Evaluation of Sensory Attributes and Shelf life of Cashew Apple Chutney (*Anacardium occidentale* L.)

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ABSTRACT

Cashew apple based food products are not popular among local people; thus, they are wasted without being used in the fruiting season. Therefore, this study was conducted to develop chutney from cashew apple (*Anacardium occidentale* L.) mixed with different proportions (0, 10, 20, 30, 40 and 50%) of *ambarella* (*Spondias dulcis* Sol. Ex Parkinson) and to evaluate the sensory attributes and shelf life of them. Six different chutney recipes were developed and physico-chemical parameters such as total soluble solids (TSS), titratable acidity (TA), moisture and ash content of freshly produced chutneys and chutneys stored in ambient temperature (32±2 °C) were measured for 45 days at 15 days intervals. A sensory evaluation was carried out to check the consumer acceptance of taste, color, smell, texture, turbidity, overall quality and purchasing intention by using a Seven Point Hedonic scale. Data were analyzed by using Minitab statistical package (version 16). This study revealed that, cashew apple can be used to produce acceptable chutneys with or without mixing *ambarella*. Even though cashew apple chutney prepared by adding 50% of *ambarella* recorded the highest median ranks for all the sensory attributes, median ranks for taste, smell and overall quality were not significantly different from 100% cashew apple chutney. Further, chutney with only cashew apples could be stored up to 45 days without any significant change in TA, TSS, moisture and ash content together with no any microbial contaminations. Therefore, this study proved the potential of promoting cashew apple chutney among locals to minimize wastage of cashew apple and to improve the economy of rural community.

KEYWORDS: *Ambarella*, Cashew apple, Chutney, Sensory attributes, Shelf life

INTRODUCTION

Cashew (*Anacardium occidentale* L.) belonging to family Anacardiaceae is one of the major plantation crops grown in Sri Lanka. Cashew fruit consists of mainly the nut containing an embryo (Kernel) and a false fruit which is known as cashew apple (Akinwale, 2000). At present, there is great potential to increase cashew production in both local and export market. During 2014, the total extent of cashew plantation was about 21,490 ha and the production of raw nut was around 637,800 mt (Anon, 2015). For every tonne of cashew nut about 10-15 tonnes of cashew apples are produced (Attri, 2009).

Cashew apple is a non-climacteric fruit and it is a rich source of vitamins especially vitamin C, organic acids, antioxidants, carbohydrates and minerals. It has long been used in traditional medicine for the treatment of many diseases such as stomach disorders, sore throat, chronic dysentery and gastric diseases. Further, it possesses anti-bacterial, anti-oxidant and anti-mutagenic properties (Cavalcante *et al.*, 2005).

Cashew apple can be eaten fresh or processed into products such as juice, syrup, jam, jellies, candy, pickle, wine, brandy, vinegar or chips (Panda, 2013). Cashew apple can be used to make different products as it possesses several good characteristics such as fleshy pulp, soft peel, lack of seeds, high sugar content and strong exotic flavor (Garruti, 2003). However, the use of fresh cashew apples is limited due to its astringency, perishable nature and transport problems. Astringency and acrid principles in cashew apple include mainly polyphenolic compounds, tannin and oily substances (3%) (Sastry *et al.*, 1962).

Cashew is a seasonal crop and cashew apples spoil in the orchard under the trees due to the lack of awareness of its nutritional and medicinal values. Therefore, it is essential to find out a simple technique to preserve cashew apple, which would be acceptable to people for effective utilization.

Chutney is one of the convenient methods of preserving fruits and requires minimal capital investment. It is a popular food item in South Asian countries and it has sweet, sour or tangy taste (Kapoor, 2001). Chutney is commonly made from fruits by adding herbs and spices. Chutney made from *ambarella* (*Spondias dulcis* Sol. Ex Parkinson) is a popular food among the locals. Only a few studies have been conducted in Sri Lanka to develop food products from cashew apples (Randeni *et al.*, 2011; Nadeera *et al.*, 2011). Hence, this study was conducted to evaluate the possibility of producing chutney acceptable by consumers from pure cashew apple and cashew apple mixed with *ambarella* and also to determine the shelf life of those

products in order to minimize the wastage of cashew apple.

