

Sensory Evaluation, Physico-Chemical and Microbial Analysis of Passion Fruit-Guava Powdered Juice

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Abstract

This study was conducted to develop spray dried passion fruit- guava powdered. Descriptive research design was employed where the sensory characteristic, physico-chemical and microbial content of the product were described. Three samples were prepared; samples vary in the amount of passion fruit extract and guava extract added. Sensory evaluation was conducted, and the result of the Analysis of Variance (ANOVA) revealed that the samples differ significantly in terms of its clarity, aroma, taste and sourness. Several laboratory tests were conducted, and the result shows that Passion fruit – Guava Powdered Juice has 91.53 lightness; -1.31 green and +16.62 yellow color, 3.10 pH, 7.92 % titratable acidity as percent citric acid, 2.23% soluble solid at 2% solution and 0.0473 water activity. Per serving have 25 calories, 6 grams carbohydrates, 1 mg vitamin C and 3.9 µg β-carotene. This can provide vitamin C of about 2 % for children and 1% for adult and vitamin A of about 1% for children and 0.7% for adult based on the recommended daily intake. It has an aerobic plate count of <300 CFU/g., a coliform count of <10 CFU/g and yeast and mold count of 4.3×10³ CFU/g., per serving of the product which are all within the allowable limit.

Keywords: Food technology, spray-dried powdered juice, sensory evaluation, passion fruit-guava powdered juice, Bicol Region, Philippines

Introduction

The growing world population depends on the availability of biodiversity as food and medicine. Loss of biodiversity and extinction is a global issue and problem that could have a severe effect on the living and economy. At present, the Philippines is facing the challenges on the sustainability of agricultural productivity as farmers are becoming less interested in cultivating green field. There are many wild plants and fruits that are available in the Philippines, but during their peak season some of them are seldom consumed, left unprocessed some simply go to waste

The Philippine government found ways to answer this issue. The government and some NGOs initiated the project and program to ensure economic sustainability at the same time conserve biodiversity. The project and program provide trainings in the community on the conservation agricultural product and on the utilization wild fruits into high quality jams, jellies and preserves. Processing of these fruits could provide a source of income may also help to alleviate food shortages and malnutrition. Dehydration or drying is another way to preserve food. The process removes water and lowers the water activity of food and eliminates the growth of molds and bacteria. Dehydrated products, therefore, last longer compared to unprocessed products. However, the elevated temperature during drying causes the loss of volatile nutrients; therefore, appropriate drying method should be applied to eliminate losses.

Spray drying method is widely used in the industry; it is a process wherein the liquid is turned into powder quickly. It decreases the water content and water activity of food, ensures microbiological stability of products, avoids the risk of chemical and/or biological degradations, reduce the storage and transport costs, and finally obtain a product that is instantaneously soluble (Gharsallaoui, 2008). It has the potential to avoid chemical degradation,

which ensures a higher retention of vitamin C, the pro-vitamins A and beta-carotene and flavor.

The study focused on the development of spray dried powder using passion fruit and native guava extracts. Three (3) samples were prepared; samples vary in the amount of passion fruit and guava extract and added with equal concentration of maltodextrin. About 25 grams resulting spray dried powder was packed in 89 microns thick laminated aluminum foil bag about per pack. The study aims to describe the (1) sensory attributes and the most preferred sample of passion fruit- guava powder; (2) the physico-chemical characteristic in terms of color, pH, titratable acidity, total soluble solids and water activity; (3) the proximate content, vitamin C, vitamin A and the nutrition facts and (4) the microbial load of the product in terms of total plate count, coliform count, and yeast and mold count.

Transforming the fruit extract into powder would ensure availability of the nutrients it provides and would add value to the fruits. At the same time, passion fruit and guava juice processed into powdered juice would also provide consumers the convenience and ease in the preparation of their refreshment, and it would give another source of income. The economic importance of these crops would encourage the community to plant, cultivate and preserve them thus the extinction would be prevented.

