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Effect of edible coatings on eating and functional quality of Japanese plum cv. Santa Rosa

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ABSTRACT

Plum (*Prunus salicina* L.) fruits of cv. Santa Rosa, were treated with Semperfresh™ (1:3), vegetable wax (1:5) and lac based (2:3) as an edible coating on the farm as well as after transportation to the laboratory (off-farm). Analytical determinations were made after 3, 6, 9, 12 and 15 days at 20 ± 2°C. All surface coatings, especially lac based wax were effective in inhibiting loss of moisture, ascorbic acid, total antioxidant activity and total phenols content. Lac based and Semperfresh™ displayed better efficacy in maintaining firmness followed by vegetable wax. At the end of storage period, lac based coated fruits showed higher fruit firmness (8.87 and 8.53 N) than control (6.50 and 6.30 N) in both on-farm and off-farm treatments, respectively followed by Semperfresh™ coated fruits (7.84 and 7.79 N). Maximum loss in titratable acidity (52%) was observed in control fruits whereas minimum loss was observed in on-farm treated lac based and Semperfresh™ coated fruits. The delay of the ripening process was also related to lower anthocyanin accumulation and least colour changes. After 15 days of storage, lac based coated fruits showed ~13% lower anthocyanin content. The maximum total antioxidant activity and ascorbic acid content at end of storage were recorded in on-farm treated fruits with lac based coating (17.49 µmole Trolox/g and 3.92 mg/100 g, respectively), followed by Semperfresh™ and vegetable wax. Overall, results suggest that the surface treatments with lac based and Semperfresh™ coatings could effectively maintain the acceptability of plum fruits.

Key words: Plums, edible coating, fruit quality, lac based wax, Semperfresh™.

INTRODUCTION

Plum, belonging to family Rosaceae, is one of the commercially important fruit crops of temperate and sub-tropical India. In the country, plums are commercially grown in the hilly regions of Himachal Pradesh, Jammu & Kashmir, Uttrakhand and north eastern states. Plum consumption has beneficial health effects due to their antioxidant compounds such as vitamin C, polyphenols and anthocyanins. Given the perishable nature of plum fruit, the use of cold storage is necessary to delay changes related to ripening, such as ethylene production, respiration rate, softening, pigment changes, weight and decrease in acidity (Diaz-Mula *et al.*, 5). However, cold storage is not enough to preserve fruit quality at optimum levels during transportation and storage, which may often lead to the incidence of severe chilling injury symptoms, evident as mealiness, translucency, and pulp reddening. Therefore, intervention with alternative postharvest technologies is the need of the hour. To maintain fruit quality for longer periods, treatments with calcium, heat, polyamines, 1-methylcyclopropene (Valero and Serrano, 12) and modified atmosphere packaging (Diaz-Mula *et al.*, 5) have been reported earlier. Also application of edible coatings has been carried out as an effective postharvest treatment to preserve fruit quality, with the additional benefit of reducing the volume of non-biodegradable packaging materials (Olivas *et al.*, 8). These edible coatings act as physical barriers on the fruit surface and decrease its permeability to O_2, CO_2 and water vapour, leading to reductions in respiration and transpiration rates and to retardation of the natural physiological ripening process. Numerous studies have been done on edible coatings but they were mostly focussed on treatments given after transportation, with no work on on-farm applications. Hence, the present investigation was undertaken in order to compare the effect of on-farm and off-farm (after transportation) application of edible coatings on the eating and functional quality of plum fruits.

MATERIALS AND METHODS

The plums of 'Santa Rosa' variety were harvested at climacteric stage of maturity in July, 2013 from a private orchard at Kullu (Himachal Pradesh). The harvested plums were grouped into two lots of 10 kg each. The first group was subjected to application of different surface coatings, namely, Semperfresh™

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(1:3), vegetable wax (1:5), lac based (2:3) and control (distilled water dip) on the farm, air- dried for 1 h and packed in wooden boxes followed by transportation to the laboratory at New Delhi. The coated plums were packed in punnets having 0.05% ventilation and stored at 20 ± 2°C for further study. The second lot of freshly harvested plums was transported to the laboratory and treated similarly as the first lot with edible coatings and stored at 20 ± 2°C for further study. Observations were recorded for both the lots of plum fruits at 3 day intervals. Peel colour was determined using Hunter Lab System (model: Miniscan XE PLUS). The colour value was expressed as chroma index and hue angle by using corresponding *L**, *a** and *b** values. Fruit firmness was determined using a texture analyzer (model: TA + Di, Stable micro systems, UK) using compression test. Firmness was defined as maximum force (kgf) during the puncture, which was expressed in Newtons (N). The total soluble solids of samples were estimated using Fisher, hand refractometer (0-50°B) and expressed as degree Brix (°B) at 20°C. Titratable acidity and ascorbic acid content of the plums were determined as per the standard procedures given by (Ranganna, 9). Total antioxidant activity in the plums was determined by the CUPRAC method (Apak *et al*., 2). The total phenols content was expressed in mg of gallic acid equivalents (GAE) / 100 g of extract by following Folin-Ciocalteau method. The anthocyanin content was determined on a UV-visible spectrophotometer by the pH-differential method (Wrolstad *et al*., 14). The overall acceptability rating of all the plum fruits was done by a panel of 10 judges on a 9 point hedonic scale (Amerine *et al*., 1).