MATERIALS AND METHODS

Location

The study was carried out at the Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila from January to May 2016.

Sample Collection

Fresh cashew apples were harvested from the Puttalum plantation, Sri Lanka Cashew Corporation, and they were transported to the laboratory in the Department of Horticulture and Landscape Gardening. Immediately after arrival, damaged, over ripen, immature or disease affected fruits were removed and stored them under refrigerated conditions. Fresh, well matured *ambarella* fruits were harvested from home gardens in Makandura area.

Physico-chemical parameters of Cashew apple and Ambarella

Cashew apples and mature peeled *ambarella* fruits were cut into small pieces and 50 g of each was used to obtain juice to measure physico-chemical parameters. Titratable acidity (TA) was measured by using 0.01 N NaOH solutions. Total soluble solids (TSS) were measured using a hand-held refractometer (Model: ATAGO N-46, Japan). Percentage moisture and ash content were determined according to the method described by Association of Official Analytical Chemists (AOAC, 2001).

Chutney Preparation

Fresh cashew apples were washed thoroughly to remove any adhering dust and dirt and immersed in 2% salt solution for three days. After that, cashew apples were steamed for 30 min at 0.7 to 1.05 kg/cm^2 pressure. Then, they were cooled (32 °C) and washed with clean water. Pretreated cashew apples were cut into small pieces. Mature *ambarella* fruits were washed, peeled and cut into small pieces after removing fibrous pit. Chutneys were prepared according to the procedure given by Panda (2013) with required modifications. Cashew apple and *ambarella* pieces were mixed according to the ratios given in the Table 1. Then, the mixture was cooked after the adding of 230 g of sugar, 3 tsp of chili powder, 30 g of red onion, 20 g of salt and 15 mL of vinegar. Thirty grams of ginger, 30 g of garlic, 2 g of cinnamon, clove and cardamom were put into a muslin cloth sachet. Then, the sachet was kept in the cooking mixture and pressed time to time for obtaining the juice of spices; the sachet was removed after 25 min when the chutney was prepared. Then, the chutneys were filled into bottles which were sterilized by keeping them in boiling water (100 °C) for 30 min.

Table 1. Composition of cashew apple and *ambarella* in six different chutneys

Treatments	Description	
	Cashew apple (%)	*Ambarella* (%)
T_1	100	0
T_2	90	10
T_3	80	20
T_4	70	30
T_5	60	40
T_6	50	50

Physico-chemical Parameters of the Chutneys

Ten grams of chutney was taken into a beaker and 50 mL of distilled water was added. Then, the beaker was kept in a boiling water bath for one hour. The obtained solution was filtered and collected in to a 100 mL volumetric flask and the volume was increased up to 100 mL by adding distilled water. Twenty milliliters of the above solution was tittered with 0.01 N NaOH solutions to measure TA. Total Soluble Solids (TSS) was measured using a hand-held refractometer (Model: ATAGO N-46, Japan). Percentage moisture and ash content were determined according to the method described by Association of Office Analytical Chemists (AOAC, 2001).

Sensory Evaluation

A panel of 20 non trained tasters carried out the acceptance tests. The sensory evaluation was done at the time of production. The panelists were asked to indicate their observation using a Seven-Point Hedonic scale for color, texture, taste, smell, turbidity, overall quality, purchasing intention for all the prepared chutneys.

Scale of Acceptance (Seven-Point Hedonic Scale)

7- Strongly like, 6- Moderately like, 5- Slightly like, 4- Neither like nor dislike, 3- Slightly dislike, 2- Moderately dislike, 1- Strongly dislike

Shelf life Evaluation of Chutneys

The chutneys were stored at ambient temperature (32± 2 °C) in a closed cupboard and physico-chemical parameters such as TA, TSS, percentage moisture and ash content were measured for a period of 45 days with 15 days intervals. The microbial growth was determined by Total Plate Count Method. It was done by

following serial dilution method using the procedure described by Maturin and Peeler (2001).

