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COMPOSITIONAL CHANGES IN JAMOON FRUITS (*EUGENIA CUMINII*) DURING STORAGE

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ABSTRACT

Studies were conducted to evaluate quality changes in jamoon fruits using modified atmosphere packaging in conjunction with ethrel or ethanol treatments up to 12 days at refrigerated and non-refrigerated temperatures. Although ethanol was effective in reducing astringency in fruits after 3 days, fruits appeared bleached with sensory evaluations revealing a distinct off-taste which became intensified with increasing storage durations. Fruits stored in sealed low-density polyethylene bags on the other hand, maintained a turgid, fresh appearance and color with minimal changes in percentage fresh weight losses and decay after 12 days at 10°C without alterations in astringency.

INTRODUCTION

The jamoon fruit, botanically *Syzygium cuminii*, is a member of the Myrtaceae family. The fruit is known by English names such as Black Plum, Indian Blackberry, Jambul and Java Plum (Williams, 1969). In the East Indies where it originated, it is called by several local names such as Jaman, Jambu, Kala Jam, Phalani and Phalinda (Kirtikar and Basu, 1975).

The fruits are ellipsoid or oblong and about 1.5 to 2.5 cm long. They are borne in grape-like clusters, consisting of a mixture of fruits at the immature green stage to fruits at the mature purple stage. The fruits are used mainly for the making of wine, beverages and vinegar. Medicinally, the fruit is stated to be stomatic, carminative, antiscorbutic, and diuretic (Kirtikar and Basu, 1975). Cooked to a thick jam, it is eaten to allay acute diarrhoea (Kirtikar and Basu, 1975). It is rarely consumed as a fresh fruit because it is very astringent even when ripe. The ripe fruits are highly perishable and are thus difficult to handle and store. While some studies have been reported on the nutritional, medicinal and processing values of jamoon fruits (Williams, 1969, Khurdiya and Roy, 1985) there are no published data on the postharvest behavior of the fruit during storage. Additionally, efforts to reduce the astringency of the fruit could result in wider utilization as a fresh fruit and as a substitute for the importation of temperate fruits. In view of this, investigation focussed on the effects of modified atmosphere packaging and prestorage chemical treatments on the general quality and compositional changes of the fruit during storage in an attempt to improve its shelf life and palatability for human consumption.

MATERIALS AND METHODS

Fresh jamoon fruits were hand-harvested between 8:00 - 9:30 a.m. in East Trinidad, and transported in single layers in cardboard cartons to the laboratory in the Department of Crop Science, University of the West Indies within 45 minutes of harvest. Fruits were carefully and individually removed from bunches and graded in terms of apparent maturity, size, and color. They were then washed in a mixed fungicidal and bactericidal solution consisting of 500 ppm Bavistin FL and 500 ppm sodium hypochlorite plus a sticker (Tween 20, 0.1%) for 10 minutes. Fruits were selected a second time for consistency in size and color as well as to remove those that had any signs of

physical injuries such as punctures, bruises, abrasions or splits and surface dried in a single layer on absorbent soft paper for 35 minutes. A total of 1,080 individual fruits were then divided randomly into three equal portions.

Fruits were then subjected to the following pre-storage chemical treatments. The first batch was dipped into a solution of 300 ppm ethrel and 0.1% Tween 20 sticker for 10 minutes. The second portion was dipped in 95% ethanol for 2 minutes and the third portion was the undipped control.

Batches of ten fruits were randomly taken from each of the above treatments and seal-packaged in low density polyethylene (LDPE, 0.025mm thick) or high density polyethylene (HDPE, 0.025mm thick) bags, or left in open paper bags and stored at 10°C 70-80% R.H., 20°C 65-75% R.H. and 30°C 60-70% R.H. respectively. Fruits were assessed at 3 day intervals up to 12 days for the following parameters:

(i) Fresh weight losses, calculated as a percentage of the initial weight prior to storage.