Material and Methods

The study attempts to develop spray dried powder. Fresh and matured yellow passion fruits and native guavas were used. All raw materials were procured locally some were purchased from the local market, and some were picked directly from the forest of Albay and Camarines Sur province. The maltodextrin DE 10 which serves as the encapsulating agent was purchased from Alyson's Chemical Enterprises, Inc in Quezon City, Philippines. The fruit extracts were collected from the two

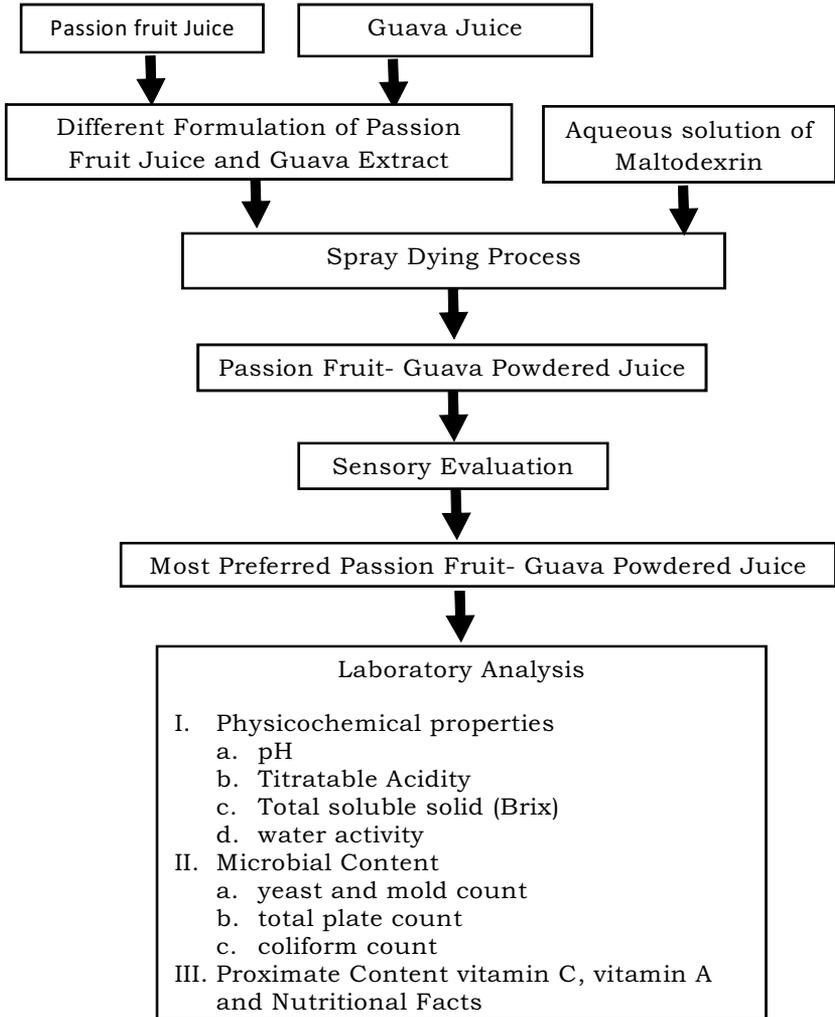


Figure 1. Research Paradigm

(2) identified fruits and three (3) mixture of the fruit extracts were prepared namely; proportion 1 has 50% passion fruit extract and 50% guava extract, proportion 2 has 60% passion fruit extract and 40% guava extract, and proportion 3 has 70% passion fruit extract and 30% guava extract. Each mixture was added with an equal amount of aqueous maltodextrin DE 10. The three (3) mixture were pasteurized at a temperature of 80°C for 2 minutes and was immediately packed in a polyethylene bag and placed in the freezer and was kept frozen until ready for spray drying.

All samples were powdered using a fabricated spray drier at a feed rate of 14 ml/ min and about 90°C of inlet temperature, 130°C final temperature and 48°C outlet temperature. About 25 grams of the resulting spray dried powdered juice was pack into 89 microns thick laminated aluminum foil bag. The foil bag was properly sealed to avoid absorption of moisture and contamination. The research paradigm is presented in Figure 1.