Two way analysis of reference was performed on the data sets using SAS 9.3 software (3) and significant effects ($p \leq 0.05$) were noted. Significant difference amongst the means was determined by Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

With an increase in storage duration, hue angle and chroma were found to decrease significantly ($P < 0.05$) with the fruits progressively becoming red and darker. Control (water dipped) fruits showed continuous decrease in hue angle (Fig. 1) with the progression of storage, with maximum decrease (~54%) in on-farm treated followed by off-farm (~43%) treated fruits. In contrast, the decrease in hue angle was slower and more gradual in the coated fruits, irrespective of the coating. Amongst the coatings, Semperfresh™ and lac based wax resulted in the slowest decrease in hue angle. While not significantly different, best control of change in fruit colour in terms of chroma values were observed in Semperfresh™ and lac based wax coated fruits (Fig. 2). In general, the changes in peel colour in terms of chroma values was significantly higher in control (~80%) plums irrespective of site of treatment. All coated plums had higher gloss than the non-coated ones, with Semperfresh™ coated fruits having the maximum followed by lac based treatment. Peel colour changed during storage in all plum samples to dark purple as could be inferred from the decrease in the chroma and hue angle, the decline being least for coated fruits. This can be ascribed to the synthesis of anthocyanins, the pigment contributing to the purple colour of plums as also reported earlier by Eum *et al.* (7) and Valero *et al.*(13) in coated plums.

In this study, the fruit firmness was found to be significantly influenced by the location and the surface coating applied and their was progressive decline (Fig. 3). The on-farm treated fruits retained higher

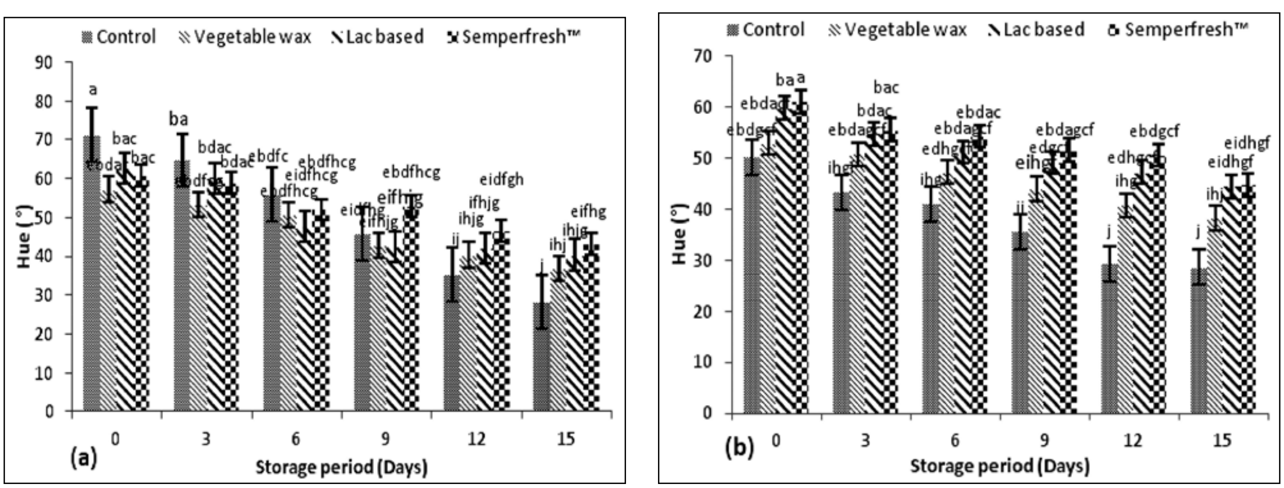

Fig. 1. Effect of on-farm (a) and off-farm (b) application of edible coatings on hue in plum cv. Santa Rosa stored at 20 ± 2°C.

