

EFFECT OF STORAGE TEMPERATURE ON SHELF LIFE OF AONLA FRUIT (*EMBLICA OFFICINALIS* G.)

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Abstract: The changes in aonla fruit quality were evaluated over 9 days storage at different storage temperatures (10, 25°C and room temperature) packaged in cardboard boxes. Samples were analysed at two days interval for physiological loss in weight, decay loss, acidity and specific gravity. The results showed that fruits of aonla stored at 10°C showed minimum physiological loss in weight, decay loss with the highest shelf life as compared to the other treatments whereas fruits of aonla stored at 25°C had maximum physiological loss in weight and decay loss during all periods of storage. Specific gravity and acidity content decreased during storage at all the temperatures.

Keywords: Aonla, Decay loss, Shelf-life, Temperature

INTRODUCTION

Nowadays, quality has become one of the most important consumer decision factors in the selection among competing products and services. The quality of the food products in conformity with consumer requirements and acceptance is determined by their sensory attributes, chemical composition, physical properties, level of microbiological and toxicological contaminants, shelf-life, packaging and labelling (Khorshidiet *al.* 2010). Food quality management has become challenging the last years due to changes in consumption patterns, development in technology and increasing legislative requirements (Luning & Marcelis, 2006).

Fruits and vegetables are two of the most perishable categories of foods and two of the most important causes for malnutrition diseases in the developing world. Losses occur either on the pre-harvest phase or on the harvested product during handling in general. The fact that the fruits and vegetables have a soft texture means that they are easily damaged having as a consequence the deterioration of quality or even making the product inappropriate for human consumption. Temperature management is one of the most important tools for extending the shelf life of fruits (Lee & Kader, 2000), because it regulates the rate of all associated physiological and biochemical process.

Many studies on the effect of storage temperature on quality and storage life of fruits have been done which shows temperature plays an important role on quality of fruits after harvest. The objective of this study was to determine the effects of different storage temperature on the postharvest quality changes in aonla fruits during storage.

MATERIAL AND METHOD

Samples were harvested from the orchard of the Horticulture department, Chaudhary Charan Singh

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Haryana Agricultural University, Hisar, Haryana with the help of secateurs keeping small intact pedicel with each fruit and immediately selected for uniformity in size and absence of defects. 2kg of aonla fruits were packed in cardboard boxes with newspaper as cushioning material and stored at 10°C, 25°C and room temperature (15-17°C). Each box was treated as one replicate and all the treatments were replicated four times. Storage at 10°C was done by keeping the cardboard boxes in refrigerator and temperature was maintained. Storage at 25°C was done by keeping the cardboard boxes in incubator and temperature was maintained. For room temperature, fruits were stored in room and average temperature was calculated. The physiological loss in weight was taken on each day of observation and calculated by the following formula suggested by Srivastava & Tandon (1968).

Physiological loss in weight (%)

Initial weight – final weight

$$= \frac{\text{Initial weight} - \text{final weight}}{\text{Initial weight}} \times 100$$

Initial weight

Fruits showing rotting due to micro-organisms infection were considered as decayed ones and were weighed on each day of observation and were separated from the box. Weight of decayed fruits was taken on each day of observation. The percent decay loss was estimated by the following formula suggested by Srivastava & Tandon (1968).

Decay loss (%) =

Weight of decayed fruits

$$= \frac{\text{Weight of decayed fruits}}{\text{Initial weight of fruits at the time of packing}} \times 100$$

The total titrable acidity was determined by the standard method (AOAC, 1990). One gram of fruit pulp (0.2g for aonla powder) was macerated/ mixed in a pestle and mortar by adding water. The extract was titrated against 0.1N sodium hydroxide using 1% phenolphthalein as an indicator. The appearance of

light pink color which persists for one minute was taken as end point. The acidity of fruit was expressed on percent basis.

$$\frac{\text{Total acidity (\%)} = \frac{\text{Titer value} \times \text{Normality of Alkali} \times \text{Volume made} \times \text{Equivalent weight of acid}}{\text{Volume of Sample taken} \times \text{weight of sample} \times 1000}}{\times 100}$$

The water displacement method was used for measuring the specific gravity.

RESULT AND DISCUSSION

Results indicated that storage temperature had little effect on surface color of fruits. While marketable quality decreased with increase in temperature. Increase in physiological loss in weight (PLW) in aonla stored at all temperatures (Table 1) was observed throughout the storage period (0-9 days). Physiological loss in weight in fruits is mainly due to various physiological processes i.e. respiration and transpiration (Singh *et al.* 2003). After harvesting of fruits, during storage, the supply of photosynthates

from plant is cut off and whatsoever is stored inside the fruit that has to be utilized for respiration, transpiration and other physiological processes. As all those physiological processes utilizes various photosynthates already stored in fruits, as result of which fruit weight decreases during storage which is expressed in terms of physiological loss in weight.

In present study, highest PLW was recorded in fruits of aonla stored at 25°C and minimum PLW was observed in fruits of aonla stored at 10°C followed by room temperature (15-17°C) during storage. This could be due to the reason that at 10°C, rate of various enzymatic activities might have been low, so rate of various physiological processes might have been low and this might have resulted in minimum PLW in 10°C stored fruits. At high temperature storage i.e. on 25°C, various physiological processes in aonla fruits might be occurring at higher rate which might have resulted in higher PLW. Results of higher PLW at high storage temperatures as compared to low storage temperatures are in conformity with results obtained by De Freitas & Mitcham (2012) in pitaya fruits (*Hylocereus undatus*), Roongruangsri *et al.* (2013) in tangerine fruits during storage.