Sensory Evaluation

The finished products were subjected for sensory evaluation. The capabilities of sensory evaluators are vital factors in the evaluation of the finished products. There were thirty (30) selected laboratory type panelists who evaluated the product. The sensory evaluators were chosen (using purposive sampling) to ensure that the samples were evaluated efficiently. They are trained individuals and have the technical know how about sensory evaluation. The researcher conducted triangle test to the target panelist, this detects panelist sensitivity, accuracy and reliability. This approach utilized three samples at any one time with two of the samples identical and the third different. All three samples were coded and presented to the panelist randomly. The panelists were allowed to re-taste or reevaluate the sample until judgment was made if which is the odd sample. There were seventy – three (73) laboratory type panelists who were

conducted the difference test. Among them fifty – six (56) qualify, and the thirty (30) panelists were selected randomly to conduct the sensory evaluation of the Passion fruit – Guava Powdered Juice. From the thirty (30) panelists, four (4) of them were Bachelor of Science in Food Technology professors and the remaining twenty – six (26) were 3rd year students of Bachelor of Science in Food Technology. All of them were technically knowledgeable in food evaluation specifically in sensory evaluation.

Two types of score sheets were prepared, the Quantitative Descriptive Analysis (QDA) score sheet and the Rank Preference Test score sheet. The Quantitative Descriptive Analysis (QDA) score sheet was used to characterize the attribute of the samples as perceived by the respondents in quantitative terms. In the Quantitative Descriptive Analysis (QDA) (Gatchalian, 1989) score sheet each descriptive term that was utilized correspond to 6 inches long unstructured unit where its extreme point that is from weak to strong indicates the intensity of the term. The products were evaluated by putting a vertical line across the unstructured scale. The ranges were from zero to six implying that each point has an equivalent score. While rank preference score sheet was used to identify the most preferred sample. In the rank preference test, the panelists are expected to rank the product based on the over-all assessment of the specified product. There was a space in the score sheets allotted for respondent's comments, remarks and suggestions if any, to help researcher improve the product.

During the sensory evaluation, the panellists were provided with the three (3) samples which are coded properly, drinking water and score sheets. The samples were placed in uniform transparent cups, with uniform volume and properly coded to avoid biases and were orderly arranged in the sensorium. Water was also provided to clear the palate of the evaluators after every sample was tasted. The score sheets were used to obtain

the data needed; these served as the questionnaire for the panellists to answer. Each panellist evaluated the product according to the suggested preference and descriptive characteristics.

Objective Evaluation of Passion fruit-Guava Powdered Juice

(Physical Analysis, Nutritional Facts and Microbial Load)

A 500 gram of the most preferred sample was submitted to the Food Nutrition Research Institute to analyze the color of the powdered, the proximate composition, vitamin C, vitamin A and its nutrition facts. Another 250 gram of the most preferred sample was brought to Department of Science and Technology V to analyze its physicochemical properties such as pH, titratable acidity, total soluble solid and water activity and the microbial load in terms of total plate count, coliform count and yeast and molds count through laboratory test.

Results and Discussion

This discusses the proportions and the ingredients of the powdered juice made of passion fruit and guava including the procedures followed in the development of the product. It also includes the results of the analysis and interpretations of the data gathered.

Ingredients and Processes in Preparing the Passion – Guava Powdered Juice

The ingredients used in processing Passion fruit – Guava Powdered Juice were passion fruit extract, guava extract and maltodextrin DE 10. The researcher prepared three (3) proportions varying in the amount of passion fruit extract and guava extract added. The ingredients and proportions are presented in Table 1.

Table 1.

Ingredients and Proportion of Passion fruit – Guava Powdered Juice.

Ingredients	Proportions		
	Proportion 1	Proportion 2	Proportion 3
PassionFruit extract	5 liters (50%)	6 liters (60%)	7 liters (70%)
Guava Extract	5 liters (50%)	4liters (40%)	3 liters (30%)
Aqueous	2.4 kilo	2.4 kilo	2.4 kilo
Maltodextrin	maltodextrin DE 10 & 2 liters water	maltodextrin DE 10 & 2 liters water	maltodextrin DE 10 & 2 liters water

Steps in Making Passion fruit – Guava Powdered Juice

Washing and Cleaning of fruits – Wash the mature fruit of passion fruit and guava fruits 2-3 times with potable water. This is to remove some of the dirt in the skin of fruit such as soil. The stems were removed, likewise the crown of the guava fruit and some dark spots.

