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**TRTM Pon Bhagavathi**  
Home Science College and  
Research Institute - Madurai,  
Tamil Nadu, India

**PS Bensi**  
Home Science College and  
Research Institute - Madurai,  
Tamil Nadu, India

**PS Geetha**  
Home Science College and  
Research Institute - Madurai,  
Tamil Nadu, India

## Sensory quality assessment of pineapple – *Garcinia cambogia* squash, principal component analysis

**TRTM Pon Bhagavathi, PS Bensi and PS Geetha**

### Abstract

The aim of this study was to analyze the sensory attributes of pineapple – *Garcinia cambogia* blend squash. The pineapple and *Garcinia cambogia* juice were mixed together with the addition of sugar to make six different treatments. In those treatments, pineapple juice was taken in 75%, 50% and 25% proportion with the alternative change in *Garcinia cambogia* juice concentration of 25%, 50% and 75% in proportion among various treatments (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>- juice of fresh *Garcinia*; T<sub>4</sub>, T<sub>5</sub>, T<sub>6</sub>- juice of dried *Garcinia*). Potassium meta-bisulphite (KMS) was added as preservative at the rate 0.1%. Pineapple – *Garcinia cambogia* squash was subjected to sensory analyses for colour and appearance, flavour, body and consistency, taste and overall acceptability attributes. The sensory evaluation score showed that treatment T<sub>1</sub> (75% pineapple juice, 25% fresh *Garcinia cambogia* juice) and T<sub>4</sub> (75% pineapple juice, 25% dried *Garcinia cambogia* juice) was highly acceptable. Microbial analysis of the squash showed no growth of Coliforms in the plates till the 30th day. This shows that the squash was very safe for consumption and the shelf life of the product is excellent. The results were further verified by principal component analysis (PCA).

**Keywords:** Pineapple – *Garcinia cambogia* squash, sensory analysis, principal component analysis.

### Introduction

India with its diverse, favorable agro climatic conditions produces a wide range of fruits and vegetables and stands as one of the largest producers of fruits in the world. Fruits and vegetables contribute majorly to human diet due to their higher nutritional value. They are the best source of vitamin A and C, which are considered as protective foods in the modern society. Some of the seasonal perishable fruits which are available in surplus amount during the seasonal glut could be converted into durable products in order to avoid wastage. Fruits are not only consumed as fresh, but are also processed in the form of products. They can be preserved by preparing squash, jams, purees, etc (Sethi *et al.*, 2005) [5].

*Garcinia cambogia* is a sub tropical fruit found in the Western Ghats of India as well as in South- East Asia. It has greater dietary importance and is widely utilized in the preparation of refreshing drinks, for curing fishes, in fish curries etc. (Abraham *et al.*, 2006) [1]. *Garcinia* had proven medicinal effects and is used in treating conditions like flatulence, oedema, chronic alcoholism, dysentery, diarrhea, obesity etc. The presence of an acid known as HCA or (-) – hydroxy citric acid in it adds nutraceutical effects to *Garcinia cambogia*. *Garcinia* is described as “Nature’s Natural Fat Buster”. It is an effective anti- obesity agent because of its appetite reducing property by inhibiting the enzyme ATP- citrate lyase which helps in the conversion of carbohydrates to glycogen (Jena *et al.*, 2002) [3].

Even though *Garcinia cambogia* had a number of nutraceutical effects, its use is under exploited in our country which resulted in the wastage of these fruits during the seasonal glut. The consumption of fruit beverages in the world has increased during the last few decades. With the improvements in processing capacity of food technology, different products like squashes, syrup, cordials, fruit juices and ready-to-serve beverages have been introduced in India on a commercial scale to a larger extent. The use of different fruits in the industry for the preparation of different products will not only reduce wastage of fruits during handling of fruits but also add nutrition and palatability to maintain health. If utilized properly, medicinally and nutritionally valuable *Garcinia* can be processed into a variety of food products.

The objective of this study was to assess the best possible combination of fruit juice for overall acceptability and for the preparation of squash through blending in different proportions.

