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Effect of storage on the vitamin c content of cashew apple

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Abstract
Cashew tree (*Anacardium occidentale* L.) is a cash crop in. The cashew-apples are highly perishable not exceeding four days at room temperature. Cashew-apple juice is a valuable source of water, minerals and rich in vitamin C. It is reported to contain five times as much vitamin C as citrus juice and ten times as pineapple juice. The focus of this work was to evaluate the effect of storage conditions on the vitamin C retention in cashew apple in order to know how best and long cashew-apple juice could be stored. The ascorbic acid content of fresh cashew apple was 245mg/100g on fresh basis (0^{th} day), which gradually reduced to 238mg/100g at 6^{th} month of storage, without much difference. However, the ascorbic acid content of the cashew apple extract was 133mg/ml at zero month and 130mg/100ml. A reduction in the Ascorbic acid content of the Cashew apple extract was observed, compared to the fresh Cashew apple, which may be due to the extraction of the juice up to 60% only, in order to extract a cashew apple juice with low Tannin content. Cashew apple on storage had a marginal reduction in the ascorbic acid content.

Keywords: Cashew apple, ascorbic acid, cashew apple extract, storage

Introduction
Cashew tree (*Anacardium occidentale* L.) is a cash crop in. The cashew-apples are highly perishable not exceeding four days at room temperature. Its availability is seasonal and even when in season, a large quantity of the apples are wasted due to lack of adequate storage facilities. To prevent wastage, add variety to the diet of the farmers and rural dwellers as well as increase their income, the apples can be converted to juice, marmalade, jam and wine (Oduwole, O.O *et al*., 2001) [10]. According to Food and Agriculture Organization (2001), the major component of fruits is water derived from the extra and intracellular fluids necessary for metabolic processes and maintenance of cell sugar. Water composition ranges from 97% in some wild barriers to 70% in over ripe grapes and less than 50% in fruits drying naturally on the plant. As a result of this, fruits and their juice are becoming an important part of the modern diet in many communities. They are nutritious and plays a significant role in a healthy diet because they offer good taste and a variety of nutrients found naturally in them. Fruit juices are fat-free, nutrient-dense beverages, rich in vitamins, minerals and naturally occurring phyto nutrients that contribute to good health and promote detoxification in the human body. Countries with abundant fruit resources with short harvest season are focusing more on established storage facilities to maintain quality of fruits, increase their shelf life and preserve fruit juices for off-season. To preserve, store and package fruit juices to increase its shelf life has led many researchers to carry out work on different fruits. Francis, M.M. and Elizabeth, N.K. (2002) [4] studied ascorbic acid retention in canned lime juice preserved with sulphur dioxide and benzoic acid. The role of sodium benzoate as a chemical preservative in extending the shelf life of orange juice was done by Muhammad, S., *et al*., (2013) [9]. while the effects of packaging materials, storage temperature and time on Roselle-mango juice blends was carried out by Mgaya-Kilima *et al*., (2015) [8]. All these were a means of preserving fruits during its off-season. Cashew-apple juice is a valuable source of water, minerals and rich in vitamin C. It is reported to contain five times as much vitamin C as citrus juice and ten times as pineapple juice. De Carvalho J M *et al*., (2007) [2] also reported that cashew-apple juice has the potential to be a natural source of vitamin C and sugar in the processed foods. Vitamin C in fruits plays important role in utilization of amino acid tyrosine, lipid metabolism and collagen formation. Vitamin C content of fruit juices degrades over time in freshly squeezed juice (Hodges, E.E. 1974) [5]. Processing of cashew-apples to produce fruit juice and to preserve it for use at off-season is the objective of the present study. The focus of this work is to evaluate the effect of storage conditions on the vitamin C retention in cashew apple in order to know how best and long cashew-apple juice could be stored.

Materials and Methods

Collection of Plant material: Cashew apple (*Anacardium occidentale* L) freshly harvested ripe cashew apples of Ullal I variety, were picked from the farm of the Zonal Agricultural and Horticultural Research Station, Brahmavar, Udupi, Coastal Karnataka, India and sorted to discard the debris, immature and the damaged fruits and other foreign particles from the surface of the fruit and analyzed in the laboratory.

Cashew apple extract

Preparation of the extract

The fresh cashew apples were frozen and the freeze-dried cashew apple was thawed, macerated with methanol (10ml/gm of weight) and extracted for 18 hrs before filtration, re-extracted twice with cold methanol, each time with frequent swirling. The filtrates were combined, concentrated by oven drying and it was analyzed for the following.

Determination of Ascorbic acid

The cashew apple juice was extracted by the method of Wimalassari and Wills (1983). 20g of cashew juice was added to 30ml of citric acid 3% (w/v). The mixture was homogenized and centrifuged at 1500g for 25 min at 0 ^{0}C.
Ascorbic acid of fresh cashew apple and cashew apple extract were determined by 2, 6-dichlorophenol indophenols visual titration method (Ranganna, 1995) [6].

