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Short Communication
Effect of different coatings on free radical scavenging activity of kinnow fruits

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Abstract
Kinnow mandarin is a non-climacteric fruit and liable to spoilage due to highly perishable in nature. The postharvest losses can be minimized through checking various physiological processes which are going on even after harvest. Present investigation was conducted to study the effect various concentrations of Gum Arabic, Calcium Lactate and Glycerin and their different combination on free radical scavenging activity of Kinnow fruits during storage at room temperature. Free radical scavenging activity decreased with increase in storage period in all treatments. All the treatments were effective in maintaining the free radical scavenging activity during entire storage period. Highest Free radical scavenging activity was observed in fruits coated with Gum Arabic 10% and control fruits had minimum free radical scavenging activity.

Keywords: kinnow, calcium lactate, glycerin and free radical scavenging activity

Introduction
The fruits are rich sources of various vitamins, minerals and fibers required by human body for optimal health. In the recent years, more attention has been paid to the antioxidants contained in fruits because epidemiological studies revealed that high fruit intake was associated with reduced mortality and cardiovascular disease and some types of cancer and one of possible mechanisms was attributed to the antioxidant activity presented by the fruits (Lampe, 1999) [5]. To protect their possible damages to biological molecules, especially to DNA, lipids and proteins, all oxygen-consuming organisms are endowed with a well-integrated antioxidant system, including enzymatic and non-enzymatic components. However, fruits are diverse in antioxidant composition and antioxidant activity and those with high antioxidant activity generally contain more antioxidants (Guo *et al*. 1997) [3]. Besides classical antioxidants including vitamin C, E and carotene, free radical scavenging activity has also been identified as important antioxidants contained in fruits. The foresaid objectives can be achieved to some extent by use of edible coatings, gel, oil, lipid, starch, packaging and wrapping materials and different type of storage used as postharvest treatments. The present experiment was conducted to find out the effective post-harvest treatments of gum arabic, calcium lactate and glycerin or in proper concentration to maintain the free radical scavenging activity of Kinnow fruits.

Materials and methods
Present experiment was conducted in the laboratory of department of Botany & and Plant Physiology, CCS Haryana Agricultural University, Hisar. The experiment was designed in completely randomized design. Mature Kinnow fruits of uniform size were harvested with the help of secateurs keeping small intact pedicel with each fruit from the orchard of the department of Horticulture, CCS Haryana Agricultural University, Hisar. Kinnow fruits were cleaned with muslin cloth and were dipped in aqueous solutions of Gum Arabic (5%), Gum Arabic (10%), Calcium lactate (1%), Calcium Lactate (3%), Glycerin (2.5%), Gum Arabic (5%)+Glycerin (2.5%), Glycerin (2.5%)+ Glycerin (2.5%), Calcium lactate (1%)+ Glycerin (2.5%) & Calcium lactate (3%)+ Glycerin (2.5%) for 10 minutes and were dried in shade thereafter were wrapped in cling film. Two kg fruits were packed in each cardboard box and all the treatments were replicated four times. Fruits of all treatments were stored at room temperature. Fruits at random were taken from each treatment for analysis free radical scavenging activity in fresh fruits and at seven days of interval up to 49th day. The antioxidant activity of the fruit juice was evaluated by DPPH free radical scavenging method according to the method of Shimada *et al.* (1988) [6]. 25 mg of DPPH dye was weighed accurately

and 10ml of ethanol was added with vigorous shaking, till the dye dissolves. 1ml of this solution was then diluted to 100 ml in a volumetric flask with ethanol. 5 ml of this solution was added to 0.4 ml of fruit extract prepared for phenol estimation. After 15 minutes of incubation at 30^0C, absorbance was measured at 517 nm.

Estimation

The percentage of DPPH scavenged, was calculated using:

Scavenging activity (%) = ($A_{control}$ - Asample /$A_{control}$) x 100

Where $A_{control}$ is the absorbance of control and A_{sample} is the absorbance of the sample.

Result and discussion

Free radical scavenging activity (FRSA) as presented in table 1 revealed that it decreased with advancement of storage period (up to 49 days) in kinnow fruits. FRSA decreased from 33.83% to 21.86% on initial day of storage to 49th day of storage. This might be due to high ascorbic acid content present in fruits which might have been responsible for the higher activity of free radical scavenging activity. As there was direct correlation between ascorbic acid free radical scavenging activity in fruits. With the increase in storage period ascorbic acid content decreased

Table 1: Effect of different treatments on free radical scavenging activity (%) in Kinnow fruits during storage at room temperature

Treatments	Days of storage								
	0	7	14	21	28	35	42	49	Mean
Gum Arabic (5%)	33.83	34.12	32.45	30.17	29.15	27.34	22.12	22.64	28.98
Gum Arabic (10%)	33.83	33.60	31.36	29.33	28.68	26.18	24.23	24.79	29.00
Calcium Lactate (1%)	33.83	32.65	31.18	29.63	28.78	25.89	22.56	21.32	28.23
Calcium Lactate (3%)	33.83	32.38	31.23	29.98	28.97	26.16	22.81	21.57	28.37
Glycerin (2.5%)	33.83	32.01	30.98	29.13	27.58	25.32	22.11	20.45	27.68
Gum Arabic (5%) + Glycerin (2.5%)	33.83	33.82	32.58	31.11	29.27	27.42	24.65	22.32	29.38
Gum Arabic (10%) + Glycerin (2.5%)	33.83	33.97	32.67	31.45	29.45	27.89	25.01	22.84	29.64
Calcium Lactate (1%) + Glycerin (2.5%)	33.83	32.11	31.32	30.28	28.36	26.21	23.12	21.52	28.34
Calcium Lactate (3%) + Glycerin (2.5%)	33.83	32.79	31.34	30.59	28.48	26.64	23.54	21.78	28.62
Control	33.83	31.96	30.12	28.24	27.24	25.18	21.89	19.36	27.23
Mean	33.83	32.94	31.52	29.99	28.60	26.42	23.20	21.86	
CD at 5%	T=0.69 D=0.65 T×D=1.09								

Which might be correlated with the decrease in activity of free radical scavenging activity. These results are also in confirmity with the results of Iloki *et al.* (2013) [4] in Noni (*Morinda citrifolia* L.). However, all the treatments were effective in retaining the FRSA as compared to control. Lowest free radical scavenging activity was observed in control fruit (27.23%) during entire storage period. This might be due to the reason as there was no additional coating over the surface of fruit which could be attributed to the decrease in ascorbic acid content enzymes which resulted in increase in activity of oxidizing. This could be correlated with the decreased FRSA in control fruits. Maximum FRSA among treatments was observed in Gum Arabic 10% coated fruits i. e 29% followed by fruits treated with Gum Arabic 5% i. e. 28.98%. This maybe because fruits coated with these coatings retained maximum ascorbic acid content. These results are in agreement with the earlier reports of Ali *et al.* (2013) [1] and Ali *et al.* (2010) [2] in Tomato fruits.

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