### Materials and Methods

#### Procurement of raw material

Fresh and dried *Garcinia Cambogia* fruits and pineapple fruits were taken from the local fruit

#### Correspondence

**TRTM Pon Bhagavathi**  
Home Science College and  
Research Institute - Madurai,  
Tamil Nadu, India

market of Thiruvanthapuram. Fruits which were used for the preparation of squash were free of damage, diseases and insect attack, and with no sign of fermentation, etc.

### Preparation of Pineapple – *Garcinia cambogia* squash

The flow sheet of Pineapple – *Garcinia cambogia* squash is given in Fig. 1. Pineapple – *Garcinia cambogia* was prepared according to the formulations as given in the Table.1. The addition of potassium metabisulphite (KMS) as a preservative

was done by dissolving the KMS in little quantity of water separately before addition to the squash. Squash was filled into sterilized air tight PET bottles, keeping the head space of almost 1 inch. The squash was stored at room temperature at the laboratory shelf. Squash was used by diluting it in 1:3 ratio, i.e. one part of squash in three parts of chilled water. The squash was offered for sensory evaluation to a panel of 15 semi trained judges from faculty members.

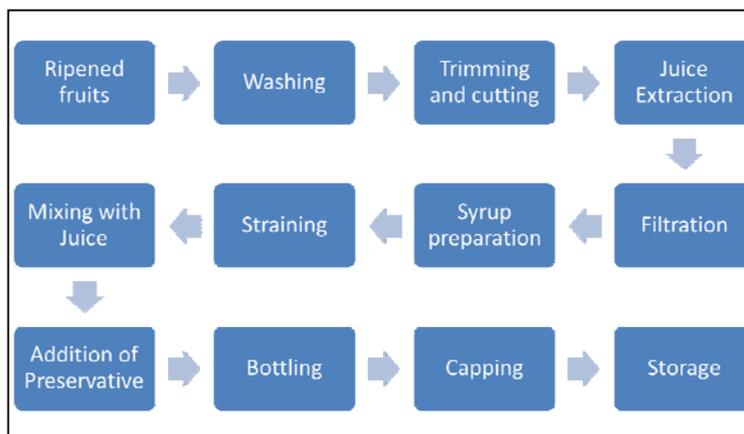


Fig 1: Process flowchart for preparation of pine apple- *Garcinia* blended Squash

Table 1: Different formulations used for the preparation of pine apple- *Garcinia* blended squashes

Treatments	Pineapple juice (ml)	<i>Garcinia</i> (Fresh fruit) juice (ml)	<i>Garcinia</i> (Dried fruit) juice (ml)	Sugar (kg)	Water (ml)	Citric-acid (g)	KMS (g)
T <sub>1</sub>	750	250	-	1.75	500	17	3
T <sub>2</sub>	500	500	-	1.75	500	17	3
T <sub>3</sub>	250	750	-	1.75	500	17	3
T <sub>4</sub>	750	-	250	1.75	500	17	3
T <sub>5</sub>	500	-	500	1.75	500	17	3
T <sub>6</sub>	250	-	750	1.75	500	17	3

### Sensory properties

Sensory characteristics of squashes were evaluated for different sensory attributes by a panel of 15 panelists. Sensory attributes like appearance and color, flavour, body and consistency, taste and overall acceptability for all samples were assessed using nine point hedonic scales. Hedonic scale was in the following sequence: 9 = Like extremely, 8 = Like very much, 7 = Like moderately, 6 = Like slightly, 5 = Neither like nor dislike, 4 = Dislike slightly, 3 = Dislike moderately, 2 = Dislike very much and 1 = Dislike extremely (Larmond, 1977) [4]. The samples were coded with letters and served to the panelists at random to guard against any bias.

### Microbiological study

Determination of total plate count (TPC), yeast and mold count and coliforms count in mixed fruit squash were carried out according to the method as described in the "Recommended Method for the Microbiological Examination of Food" (American Public Health Association, 1966) [2].