Table 1. Physiological loss in weight (%) during storage at different temperatures in fruits of aonla (*Embllica officinalis* G.) cv. Chakaiya

Storage temperatures (T)	Physiological loss in weight (%)		
	Period of storage (D)		
	3	6	9
Room temperature (15-17°C)	0.88	2.36	3.53
10°C	0.34	1.02	1.98
25°C	3.75	12.1	22.3
CD at 5%	0.36	2.07	1.83

Data in table 2 predicts that no decay loss was observed up to 3rd day of storage in fruits of aonla at all storage temperatures. Decay loss increased from 6th to 9th day in all the storage temperatures. On the 6th day of storage, minimum decay loss was observed in fruits stored at 10°C (0.53%) whereas maximum decay loss was observed in fruits kept at 25°C which was 8.63% on same period of storage. Similar trend was observed on 9th day of storage where fruits stored at 10°C showed minimum decay loss of 0.71% and fruits kept at 25°C had maximum decay loss i.e. 35.74% on same period of storage. Maximum decay

loss in fruits stored at 25°C might be due to higher rate of various physiological processes and degradation of pectin substance leading to softening and attacked by microflora whereas these physiological processes might be occurring at slower rate in fruits stored at 10°C that's why fruits of aonla kept at 10°C had minimum decay loss at all periods of storage. These results are in agreement with those reported by Ayala-Zavala *et al.* (2004) in strawberry fruits and Kivi *et al.* (2014) in raspberries stored at different temperatures.

Table 2. Decay loss (%) during storage at different temperatures in fruits of aonla (*Embllica officinalis* G.) cv. Chakaiya

Storage temperatures (T)	Decay loss (%)	
	Period of storage (D)	
	6	9
Room temperature	0.53	0.85
10°C	0.37	0.71
25°C	8.63	35.74
CD at 5%	0.45	2.26

Decrease in specific gravity with increasing period of storage observed in fruits of aonla kept at different storage (Table 3). This might be attributed to more evaporative and transpirational losses which might have resulted in decrease in mass however volume might not have been decreased to same extent. So, the specific gravity of aonla fruits decreased during the storage. Fruits of aonla stored at 25⁰C had minimum specific gravity on 9th day of storage whereas fruits of aonla kept at 10⁰C showed

maximum specific gravity at same period of storage. This might be attributed to higher evaporative and transpirational losses in fruits stored at 25⁰C which might have resulted in decrease in mass whereas 10⁰C stored fruits might be having low evaporative and transpirational losses which resulted in slow decrease in specific gravity. These results are in agreement with reported by Antala *et al.* (2014) in sapota and Singh & Pal (2008) in guava.

Table 3. Specific gravity during storage at different temperatures in fruits of aonla (*Emblca officinalis* G.) cv. Chakaiya

Storage temperatures (T)	Specific gravity				Mean
	Period of storage (D)				
	0	3	6	9	
Room temperature	1.13	1.10	0.99	0.95	1.05
10 ⁰ C	1.13	1.08	0.97	0.96	1.03
25 ⁰ C	1.13	1.03	0.95	0.92	1.01
Mean	1.13	1.07	0.98	0.95	

Acidity content of aonla fruits stored at different temperatures decreased with increasing period of storage (Table 4). This is obvious because various acids might have been utilized in various physiological processes (i.e. respiration) going on in

the fruits during storage. Decrease in acidity content during storage might also be associated with bio-conversion of organic acids to sugars (Bhullar *et al.* 1981).

Table 4. Acidity content (%) in fruits of aonla (*Emblca officinalis* G.) during storage in different cultivars at room temperature

Cultivars (C)	Acidity (%)						Mean
	Period of storage (D)						
	0	3	6	9	12	15	
CHAKAIYA	2.16	1.83	1.64	1.46	1.26	1.09	1.57
BANARASI	2.20	1.99	1.84	1.61	1.42	1.27	1.72
HATHIJHUL	2.19	1.99	1.82	1.65	1.45	1.29	1.73
KRISHNA	2.27	2.15	1.93	1.75	1.55	1.39	1.84
KANCHAN	2.24	2.07	1.90	1.72	1.52	1.33	1.80
Mean	2.21	2.01	1.83	1.64	1.44	1.27	
CD at 5%	C= 0.01		D= 0.02		Cx D = 0.03		

Fruits of aonla stored at 25⁰C had minimum acidity content on 9th day of storage whereas fruits of aonla stored at 10⁰C retained maximum acidity content at the same period of storage. This might be due to the reason that fruits of aonla stored at 25⁰C might have higher rate of various physiological processes which might have caused the rapid utilization of acids and decrease in acidity content to higher extent during storage. Fruits of aonla kept at low temperature i.e. 10⁰C might be having slow rate of various physiological processes which might have caused less utilization and decrease in acidity content to lesser extent during storage. The results of decrease in acidity content to different extent in fruits stored at different storage temperatures are in accordance with findings of De Freitas & Mitcham (2012) in pitaya fruits and Roongruangsri *et al.* (2013) in tangerine fruits.

CONCLUSION

Fruits of aonla kept at 10⁰C had minimum PLW as well as decay loss whereas fruits of aonla stored at 25⁰C had highest PLW and decay loss on all days of storage. Specific gravity and acidity content of aonla decreased with increase in the period of storage at all storage temperatures. Fruits stored at 25⁰C had minimum specific gravity and acidity content whereas fruits of aonla kept at 10⁰C had maximum specific gravity and acidity content during storage.

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