Statistical Analysis

Data from sensory evaluation were analyzed by non-parametric analysis method (Kruskal Wallis test) and quantitative data were subjected to Analysis of Variance (ANOVA) procedure. Mean separation was done with Turkey's test using Minitab statistical package (Version 16).

RESULTS AND DISCUSSION

Physico-chemical Parameters of Fresh fruits and Fresh chutneys

Physico-chemical parameters of cashew apple, *ambarella* and fresh chutneys were given in Table 2. It was noted that moisture content of the six different chutneys was significantly lower than that of both fresh fruits. This was due to the water of fruit pieces by mixing with dry sucrose and prolonged cooking. Further, this may be the reason for the significant increased TSS in chutneys than in fresh fruits. Even though vinegar (acetic acid) was added to chutney, TA of the chutneys was lower than that of cashew apple and *ambarella*. This was attributed to the high sugar content in chutneys. Further, it was interesting to note that when increase *ambarella* in the formulation, acidity of chutney gradually increase.

Moisture and acidity play major roles in food preservation and all the prepared chutneys had a low moisture content and high acidity. Further, spices which have anti-microbial properties, and sucrose were added as ingredients and preservatives. According to the results, all the chutneys possessed acceptable level of TA, TSS, moisture and ash contents.

Sensory Evaluation of Fresh chutneys

There were significant differences ($p<0.05$) in colour, texture, taste, overall quality and purchasing intention among treatments except in turbidity and smell. All the prepared chutneys obtained median rank 5 or more for all the sensory attributes. The highest median ranks for all sensory attributes were recorded by T_6 which was made by adding 50% of both cashew apple and *ambarella*. However, there were no significant differences in texture, taste, smell and overall quality between 100% cashew apple chutney and chutney made with 50% of both cashew apple and *ambarella*. Chutney composed with 90% of cashew apple and 10% of *ambarella* recorded the lowest median rank (5) for all the sensory attributes. These differences may be due to the variation in their preparation, especially the *ambarella* percentages as the other ingredients were same for all the treatments.

Evaluation of Shelf life of Cashew apple Chutney

Variation of TA, moisture and ash percentages and TSS of the stored chutneys were given in Table 3. There was an increase of TA with the increase of storage time in all the treatments. Increase of acids in chutneys may be due to the formation of acids by degradation of polysaccharides and oxidation of reducing sugars during the storage time (Hussain *et al.*, 2008).

There was a rise in TSS content in all the treatments with storage time. It was noted that TSS content in T_2, T_3 and T_5 were significantly increased with storage time while there was no significant increase observed in T_1 and T_6. This may be due to either loss of moisture or conversion of starch and other insoluble carbohydrates into sugars (Vidhya and Narain, 2010).

Percentage moisture decreased in all the treatments except T_6 with the storage time however, a significant decrease was observed only in T_2. The ash content varied with time probably due to the reduction in moisture content during storage period. However, it is interesting to note that there was no significant change in TA, moisture, ash contents and TSS in 100% cashew apple chutney during the storage period.

There was no any microbial contamination observed up to 45 days in all the treatments.

CONCLUSIONS

Cashew apples can be preserved by producing chutneys much acceptable by consumers with or without mixing *ambarella*. Though cashew apple chutney prepared by adding 50% of *ambarella* recorded the highest median ranks for all the attributes (colour, smell, texture, taste, turbidity, overall quality and purchasing intention), median ranks for taste, smell and overall quality were not significantly different from 100% cashew apple chutney. Further, this could be stored without significant changing TA, TSS, moisture and ash content together with no any microbial contaminations up to 45 days under ambient temperature. This study proves that, the production of chutney would be an effective alternative to increase the shelf-life of cashew apple. Further studies are required to select best varieties to produce chutney and improve the shelf life by adding recommended preservatives. Production of cashew apple chutney can be promoted among locals in order to improve the economy of rural people.