Preparation of 2, 6-dichlorophenol indophenols dye solution

In a beaker, 52 mg of 2, 6-dichlorophenol indophenols dye and 42 mg of sodium bicarbonate were disssolved using 150 ml hot distilled water. Then, the volume was made upto 200 ml with distilled water.

Preparation of 4 per cent oxalic acid

Fourty gram of oxalic acid was dissolved in 900 ml distilled water. Then, the volume was made up to 1000 ml with distilled water.

Standard ascorbic acid

Fifty mg of L-ascorbic acid was dissolved in a small quantity of 4 per cent oxalic acid in a 50 ml volumetric flask and the volume is made up to 50 ml with 4 per cent oxalic acid. 10 ml of this stock solution was diluted to 100 ml using 4 per cent oxalic acid. Therefore, the standard ascorbic acid contained 0.1 mg of ascorbic acid per ml of solution.

Standardization of dye

One ml of standard ascorbic acid solution and 5 ml of 4 per cent oxalic acid were taken in a conical flask and titrated against the dye solution. The end point was light pink colour which persisted for at least 5-10 seconds. The dye factor was then calculated as:

Dye factor = 0.1 / Titre value

Preparation of sample

Ten ml of sample was taken in a 100 ml volumetric flask and 50 ml of 4 per cent oxalic acid was added. The sample was thoroughly mixed and the volume was made up to the mark using 4 per cent oxalic acid. The solution was filtered using Whatman No. 4 filter paper and the filtrate was used for analysis.

Procedure

Ten ml of ascorbic acid extract was taken in a conical flask and titrated against the standard dye solution. The end point was light pink colour that persisted for 5-10 seconds.

Calculation

$$\text{Ascorbic acid, mg/100g} = \frac{\text{Titer value} \times \text{Dye factor} \times \text{Volume made up}}{\text{Volume taken for titration} \times \text{Weight of the sample}} \times 100$$

Results and Discussion

The cashew apple and its extract in the fresh and in chilled condition (4 ºC) were analyzed for ascorbic acid from month zero, up to 6 months (Fig 1 and Table 1). The ascorbic acid content of fresh cashew apple was 245mg/100g on fresh basis (0th day), which gradually reduced to 238mg/100g at 6th month of storage, without much difference. However, the ascorbic acid content of the cashew apple extract was 133mg/ml at zero month and 130mg/100ml. A reduction in the Ascorbic acid content of the Cashew apple extract was observed, compared to the fresh Cashew apple, which may be due to the extraction of the juice up to 60% only, in order to extract a cashew apple juice with low Tannin content. Cashew apple on storage had a marginal reduction in the ascorbic acid content.

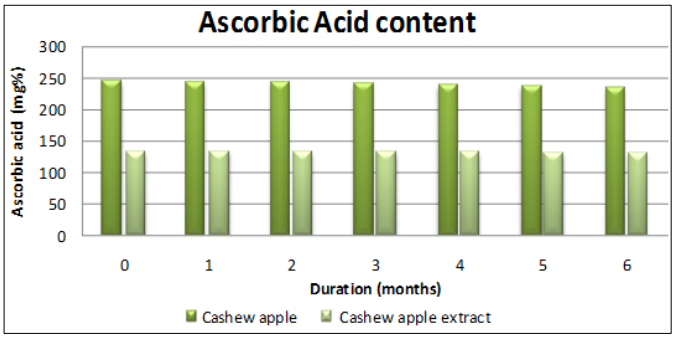

Fig 1: Changes in ascorbic acid content of Cashew Apple during storage period

Table 1: Ascorbic acid content of cashew apple during 6 months storage

	ASCORBIC ACID (mg)						
Months	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Cashew Apple (mg/100g)	245	244	244	242	240	240	238
Cashew Apple Extract (mg/100ml)	133	133	133	133	132	132	130

Fruit juices are perishable commodities, their stability is influenced by many factors including microbiological, physical and chemical factors. Various processing methods are used in stabilization and preservation of fruit juices. Ascorbic acid, total soluble solids (TSS), titratable acidity and pH stability are the parameters that determine the acceptability and quality of fruit juices. Ascorbic acid content in cashew apple is reported to be 6 times higher than in citrus fruit. (Michoudjehoun-Mestres *et al*. 2009). This water-soluble vitamin is very essential for absorption of dietary iron and also functions as an excellent antioxidant (Akinwale 2000) [1]. However, it is subject to oxidation and losses during processing and storage of fruit juices. Higher content of ascorbic acid was found in cashew apple juice on fresh basis, although a reduction was observed on storage. Storage of

cashew apple juice and extract had a marginal reduction in the ascorbic content. Our results are comparable to the observations reported by Akinwale 2000 [1].

Conclusion

The cashew apple and its extract in the fresh and in chilled condition (4 ºC) were analyzed for ascorbic acid from month zero, up to 6 months. There was no much difference in ascorbic acid content in cashew apple and its extract up to six months when they were stored at 4 ºC.

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