	.056	ns
T3 - Jam with calamansi juice & Cabbage vs T1- Jam (Control)	-2.150	.044	s
<b>Texture</b>			
T1- Jam (Control) vs T2 - Jam with calamansi juice	-2.657	.018	s
T3 - Jam with calamansi juice & Cabbage vs T1- Jam (Control)	3.297	.005	s

#### 4.8 Findings

The study analyzed the sensory evaluation of T1- Jam (Control) vs T2 - Jam with calamansi juice and T3 - Jam with calamansi juice & Cabbage. The three treatments had similar adjectival descriptions, with the highest mean in taste being slightly. T2 - Jam with calamansi juice had higher mean in appearance, aroma, and texture, but low in texture. Treatment 3 was first in appearance and low in taste. Treatment 2 had better quality attributes in appearance, aroma, and texture. The acceptability of jam was highest in jam with calamansi juice, while treatment 3 was slightly. The study also showed significant differences in sensory evaluations between male and females in terms of appearance, aroma, taste, age, aroma, and texture. The study highlights the importance of considering gender and sensory evaluation in food production.

The study aimed to compare the quality of jam products based on sensory evaluations of experts considering income. Results showed dissimilarities in appearance, aroma, taste, and texture between the control and jam with calamansi juice and cabbage. The study also found significant differences in acceptability of products based on gender, aroma, taste, and texture in all treatments. The results also showed differences in appearance, aroma, and texture between the two jam treatments. The study also found significant differences in the acceptability of products based on income in terms of appearance, aroma, and texture in the jam with calamansi juice treatment. The overall quality properties of the products were evident between the two treatments, with differences in appearance, taste, aroma, and texture.

## 5. Conclusion and Implications

It means the acceptability of the product is divided division the age of the respondents. Some favored treatment 1, and others preferred treatments 2 and 3. In general, the quality attributes of treatment 2 edge over the two treatments in terms of appearance, aroma and texture. It was only in terms of taste that treatment 1 – control, was better than treatment 2 and 3. As to the overall mean per quality attributes, treatment 2 was better and treatment 3 the least. The acceptability of jam in different treatments, majority was in favor of T2 - jam with calamansi juice which was like moderately while treatment 3 was like slightly.

The significant difference on sensory evaluation of experts considering gender was evident between male and females as to appearance, aroma, taste of T2 - jam with calamansi juice and for T3 - jam with calamansi juice and cabbage.

In terms of age, variation existed in appearance and aroma of T1 - jam (control) and T3 - Jam with calamansi juice & Cabbage and in texture, difference was evident in T3 - jam with calamansi juice & Cabbage. The experts have varied assessment on the quality of the products from different treatments.

As to income dissimilarity in quality was apparent in appearance and aroma in T1 - jam (control) and T3 - jam with calamansi juice & Cabbage. As to taste, difference was in T2 - jam with calamansi juice and T3 - jam with calamansi juice & Cabbage but as to texture, difference was only in T3 - jam with calamansi juice & Cabbage. In general, the significant difference between treatment as to sensory evaluation of experts on the quality of jam was in aroma and texture between T3 - Jam with calamansi juice & Cabbage vs T1 - Jam (Control).

The difference in acceptability of the products in terms of gender was between Treatment 1 and 3 as a whole, between treatment 1 and 2 as to aroma, in taste between treatment 1 and 3 and in texture in all treatments.

The findings on difference as a whole and T2 - jam with calamansi juice, difference was in appearance and between T2 - jam with calamansi juice and T3 - jam with calamansi juice and cabbage. In terms of taste considering age, difference was on T2 - Jam with calamansi juice and in T3 - jam with calamansi juice and cabbage as well as between texture and age.

The difference in acceptability of products in terms of income was between treatments as to appearance, aroma and texture between treatment 2 - jam with calamansi juice. Variation was also evident in treatment 2 - jam with calamansi juice, in treatment3 - Jam with calamansi juice & Cabbage as to taste.

In general, difference in the quality properties of the products was apparent between Treatment 1-Jam (Control) vs treatment 2 - Jam with calamansi juice. Likewise difference was noted between Jam with calamansi juice & Cabbage vs Jam (Control) as to appearance, taste, aroma and texture.

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