### Statistical analysis

The data obtained from the experiments were statistically analyzed for analysis of variance (ANOVA) and consequently Duncan's Multiple Range Test (DMRT) was used to determine significant difference among the various samples in triplicate. Data were analyzed using the software, Statistical Package for Social Sciences (SPSS) version SPSS 16.0.2 at the 0.05 level (SPSS, 2008).

### Result and discussion

#### Effect of different treatments on the sensory characteristics

The results regarding sensory characteristics are presented in Table.2. The sensory evaluation score showed that treatment T<sub>1</sub> and T<sub>5</sub> was highly acceptable as tested by the sensory panel. The maximum score for color was observed in the samples of T<sub>2</sub> (8.00), whereas, the minimum score was observed in the samples of T<sub>6</sub> (6.00). The treatments showed a decreasing trend for color when the concentration of juice of dried *Garcinia* increases. The score for color of pineapple – *Garcinia cambogia* squash ranged between 6.00-8.00. The overall flavor impression is the result of the tastes perceived by the taste buds in the mouth and the aromatic compounds detected in the nose. The maximum score for flavor was found in the samples of T<sub>2</sub> and T<sub>4</sub> (7.50), whereas, the minimum score was observed in the samples of T<sub>6</sub> (6.00). The treatments showed a decreasing trend when the concentration of juice of dried *Garcinia* increases because of the smoky flavour present in the dried fruit of *Garcinia*. The maximum score for taste was observed in the samples of T<sub>5</sub> (8.12), whereas, the minimum score was observed in the sample of T<sub>1</sub> (6.26). The treatments showed a decreasing trend for a taste during storage. The treatment does not show any significant difference in body and consistency of the blended squashes. The score for ranged between 6.74-6.81. The treatment does not showed any significant difference in taste of the blended squashes. Even though there is no significant

difference in overall acceptability of pineapple - *Garcinia* blended squash, the maximum score for overall acceptability was observed in the samples of T<sub>1</sub> (7.83) and T<sub>2</sub> (7.81), whereas the minimum score was observed in the sample of T<sub>6</sub>

(6.58). Pineapple- dried *Garcinia* juice blend squash received minimum score because of the processing techniques used for the drying of fruits. The score for overall acceptability of pineapple- *Garcinia* squash ranged between 6.58-7.83.

**Table 2:** Mean sensory score of mixed fruit squash

Treatments	Colour and appearance	Flavour	Body and consistency	Taste	Overall acceptability
T <sub>1</sub>	7.30±0.18 <sup>d</sup>	7.45±0.11 <sup>d</sup>	6.81±0.19 <sup>a</sup>	7.75±0.68 <sup>a</sup>	7.83±0.70 <sup>a</sup>
T <sub>2</sub>	8.00±0.26 <sup>c</sup>	7.50±0.04 <sup>d</sup>	6.88±0.15 <sup>a</sup>	7.41±1.08 <sup>a</sup>	7.26±1.53 <sup>a</sup>
T <sub>3</sub>	7.45±0.09 <sup>d</sup>	7.25±0.45 <sup>c</sup>	6.76±0.30 <sup>a</sup>	6.89±0.73 <sup>a</sup>	6.59±0.96 <sup>a</sup>
T <sub>4</sub>	7.00±0.17 <sup>c</sup>	7.50±0.04 <sup>d</sup>	6.86±0.25 <sup>a</sup>	7.72±0.67 <sup>a</sup>	7.81±0.74 <sup>a</sup>
T <sub>5</sub>	6.50±0.17 <sup>b</sup>	6.50±0.14 <sup>b</sup>	6.83±0.28 <sup>a</sup>	7.37±1.07 <sup>a</sup>	7.27±1.50 <sup>a</sup>
T <sub>6</sub>	6.00±0.15 <sup>a</sup>	6.00±0.10 <sup>a</sup>	6.74±0.24 <sup>a</sup>	6.86±0.61 <sup>a</sup>	6.58±0.99 <sup>a</sup>

Values are Mean± S.D. Means with different superscripts within a column are significantly different and the same superscripts do not significantly different (NSD) at p<0.05.

