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Changes in physico-chemical properties and organoleptic characteristics of custard apple (*Annona squamosa* L.) fruit during storage

V.N. PAWAR AND SYED IMRAN HASHMI

ABSTRACT

The custard apple (*Annona squamosa* L.) is notified as a non-conventional, climacteric and highly perishable tropical type of fruit. The custard apple fruit is mostly used as a dessert because of its delicious taste and nutritive value. The white, creamy flesh has strong aroma reminiscent of a mixture of strawberry, banana and pineapple. The fruits are highly perishable having limited consumable shelf-life after ripening. It is important to understand the consumer shelf-life of fruit so as to optimize the time of harvesting of fruit to prevent losses. In present investigation, efforts were made to study the physico-chemical and organoleptic changes in fruit during storage. The results revealed that the custard apple fruit harvested at the commercial stage of maturity resulted in increase in total soluble solids, total sugar and acidity up to 4th day of storage while further storage caused reduction in these parameters. In terms of organoleptic characteristics of fruit, maximum score was observed in case of fruit storage for till 4th day while subsequent storage of fruit resulted in decrease in consumer acceptability of fruit.

Key words : Custard apple, *Annona squamosa*, Organoleptic characteristics, Consumer shelf-life

INTRODUCTION

Annona is a genus of tropical fruit trees belonging to the family Annonaceae. Five species have been notified as important but under-utilised (Abdul Khader *et al.*, 1977). *Annona squamosa* is a deciduous tropical species, especially when cultivated in areas with a pronounced dry season and without irrigation (Jadhav *et al.*, 1992). The fruits contain vitamin C and minerals such as calcium, phosphorus and potassium. They are also an excellent source of carbohydrate base energy. Annonas are notified as table consumable fresh fruits because of pronounced perishability but made feasible for distant marketing by adopting intensive post harvest commodity treatments (Gutierrez *et al.*, 1994). The freshly harvested, uniformly ripened fruits of custard apples are reported to be of poor quality when stored for prolonged period at ambient temperature specifying little commercial importance. The pulp is of pleasant texture and flavour. It is sweet and slightly acidic. The food value is predominantly associated with sugar (12 to 22 per cent) and protein content (1.6%

per cent) (Pal and Kumar, 1995).

The custard apple (*Annona squamosa* L.) is notified as a non-conventional, climacteric and highly perishable tropical type of fruit. The custard apple fruit is mostly used as a dessert because of its delicious taste and nutritive value (Soliva-Fortuny, 2002). The white, creamy flesh has strong aroma reminiscent of a mixture of strawberry, banana and pineapple (Brown *et al.*, 1988). The fruits are highly perishable having limited shelf-life after ripening.

Custard apple has a limited shelf-life at ambient conditions and is highly perishable. The custard apple fruits are feasible to eat even after the storage period of 8 days. However, consumers judge the quality of fruit on the basis of external appearance which start deprecating after few days of harvesting. The importance of optimizing the harvesting of fruits to determine the acceptable period of consumption after harvesting will go a long way in judging the suitability of harvesting with maximum consumer acceptability. Hence, in present investigation efforts were made to study the changes in physico-chemical properties

and organoleptic characteristics of custard apple fruit during storage.

MATERIALS AND METHODS

Collection of custard apple fruits:

Custard apple fruits were collected from University orchards of Marathwada Agricultural University, Parbhani (MS). The fully developed, freshly harvested fruits without blemishes, having commercial maturity were packed in 10-kg capacity corrugated fibre boxes.

Physico-chemical analysis characteristics of custard apple:

The physico-chemical analysis of fruit *viz.*, physiological loss in weight (PLW), total soluble solids (TSS), titrable acidity, pH, ascorbic acid and reducing sugar was determined as per standard method (AOAC, 1990).

Organoleptic evaluation of fruit:

The organoleptic evaluation in respect of colour, flavour, texture, palatability of the pulp, firmness at edible ripe stage of custard apple fruit was evaluated by trained/semi-trained judges using nine point Hedonic Scale.

RESULTS AND DISCUSSION

The post harvest biochemical changes in custard apple are comparatively faster notifying its fast progress status confined to limited shelf-life. The experiment was designed to preserve natural quality parameters of fresh fruit at specified conditions ($27\pm 3^{\circ}\text{C}$ and 85% RH) to justify its overall acceptability. The experiments was continued for 8 days to assess its table consumable status. The observations recorded on physico-chemical of fresh fruit are presented in Table 1.

Physiological loss in weight (PLW) of custard apple

The physiological loss in weight of fruit harvested at specified maturity stage was found linearly increasing up to 8 days where fruit became inedible. It was interesting to note that profound loss in physiological weight of fruit was observed up to 4 days (15.87 per cent) followed by 19.79 and 21.89 per cent at 6th and 8th day, respectively

(Table 1). Such type of non-uniform increase in loss in weight may be associated with ripening of fruit. The physiological loss in weight is collective effect of respiration and transpiration processes facilitating the ripening as one of the intermediate physiological development phase of the fruit.