Extracting of Juice – The passion fruit was cut into halves, and the edible part were scooped. The flesh was pressed with a spoon to release its juice. Guava fruits were cut into four, placed in a pot and water is added up to the level of the guava fruit and was cooked for about 7 minutes or more until the guava is softened. Mashed the guava and add 2-3 cups water for every 1 ½ cup of mashed guava then coarsely chop the fruit in the blender or food processor. To get the fruit extract, let the fruit pulp pass through a strainer or clean white cloth.

Mixing of Ingredients and Pasteurization – In a bowl mix the passion fruit and guava extract. In a separate bowl dilute, the 2.4 k of maltodextrin DE 10 in 2 liters of hot water. Combine 10 liters of fruit extract mixture and aqueous maltodextrin and stir until well blended. Pasteurize the juice prior to spray drying. Pasteurization was done by heating the juice mixture at a temperature of 80 °C for 2 minutes. The pasteurized mixture was immediately packed in a polyethylene bag and placed in

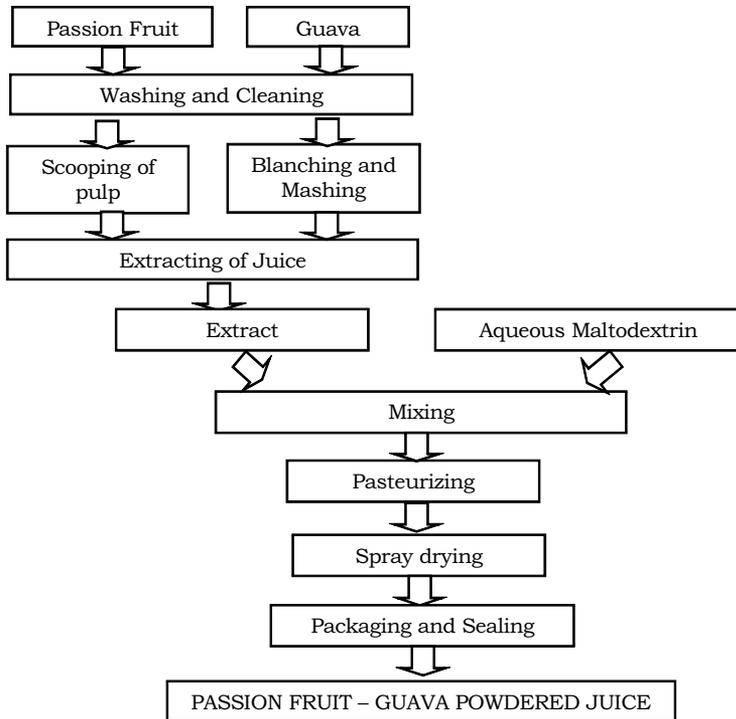


Figure 2. Process Flow Chart in Processing Passion fruit – Guava Powdered Juice

the freezer and was kept frozen until ready for spray drying.

Spray drying – The frozen mixture of fruit extract and maltodextrin was thawed and was fed it in a fabricated spray drier at a feed rate of 14 ml/ min at 90 °C of inlet temperature, 130 °C final temperatures and 48 °C outlet temperature.

Packaging – Filled about 25 grams of the resulting spray dried powdered juice into 89 microns thick laminated aluminum foil bag. The aluminum foil bag was sealed properly to avoid absorption of moisture and contamination.

Sensory Characteristics of Passion fruit – Guava Powdered Juice

The samples of powdered juice were separately diluted in equal amount water and added with an equal amount of sugar. The juice drink was cooled before it was subjected to sensory evaluation. The results of the sensory evaluation on the descriptive test on the different attributes of the three samples of Passion fruit – Guava Powdered Juice are presented in Table 2, likewise the result of the Analysis of Variance (ANOVA) or F – test. The sample containing 50% passion fruit extract and 50% guava extract was slightly cloudy, weak passion fruit and medium guava aroma, medium passion fruit and guava taste, sourness, sweetness and aftertaste. While the sample containing 60% Passion fruit extract and 40% Guava extract is clear in appearance, medium passion fruit and guava aroma, medium passion fruit and guava taste, medium sweetness and sourness and medium aftertaste. The sample containing 70% Passion fruit extract and 30% Guava extract is clear in appearance, medium passion fruit and guava aroma, medium passion fruit and guava taste, medium sweetness and sourness and medium aftertaste. This shows that the proportion of passion fruit and guava extract into powdered juice affect the sensory characteristics of the Passion Fruit- Guava Powdered Juice.