(ii) Astringency score based on a hedonic scale from 1-5 with 1 = non-astringent, 2 = slightly astringent, 3 = moderately astringent, 4 = astringent and 5 = extremely astringent. This subjective evaluation was correlated with the ferric chloride test as previously conducted by Gazit and Levy (1963). The freshly cut surface of the fruit was pressed against dry filter paper that was previously soaked in a 5% ferric chloride ($FeCl_3$) solution. This resulted in the development of a purple-black color if the fruit was considered to be extremely astringent to a light pink color if the fruit was non-astringent. The varying intensity of color changes of the filter paper from pink to dark purple-black was used to develop a color chart to correspond to the degree of astringency as described previously.

(iii) The pH of the fruit was obtained by blending 12.5g of the pitted fruit in 50 ml of distilled water (Oster 8-speed blender) for 1 minute. The mixture was strained through a 0.5mm gauge strainer and the pH of the filtered liquid was determined using an Orion Research Expandable Ion Analyzer, Model EA920. The pH meter was standardized with buffer solutions at pH 2 and pH 7.41 respectively.

(iv) Total soluble solids (TSS) concentration was done by using a Bettingham and Stanley hand-held refractometer with a measuring range of 0-20% using the expressed juice and expressed as a percentage.

(v) Percentage decayed fruits were obtained by calculating the number of fruits per treatment showing visible signs of pathological infections.

(vi) Microbial analysis was done by aseptically isolating microorganisms from the decaying fruits on commercially prepared Oxoid Potato Dextrose Agar (PDA) for yeast and mould, and Oxoid Nutrient Agar (NA) for bacteria using the Direct Streak technique. Both the PDA and NA media were prepared for inoculation by rehydration with distilled water followed by sterilization in a Prestige 4-quart pressure cooker at 121°C and 15 psi for 15 minutes. After cooling at 50°C, 15ml aliquots of each medium were poured into sterile Pyrex glass petri dishes and allowed to cool before inoculation. The petri dishes containing the inoculated media were then incubated aerobically at 25°C for 48-72 hours in a Gallenkamp Size 2 Model INA 300-130M incubator. The yeast and bacterial colonies isolated were then stained using Grain stain method, while the moulds were mounted on glass slides and fixed under a cover-slip in lactophenol cotton blue solution. All of the isolated organisms

were examined using a Bauch and Lomb microscope for identification of micro-organisms.

(vii) Fruits were classified into one of four chilling injury categories where 1 = no injury; 2 = slight; 3 = moderate (limit to marketability); 4 = severe with extensive secondary infections. The chilling injury index was determined for each fruit by summing the products of the number of fruits in each category and then dividing this sum by the total number of fruits asessed (Wild and Hood, 1989).

The experiment consisted of four replicates. Data were analyzed as a completely randomized design with a factorial arrangement of variables, and significance tested by the F-test and L.S.D. where applicable after transformation for ranking (Sneddor and Cochran, 1980).

RESULTS AND DISCUSSION

The results in this study indicated that jamoon fruits stored best at 10°C when seal-packaged in LDPE bags having the lowest percentage of decayed fruits after 12 days when compared to decay incidence in fruit stored in HDPE or paper bags (Table 1). Dipping fruits in ethanol was most effective in reducing fruit astringency after 3 days with a steady decline as storage time increased (Figure 1). Despite the reduction in astringency, a slight alcoholic-taste was detected but this was objectionable after 9 days and more so at the two higher temperatures where fruits were seal-packaged in the two types of polyethylene packaging. Ethanol-treated fruits appeared bleached with fruits having a lighter purple color compared to the normal dark purple color. Ethanol probably dissolved some wax on the fruit epidermis thus reducing the normal gloss associated with these fruits. In some cases ethanol promoted fruit-splitting which contributed to the occurrence of secondary infections. Apparently the ethanol treatment was more effective than the other chemical treatments because it promoted a faster conversion of the astringent tannins from a soluble to an insoluble form as fruits become non-astringent, although the fundamental change in tannins leading to insolubility and the mechanism initiating this change is not known (Eaks 1967, Gazit and Levy 1963, Overholser 1927). In other studies, Gazit and Levy (1963) and Eaks (1967) obtained similar results in terms of improved palatability when persimmons were treated with 95% alcohol.