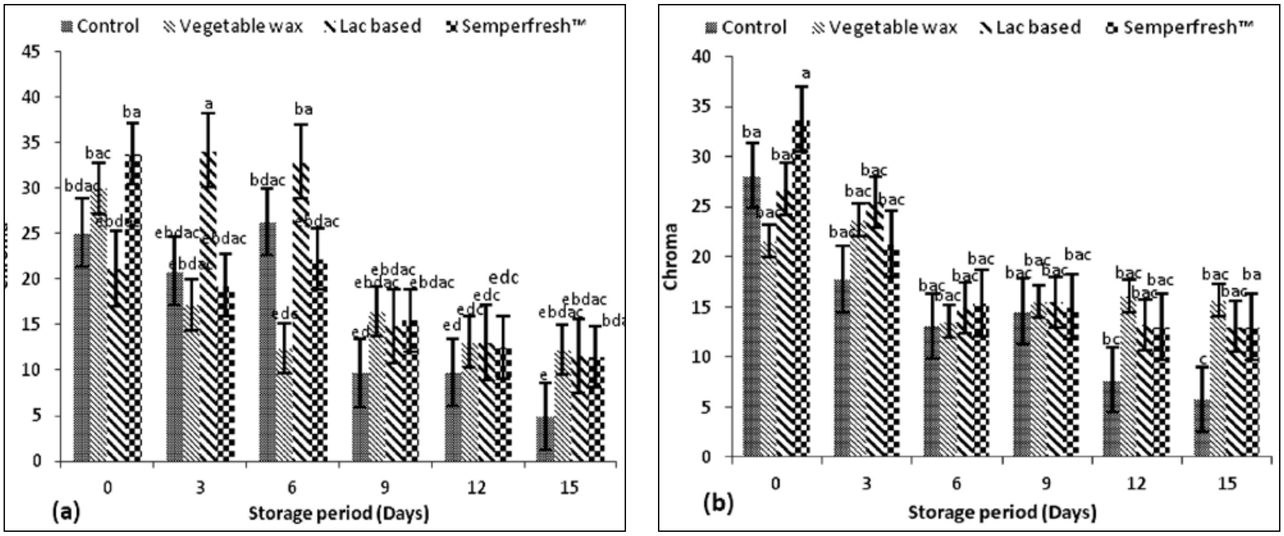

Fig. 2. Effect of on-farm (a) and off-farm (b) application of edible coatings on chroma in plum cv. Santa Rosa stored at 20 ± 2°C.

firmness (13.87 N) as compared to fruits that were treated after transportation (13.75 N) in the lab (off-farm). Fruits coated with the edible coatings displayed a slower rate of decline in firmness than the uncoated fruits. At the end of storage period of 15 days, lac based coated fruits showed ~ 69% higher fruit firmness than control in both on-farm and off-farm treatments (Fig. 3) followed by Semperfresh™ coated (~ 66% and 65.5%, respectively) and vegetable wax coated fruits (~35 and 34%, respectively). Higher retention of firmness by the coated fruits indicated that coatings were effective in retarding the metabolic and enzymatic activities and also degradation of cell wall components in the plums. Previous studies have reported a similar performance of delaying softness in Semperfresh™ coated cherry (Yaman and Bayoundurlc, 15). Fruits treated after transportation reported lower values of firmness because of the absence of any physical barrier to restrict the physiological activities during transportation.

The total soluble solids showed an initial increase followed by a gradual reduction with the values significantly lower in untreated plums than those treated with different edible coatings (Table 1). Control (water dipped) fruits showed an initial increase in TSS upto 6th day of storage followed by a decline. Fruits treated on-farm showed a higher mean retention of TSS in comparison to those treated off-farm. Soluble solids are substrates that are consumed by respiration during storage. The TSS increased initially followed