The result of the sensory evaluation was subjected to F – test, and it was computed using five percent (5%) level of significance. The result of computed F value on the different sensory characteristic of the Passion fruit – Guava Powdered Juice revealed that there is a significant difference in the clarity of product with a $F_c = 9.77$, passion fruit aroma with a $F_c = 12.28$, passion fruit taste with a $F_c = 6.53$ and in sourness with a $F_c = 3.31$. These are higher than the F_t which is 3.15; thus H_0 was rejected.

Table 2.

Results of Sensory Evaluation and ANOVA on the Different Sensory Attributes of Passion fruit – Guava Powdered Juice.

Characteristic	Samples						ANOVA	
	50% Passion fruit extract & 50% Guava extract		60% Passion fruit extract & 40% Guava extract		70% Passion fruit extract & 30% Guava extract		F _c (Significant at the 5% level)	Decision
	X	Description	X	Description	X	Description		
Clarity	1.7	Slightly cloudy	2.43	Clear	3.07	Clear	9.77	Reject Ho
Passion fruit aroma	2.0	Weak	2.44	Medium	3.48	Medium	12.78	Reject Ho
Guava aroma	2.9	Medium	2.71	Medium	2.54	Medium	0.93	Accept Ho
Passion fruit taste	2.4	Medium	3.14	Medium	3.42	Medium	6.58	Reject Ho
Guava taste	3.0	Medium	2.94	Medium	2.51	Medium	1.64	Accept Ho
Sourness	2.2	Medium	2.74	Medium	3.03	Medium	3.31	Reject Ho
Sweetness	3.1	Medium	2.81	Medium	2.42	Medium	2.58	Accept Ho
Aftertaste	3.0	Medium	2.82	Medium	2.36	Medium	2.50	Accept Ho

Clarity (0-2.0 slightly cloudy; 2.1-4.0 clear; 4.1-6.0 very clear)

Passion fruit aroma. Guava aroma, passion fruit taste, guava taste, sourness, sweetness and aftertaste (0-2.0 weak; 2.1-4.0 medium; 4.1-6.0 strong)

The plotted mean score of the evaluation of Passion fruit – Guava Powdered Juice are shown in Figure 2. Each radiating line that emanates from the center point represents the descriptive term. From the center, the mean intensity score for every attribute is marked off on the respective lines. The points were connected and it forms the product profile. The three (3) sample of Passion fruit – Guava Powdered Juice showed slight differences. The space shown between profiles of the different samples indicates the significant differences in the sensory characteristics. The three (3) products significantly differ

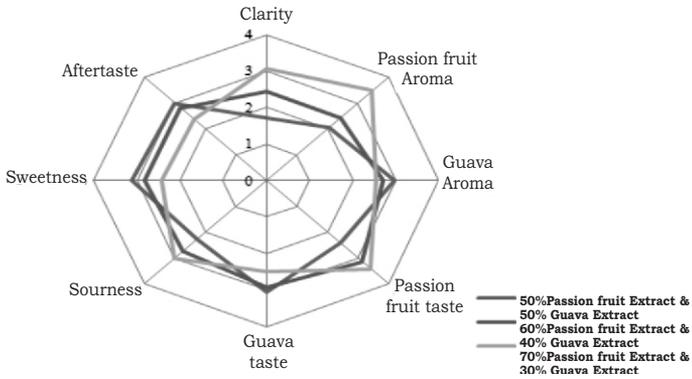


Figure 3. Summary of the product's profile.