Total soluble solids of custard apple fruit during storage:

The data on the effect of storage period on total soluble solids of custard apple fruits are also given in Table 1. At the zero hour storage period of fruit having notified post harvest lag phase the total soluble solids content of fruits was recorded as 10.24 per cent. The TSS of custard apple fruits increased linearly but non-steadily. Progressive and steady increase in TSS was observed to be up to a uniform and controlled ripening of stage (24.1^oBx TSS and 0.26% acidity) followed by steady gradual decrease irrespective of storage period. The similar trend with respect to change in TSS was observed by Geetha Lekshmi (1999).

Reducing sugar of custard apple fruit during storage:

Data depicted in Table 1 reveal that at zero hour storage, reducing sugars content of the fruit was 2.19 per cent. The reducing sugar content of the fruit recorded similar trend as reported for total soluble solids content. Reducing sugars are responsible for justifying the table consumption and processable status of fruit.

Titrable acidity of custard apple fruit during storage:

At the zero hour storage period the total titratable acidity of fruit was recorded as 0.07 per cent. The acidity was found to increase steadily till it reached the peak against the uniform ripening stage, followed by a slight decline at the end of storage period notifying its feasibility as inedible status. The similar trend was observed by Kamble and Chavan (2005) in custard apple.

Organoleptic characteristics of custard apple fruit during storage:

On the basis of data generated on sensorial quality parameters (Fig.1), it could be observed that highest

Table 1 : Effect of storage period on physico-chemical properties of fresh fruit

Days of storage	Physico-chemical properties				
	PLW (%)	TSS (%)	Reducing sugar (%)	Ascorbic acid (mg/100g)	Titrable acidity (%)
Day 0 (initial)	00.00	10.24	02.19	43.12	0.070
Day 4	15.87	24.19	10.09	39.92	0.262
Day 6	19.79	20.33	14.13	28.17	0.233
Day 8	21.89	18.10	15.50	21.86	0.210

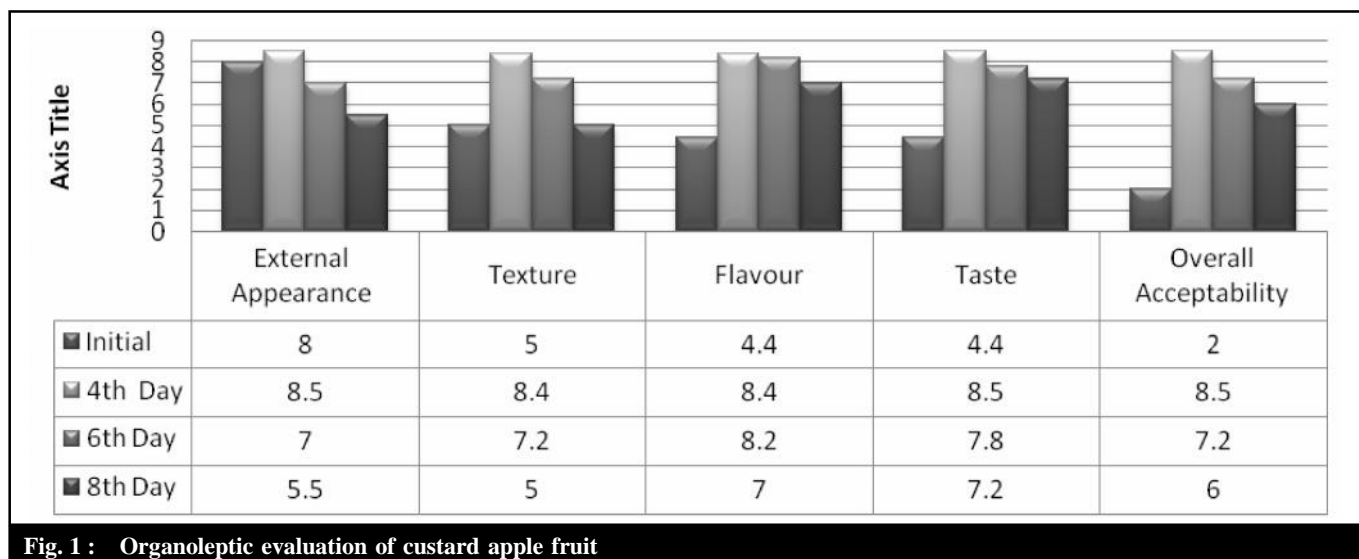


Fig. 1 : Organoleptic evaluation of custard apple fruit

organoleptic score (8.5) was recorded on 4th day of storage period notified its uniform and controlled ripening phase justifying its end use.