Several studies have shown ethrel as an effective remover of fruit astringency (Rosa, 1925; Chase and Denny 1924). The limited success of ethrel in this study could be related to the duration of application and the type of fruit. Perhaps the 10 minute dip was too short compared to the 15-24 hours exposure given to other fruits as reported by the authors cited above. Ethrel did promote fruit ripening accounting for higher total soluble solids after 12 days at 10°C compared to the other treatments (Table 3). The higher ($P<0.05$) total soluble solids for fruits in paper bags could be attributed to the loss of moisture and the resultant concentrating of sugars.

While it is obvious that the microsaturated environment and modified atmosphere created within the sealed bags would have accounted for the lower fresh weight losses and extended shelf life for fruits in LDPE and HDPE bags (Table 2) compared to fruits kept in paper bags it was also evident (Figure 2) that this may have also accounted for a reduction in chilling injury. In other studies Ben-Yehoshua *et al* (1983) and Mohammed *et al* (1990) obtained similar results although both groups of authors agreed that HDPE bags was more effective than LDPE bags in reducing chilling injury. In this study both polyethylene bags had similar effects on chilling injury (Figure 2). The higher degree of desiccation of fruits in paper bags compared to LDPE and HDPE bags contributed to a significant ($P<0.05$) reduction in decay (Table 1). The causal organism of decay for fruits in LDPE and HDPE bags were species of the Genus *Mucor*.

Further investigations are continuing to determine alternative methods for removal of fruit astringency and extending shelf life using perforated and non-perforated polyethylene bags.

Table 1. Effects of M.A.P. and Chemical Treatments on % Decayed Jamoon Fruits after 12 days at 10°C.

AFTER 12 DAYS AT 10°C			
CHEMICAL TREATMENTS	% DECAYED FRUITS		
	LDPE	HDPE	PAPER BAGS
ETHREL	26.1 bc	30.9 d	100.0 g
ETHANOL	18.4 a	23.2 b	90.4 f
CONTROL	23.5 b	28.4 cd	86.9 e
LSD (0.05)		±3.2	

Table 2. Effect of packaging upon percentage fresh weight losses of jamoon fruits during storage.

FRESH WEIGHT LOSSES (%)				
PACKAGES	3 DAYS	6 DAYS	9 DAYS	12 DAYS
LDPE	7.99 ab	8.40 ab	9.76 bc	11.14 c
HDPE	7.45 a	8.20 ab	8.52 ab	10.11 bc
PAPER BAGS	20.74 d	32.59 e	38.02 f	47.74 g
LSD (0.01)		±2.15		

Table 3. Effects of packaging and chemical treatments on pH and T.S.S. in Jamoon after 12 days at 10°C.

AFTER 12 DAYS AT 10°C						
CHEMICAL TREATMENTS	pH			T.S.S.		
	LDPE	HDPE	P.BAGS	LDPE	HDPE	P.BAGS
ETHREL	2.84 bc	2.85 c	2.83 bc	11.78 d	11.44 c	13.11 f
ETHANOL	2.80 a	2.82 ab	2.80 a	10.69 b	10.36 a	12.03 d
CONTROL	2.83 bc	2.84 bc	2.83 bc	11.19 c	10.86 b	12.53 e
LSD (0.01)		±0.02			±0.25	

REFERENCES

Ben-Yehoshua, S., Shapiro, B., Even-Chen, Z. and Lurie, S., (1983). Mode of action of plastic film in extending life of lemon and bell pepper fruits by alleviation of water stress, Plant Physiology 73: 87-93.

Braithwaite , C.W.D. (1981). Introduction to the diagnosis of plant diseases. IICA Publ. ISBN 92-9039-0131 51 pp.

Chase, E.M. and Denny, F.E. (1924). Use of ethylene in the coloring of citrus fruits, Industrial and Engineering Chemistry 11:339-340.

Eaks, I.L. (1967). Ripening and astringency removal in persimmon fruits, Proceedings of the American Society for Horticultural Science, 91:868-875.

Gazit, S. and Levy, Y. (1963). Astringency and its removal in persimmons. Israel Journal Agric. Res. 13:3, 125-131.