Most Preferred Sample of Passion fruit – Guava Powdered Juice

Table 3 presents the summary and the rank of the Passion fruit – Guava Powdered Juice. The product containing 70% passion fruit extract and 30% guava extract was considered as the most preferred as revealed by the weighted mean of one point forty – three (1.43), ranking first among the three samples. This was followed by the sample containing 60% passion fruit extract and 40% guava extract in the second rank with a weighted mean of one point ninety – three (1.93). The third in rank was the sample containing 50% passion fruit extract and 50% guava extract having a weighted mean score of two point sixty – three (2.63).

Table 3

Results of Preference Test of Passion fruit – Guava Powdered Juice

Rank	Samples					
	50% Passion fruit extract & 50% Guava extract		60% Passion fruit extract & 40% Guava extract		70% Passion fruit extract & 30% Guava extract	
	F	FW	F	FW	F	FW
1	3	3	7	7	20	20
2	5	10	18	36	7	14
3	22	66	5	15	3	9
Weighted means	2.63		1.93		1.43	
Ranking	3rd		2nd		1st	

Physico-chemical Characteristic of the Most Preferred Passion fruit – Guava Powdered Juice

The most preferred sample of Passion fruit – Guava Powdered Juice was submitted for color, pH, titratable acidity, total soluble solid and water activity test. Summary of the results was presented in Table 4. It showed that the color of the product has 91.53 lightness; - 1.31 green color and +16.62 yellow color, this means that the product resembles as light yellow color.

The pH was measured at 10% solution of the product, and the pH is 3.10. The low pH of the product indicates a higher concentration of hydrogen ion and it is acidic. Another test conducted was titratable acidity, result shows that product titratable acidity is 7.92 % (as % citric acid). The test measures the concentration of available hydrogen ions present in the product (PNS, 2007). Acidity preserves food by decreasing the microbial growth. Passion fruit – Guava Powdered Juice is considered as acid food because of its pH that is below 4.6, and lower pH means more hydrogen ion present in the product.

To determine the total soluble solid the product was diluted at 2% solution, and the result shows that about 2.23% were soluble. This means that the maltodextrin DE 10 added to the product is very soluble in water. The

product also underwent water activity test. Result shows that it has 0.0473 water activity; this is due to the low moisture content of the product. Water activity control microbial spoilage, and at 0.30 water activity there was no microbial growth. Furthermore, the product is hygroscopic which absorb water from the environment, thus proper packaging and storage is required.

Table 4. Physico-chemical Characteristic of the Most Preferred Passion fruit – Guava Powdered Juice.

Parameters	Result
Color * (in powdered form)	L = 91.53 ± 0.08 a = -1.31 ± 0.04 b = + 16.62 ± 0.10
pH	3.10
Titrateable Acidity (as citric acid)	7.92
Total Soluble Solids	2.23% @ 2% w/w
Water Activity	0.0473

**L indicates lightness: L = 100, white; L = 0, black; a and b are the chromaticity coordinates: +a = red; -a = green; +b = yellow; -b = blue*

Proximate Content and the Nutrition Facts of Most Preferred Sample of Preferred Passion fruit – Guava Powdered Juice

The study conducted the proximate analysis; it refers to the determination of the major component of food (Nielsen, 2003). The result of proximate analysis and nutrition facts of the Passion fruit – Guava Powdered Juice is presented in Table 5. The result of the analysis revealed that 100 grams sample had a moisture content of 3.6 grams and followed by ash, fat, carbohydrate and protein of 1.3 grams, 0.4 grams, 93.0 grams and 1.7 grams respectively. The findings also revealed that moisture content of the product was low due to the drying process it underwent using spray drier.

Packed Passion fruit – Guava Powdered Juice has a net weight of 25 grams about 4 Tbsp. It revealed that a packed of Passion fruit – Guava powdered Juice has 4 serving and per serving is 6 grams or 1 Tbsp of powdered juice to be diluted in 250 ml of water. Per serving of the product could provide 25 Calories with total carbohydrates of 6 grams, and 0 gram of fat protein and sodium. The 100 grams of powdered juice provided 380 Calories, 93 grams of carbohydrate, 2 grams of protein and 10 mg of sodium. Therefore per serving of such juice provides about 1.25% of the recommended energy intake based on 2000 Calorie diet.