Effect of storage on external appearance of fruit:

The external appearance of the fruit justifying its overall acceptability was reported to be significantly affected by the storage period. The external appearance of fruits is an important factor not only for freshness of fruit but also for better acceptability and marketability. The external appearance of the fruit is function of its three dimensional development governed by glossiness, size, shape, volume and weight. The uniform and fully ripened fruit scored maximum (8.5) on 4th day notifying its utmost overall acceptability. Over-ripening of the fruit facilitates deterioration of nutritional constituents leading the fruit unfit for consumption specified with excessive loss of external appearance (Babu *et al.*, 1990).

Effect of storage on texture of custard apple fruit:

The texture of the fruit of custard apple is an indication of uniform and controlled ripening of the fruit justifying its end use. The fruit softening was found to increase continuously and steadily during storage of the fruits. The recorded score of 8.4 was found to be most acceptable with respect to sensorial quality parameters and overall acceptability (Fig. 1). The softening of fruits is mainly associated with progressive maceration facilitated by *in vivo* pectinolytic enzymes responsible for degradation of pectic substances to pectic acid and galacturonic acid.

Effect of storage on flavour of custard apple fruit:

Flavour development in custard apple fruit pulp is a functional of increase in acidity which leads to formation

of various flavouring volatile compounds indicating its acceptability. However, long term storage *i.e.* up to 6 or more days may leads to phenolic interaction of compounds which are being resulting in decrease in flavour profile (Table 1 and Fig. 1).

Effect of storage on Taste characteristics of custard apple fruit:

The taste of fruit increased with increase in storage period up to 4th day. It was mainly due to the increase in sugar content during storage. However, excessive increase in sugar content lead in reduction of taste characteristics as observed in 6th and 8th day, respectively.

Effect of storage on overall acceptability of custard apple fruit

According to sensorial evaluators, the overall acceptability of custard apple fruit is majorly a function of textural and flavour characteristics of the fruit while the appearance and taste plays a minor role during consumption. With increase in time period of 4th day of storage, the excessive degradation of starch in pulp caused degradation of textural profile with increase in sugar content. In all, on the basis of sensorial characteristics of product, it could be concluded that 4th day of storage of custard apple fruit under controlled condition was optimum with respect to organoleptic characteristics.

Conclusion:

The physiological loss in weight of fruit decreased with increase in storage period while drastic loss of weight was observed after 4th day of storage and custard apple fruit was highly acceptable as per the sensorial point of view at 4th day of harvesting under uniform and controlled

ripening phase.

REFERENCES

- A.O.A.C** (1990). *Official methods of analysis*. Association of Official Analytical Chemists. 15th Edition. Washington D.C.
- Abdul Khader, J.B.M. and Jaypal, R.** (1977). Atemoya is as good as cherimoya. *Indian Horticulture*, **21** (4): 9 – 10
- Babu, K. H., Zageeruddm, M. and Prasad, P.K.** (1990). Studies on post-harvest storage of custard apple. *Acta Horticulturae.*: 269 – 299
- Brown, B. I., Wong, L. S., George, A. P. and Nissen, R.J.** (1988). Comparative studies on the post-harvest physiology of fruit from different species of *Annona* (custard apple). *J. Hort. Sci.*, **63** (3): 521-528
- Geetha Lekshmi, P.R.** (1999). Studies of fruit development, ripening, storage and packaging of custard apple. M.Sc. (Ag.) Thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, M.S., India.
- Gutierrez M., Lahoz I.M., Pascuad, S.L. and Vargas, A.M.** (1994). Postharvest changes in total soluble solids and tissue pH of cherimoya fruits stored at chilling and non chilling temperatures, *J. Hort. Sci.*, **69** (3) : 459 – 463.
- Jadhav, SB., Kaulgud, S.N. and Waskar, D.P.** (1992). Effect of chemical treatments and polyethylene packaging on shelf-life of custard apple. *Maharashtra J. Hort.*, **6**(1): 62 – 67
- Kamble, P.B. and Chavan, J.K.** (2005). Effect of post harvest treatments and storage temperature on shelf-life of custard apple fruit. *J. Food Sci. Technol.*, **42**(3): 253 – 255
- Pal, D.K., and Kumar, S.P.** (1995). Changes in the physico-chemical and biochemical compositions of custard apple (*Annona squamosa L.*) fruit during growth, development and ripening. *J. Hort. Sci.*, **70**(4): 569 – 572
- Soliva-Fortuny, R.C., Pedro, E.M., Iez-Martinez, Merce S.C., and Olga Martin Belloso** (2002). Kinetics of PPO activity, inhibition and browning of avocado puree preserved by combined methods., *J. Food Engg.*, **55**: 131 – 137.

Address for correspondence :

SYED IMRAN HASHMI

Department of Food Trade and Business Management,
College of Food Technology,
Marathwada Agricultural University, PARBHANI (M.S.) INDIA
E.mail : imran.foodresearch@gamil.com

Authors' affiliations :

V.N. PAWAR

Department of Food Science and Technology,
College of Food Technology,
Marathwada Agricultural University, PARBHANI (M.S.) INDIA
E.mail : vasantraopawar@rediffmail.com