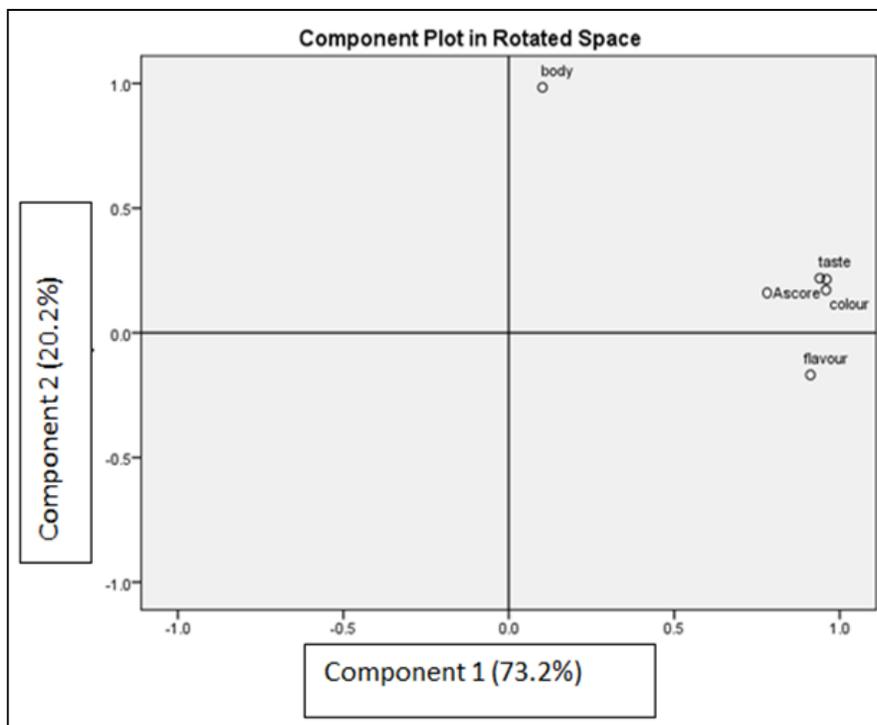
**Microbial analysis**

Storage period (Weeks)	SPC (log cfu/g)	Coliform (log cfu/g)	Yeast and mold (log cfu/g)
0	3.81	Absent	Absent
1	3.81	Absent	Absent
2	3.82	Absent	Absent
3	3.81	Absent	Absent
4	3.83	Absent	Absent

The microbial analysis shows that there was no coliform, yeast and mold growth with negligible standard plate count in the plates of pineapple - *Garcinia* squash till the 30th day. This shows that the products are very safe for consumption and the shelf life of the product is excellent.

**Principal component analysis (PCA)**

PCA was used to analyze the data in order to make a correlation of pineapple - *Garcinia cambogia* sensory parameters. The biplot made from PCA of pineapple - *Garcinia cambogia* squash samples sensory parameters defined by the first and second PCA dimensions is presented in Fig. 2. The sum of principal components PC1 and PC2 contributed to 93.6% of variance among pineapple - *Garcinia cambogia* squash samples. The first principal component (PC1) accounted for 73.4% of the total variation and the second principle component (PC2) contributed to 20.2% of the total variation. PC1 was positively correlated with colour and appearance, flavour, body, taste and overall acceptability. PC2 was positively correlated with colour and appearance, body, taste and overall acceptability and negatively correlated with flavour.



**Fig 2:** Principle component analysis (PCA) of pineapple- *Garcinia* squash samples sensory parameters.

**Conclusion**

Under exploited fruits like *Garcinia* are the several less known fruit species which have the potential for commercial exploitation and yet to be utilized for their potential. Since life style diseases are increasing today the fruit beverages by

incorporating *Garcinia* can be best suited for the persons who are suffering from obesity, diabetes, cardiovascular diseases etc. as a refreshing drink and this processed nutrient rich fruit drink helps in increasing the usage of the fruit by making it available throughout the year.

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