Table 5. Proximate Content and Nutritional Information of the Most Preferred Sample Passion fruit – Guava Powdered Juice.

Proximate Content		Nutrition Facts	
		Serving Size 1 Tbsp (6g)/ glass (250ml) Serving per pack/ number of serving 4	
Analyte per 100 g	Result	Amount per Serving	Amount per 100 g
		Energy (kcal)	25 380
		Total Fat (g)	0 0
Moisture	3.6 g	Total carbohydrate (g)	6 93
Ash	1.3 g	Protein (g)	0 2
Fat	0.4 g	Sodium (mg)	0 10
Total carbohydrate	93 g	Vitamin C (mg)	1 17
Protein	1.7 g	Vitamin A (β-carotene, μg)	3.9 65

It was found out also that 100g of Passion fruit – Guava Powdered Juice contains 17 mg of vitamin C and 65μg of beta-carotene. The recommended daily allowance of vitamin C is 45 mg for children and 75 mg of for adult, which means that per serving of the product, can provide about 2 % for children and 1% for adult based on the recommended daily intake. The recommended daily allowance of vitamin A is 375 μg for children and 525 μg for adult, which means that per serving of the product, can provide about 1% for children and 0.7% for adult based on their recommended daily intake. Assuming that two servings are likely to be consumed the Passion fruit – Guava Powdered Juice shall have at least 62.5 – 87.5 μg of vitamin A and 22.5 mg – 37.5 mg of vitamin C per serving.

Microbial Load of Passion fruit – Guava Powdered Juice

Most of the processed foods are regarded unwholesome when they have a large population of microorganism that may lead to food borne diseases. The allowable microbial limit was based on the guidelines for the microbial quality of dry mixes for soup and sauces. It shows that Passion fruit – Guava Powdered Juice has an aerobic plate count of <300 CFU/g. The result of the aerobic plate count is within the allowable limit colony count which is 10⁴ - <10⁶ CFU /g in dry food.

The presence of a large number of coliform in food is highly undesirable. The coliform count of Passion fruit – Guava Powdered Juice is found to have <10 CFU /g. This amount of coliform is also within the allowable limit of 10¹ - <10³ CFU /g.

Yeast and mold are acidophiles or acid-loving microorganism, low pH favor their growth. Passion fruit – Guava Powdered Juice is an acid food at the same time has a low water activity, in this condition yeast and mold outgrow bacteria and thus can cause spoilage especially if improperly stored. The product has a colony of yeast and molds of about 4,300 CFU/g. This result is still within the allowable limit which is 10² - <10⁴ CFU /g for dried products. The Passion fruit – Guava Powdered Juice is, therefore, safe for consumption. The result of the microbial load analysis of Passion fruit – Guava Powdered Juice is presented in Table 6.

Table 6. Result of the Microbial Load Analysis of Passion fruit – Guava Powdered Juice.

Parameters	Result
Aerobic Plate Count	<300 CFU */g
Coliform Count	<10 CFU */g
Yeast and molds	4,300 CFU */g

* CFU - *colony forming unit*

Conclusion

The findings revealed that the proportion of ingredient affects the sensory attributes of the samples especially in terms clarity, passion fruit aroma, passion fruit taste and in sourness. The sample with 70% Passion fruit extract and 30% Guava extract was most preferred being rank first among the three samples. The result for color analysis shows that the product resembles the light yellow in color. It is also considered as acid food because of its pH that is below 4.6, and lower pH mean more hydrogen ion present. The product is soluble; therefore, the maltodextrin added did not adversely affect the solubility of the product. The drying method caused the product to have a low water activity thus proper storage is required. Passion fruit – Guava Powdered Juice is a good source of energy derived from the fruit extract and the maltodextrin. It has a small amount of vitamin C and vitamin A, which has been lost during the heating produce to produce the Passion fruit – Guava Powdered Juice. The number of the colony of microorganism is affected by the pH and water activity of the product. The microbial load also of Passion fruit – Guava Powdered Juice is within the allowable limit of microorganism in dried food mixes and therefore, it is safe for consumption.

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