Khurdiya, D.S. and Roy, S.K. (1985). Processing of jamoon fruit into a ready to serve beverage. J. Food Science and Technology 22, 27-30.

Kirtikar, K.R. and Basu, B.D. (1975). Indian medicinal plants, MIS Periodical Experts, New Delhi 2.

Mohammed, M., Wilson, L.A. and Gomes, P.I. (1990). Effects of polyethylene bags, temperature and time on storage of two hot pepper cultivars, Tropical Agriculture, 67 (3): 194-199.

Overholser, E.L. (1927). Some studies upon the ripening and removal of astringency in Japanese persimmons, Proceedings of The American Society for Horticultural Science, 24: 256-266.

Rosa, J.T. (1925). Ripening of tomatoes, Proceedings of the American Society for Horticultural Science, 315-322.

Sneddor, G.W. and Cochran, W.G. (1980). Statistical Methods, 6th ed., Ames, Iowa State University Press. pp 507.

Wild, B.L. and Hood, C.W. (1989). Hot dip treatments reduce chilling injury in long term storage of Valencia orange. HortScience 24 (1): 109-110.

Williams, R.O. (1969). The Useful and Ornamental Plants in Trinidad and Tobago, Trinidad and Tobago Printery. pp 78.

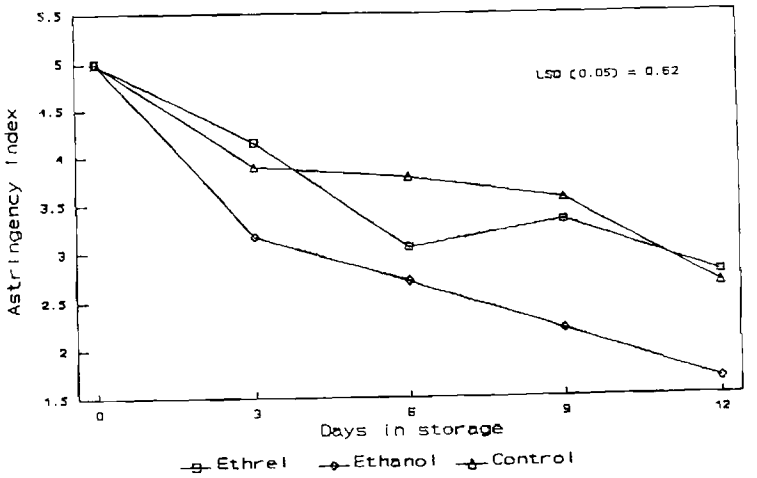

Fig. 1. Effect of chemical treatment on th removal of astringency in Jamoon fruits.

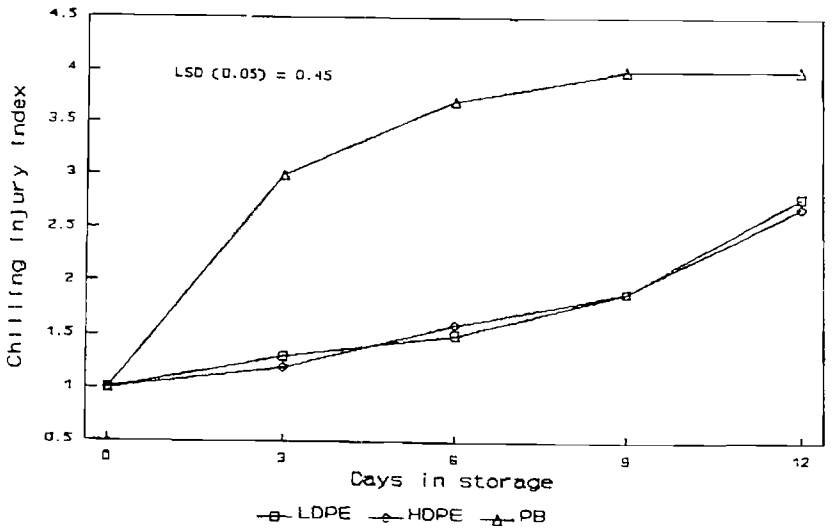

Fig. 2. Effect of packaging upon chilling injury in Jamoon fruits.