Table 2: Physico-chemical parameters of fresh fruits and chutneys

Fresh fruits/ chutneys	TA %	TSS %	Moisture %	Ash%
Cashew apple	0.33±0.0^{b}	11.3±1.1^{b}	80.7±3.2^{b}	5.14±2.8^{a}
Ambarella	0.55±0.0^{a}	6±0.0^{c}	92.2±0.4^{a}	7.3±0.4^{a}
T_1	0.21±0.0^{d}	69.5±0.2^{a}	38.6±0.7^{c}	5.5±0.2^{a}
T_2	0.22±0.0^{d}	71±0.0^{a}	35.7±2.3^{c}	5.2±1.1^{a}
T_3	0.23±0.0^{d}	70±0.0^{a}	22.9±2.5^{d}	5.7±0.0^{a}
T_4	0.24±0.0^{cd}	66.3±1.1^{a}	25.4±0.5^{d}	6.3±1.1^{a}
T_5	0.26±0.0^{cd}	66.3±1.7^{a}	37.4±2.6^{c}	5.5±0.6^{a}
T_6	0.31±0.0^{bc}	69.5±3.5^{a}	19.6±0.4^{d}	4.4±1.0^{a}

Same letters in each columns are not significantly different from each other; TA- Titratable acidity, TSS- Total soluble solids, T1- 100% cashew apple, T2- 90% cashew apple+10% ambarella, T3- 80% cashew apple+20% amberalla T4- 70% cashew apple+30% amberalla, T5- 60% Cashew apple+40% amberalla, T6- 50% cashew apple+ 50% amberalla

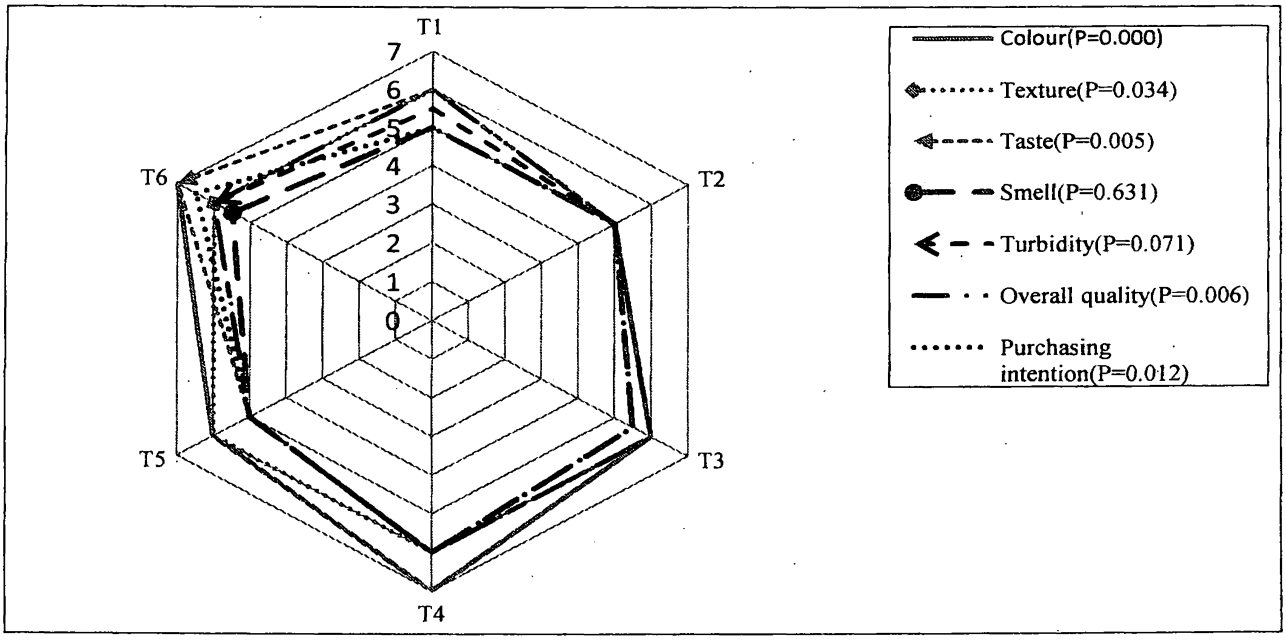

Figure 1. Median ranks obtained for sensory attributes in fresh chutneys

Table 3. Variation of Physico-chemical parameters of chutneys stored under room temperature

Treatments	Time period(days)	TA%	TSS%	Moisture %	Ash%
T_1	0	0.21±0.0^{a}	69.5±0.2^{a}	38.6±0.7^{a}	5.5±0.2^{a}
	15	0.26±0.0^{a}	71±1.1^{a}	36.5±0.7^{a}	5.8±0.2^{a}
	30	0.26±0.0^{a}	71.2±3.5^{a}	36.8±1.6^{a}	6.2±1.4^{a}
	45	0.26±0.0^{a}	72.3±0.6^{a}	35.5±0.7^{a}	6.7±1.8^{a}
T_2	0	0.22±0.0^{b}	71±0.0^{b}	35.7±2.3^{a}	5.2±1.1^{a}
	15	0.23±0.0^{ab}	72.3±0.7^{ab}	22.9±3.3^{b}	5.3±0.8^{a}
	30	0.24±0.0^{ab}	72±0.0^{ab}	19.4±1.9^{b}	5.7±0.5^{a}
	45	0.27±0.3^{a}	73±0.7^{a}	16.5±3.3^{b}	5.3±1.8^{a}
T_3	0	0.23±0.0^{a}	70±0.0^{b}	25.3±2.5^{a}	5.7±0.0^{a}
	15	0.25±0.0^{a}	71.3±0.7^{a}	24.9±0.6^{a}	5.7±0.0^{a}
	30	0.25±0.0 ^{a}	72 ±0.0^{a}	23.69±3.2^{a}	7.0±1.8^{a}
	45	0.26±0.0^{a}	72.1±0.1^{a}	22.2±1.4^{a}	7.3±5.8^{a}
T_4	0	0.24±0.0^{a}	66.3±1.1^{c}	25.4±0.5^{a}	6.3±1.1^{a}
	15	0.25±0.0^{a}	69±0^{b}	21.2±2.1^{a}	5.7±0.9^{a}
	30	0.26±0.0^{a}	72.3±0.6^{a}	20.7±6.6^{a}	4.8±2.1^{a}
	45	0.27±0.0^{a}	72.3±0.6^{a}	18.0±1.2^{a}	4.7±0.8^{a}
T_5	0	0.26±0.0^{a}	66.3±1.7^{c}	37.4±2.6^{a}	5.5±0.6^{a}
	15	0.27±0.0^{a}	69±1.0^{b}	28±3.9^{a}	4.9±0.2^{a}
	30	0.29±0.0^{a}	72.7±1.0^{a}	27±3.4^{a}	5.3±0.3^{a}
	45	0.31±0.0^{a}	72.8±0.6^{a}	26.5±2.1^{a}	4.6±0.8^{a}
T_6	0	0.31±0.0^{a}	69.5±3.5^{a}	19.6±0.4^{b}	4.4±1.0^{a}
	15	0.31±0.0^{a}	70.5±3.5^{a}	37.4±9.6^{ab}	5.1±0.1^{a}
	30	0.33±0.0^{a}	70±0.0^{a}	46.9±4.1^{a}	5.1±1.1^{a}
	45	0.36±0.0^{a}	72±0.0^{a}	48.1±11.3^{a}	5.7±0.2^{a}

T_1- 100% cashew apple, T_2- 90% cashew apple+10% ambarella, T_3- 80% cashew apple+20% amberalla T_4- 70% cashew apple+30% amberalla, T_5- 60% Cashew apple+40% amberalla, T_6- 50% cashew apple+ 50% amberalla
Same letters in each treatment are not significantly different from each other

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