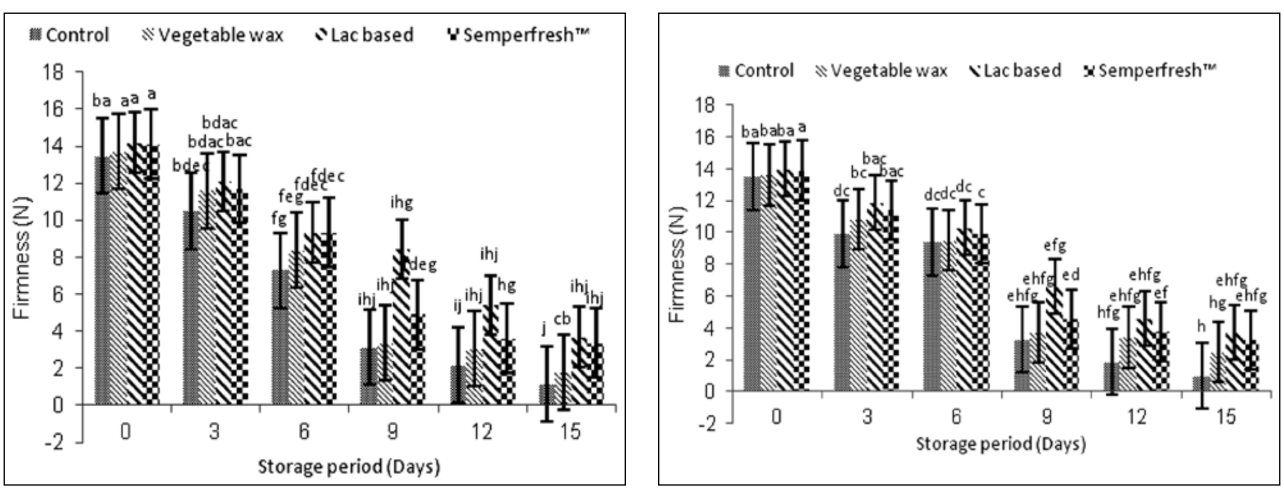

Fig. 3. Effect of on-farm (a) and off-farm (b) application of edible coatings on firmness in plum cv. Santa Rosa stored at 20° ± 2°C.

by a decline. This increasing trend of TSS with advancement of storage might be due to hydrolysis of starch to simple sugars. In the later storage stages, owing to high respiration rate the sugars got utilized and resulted in a subsequent decrease in TSS, the decrease being more prominent in control (water dipped) fruits treated after transportation. Similar trends have been reported by Baritelle *et al*. (4). Moreover, lac based coating was more effective in the retention of soluble solids because of the lower gas permeability that inhibited the respiratory rates and retarded the overall metabolic activities of plums during storage. The results are in accordance with that reported by Zhou *et al.* (16) on pears.

Observations recorded for change in titratable acidity revealed a declining trend during storage, in both coated and control fruits (Table 2), the decline being more pronounced (0.88%) in case of control (water dipped) fruits. Surface coatings apparently slowed down the reduction in acidity as compared to control at both treatment sites thereby having higher acidity retention. At the end of storage of 15 days, amongst the on-farm coated fruits, lac based and Semperfresh™ coatings were able to retain significantly higher titratable acidity as compared to vegetable wax coated fruits (~74%). Decrease in total acidity is typical during postharvest storage of fleshy fruit, such as plums, and has been attributed to the use of organic acids as substrates for the respiratory metabolism in detached fruits. In the present study, reduction in titratable acidity was observed with the advancement of storage period, with maximum being in control fruits (0.88%). Surface coating of fruits apparently slowed down the reduction in acidity as compared to control at both treatment sites thereby having higher retention. Earlier, Valero *et al.* (13) also showed more retention of titratable acidity in alginate coated plums. With regard to the effect of treatment site, on-farm treated fruits showed slow-decline in titratable acidity as compared to fruits treated in the laboratory after transportation.

The total antioxidant activity was significantly higher in fruits coated with edible coatings as compared to water dipped (control) fruits. However, maximum total antioxidant activity after 15 days of storage was recorded (Table 3) in on-farm treated fruits coated with lac based coating (mean value of 17.49 µmole Trolox/g), followed by Semperfresh™ (mean value of 16.34 µmole Trolox/g) and vegetable wax (mean value of 15.81 µmole Trolox/g). The antioxidant capacity increased initially followed by a progressive decline with the increase in storage duration. The percent decrease was highest (20.90) for off-farm treated plums. Similar trend was also reported by Sanchez-Gonzalez *et al.* (10) in hydroxypropylmethyl cellulose and chitosan coated grapes.

The surface coatings retarded the loss in ascorbic acid in plum fruits (Table 4). This resulted in higher retention of vitamin C in coated fruits as compared to control, maximum being in fruits coated with lac based on the farm. Control fruits, in contrast, recorded faster rate of reduction (~35%) in ascorbic acid content. Overall, there was a continuous decline in ascorbic acid content in plum fruit throughout the storage period. Ascorbic acid is primarily regulated by activity of ascorbic acid oxidase and phenoloxidase whose activities are influenced by the oxygen content in the storage conditions. This reduction of ascorbic acid loss in coated plums may be due to the low oxygen permeability of the coatings, which might have lowered the activity of the enzymes and prevented oxidation of ascorbic acid.

In all the treatments, there was an increase in total phenols initially followed by a gradual decline, through it was more pronounced in control (water dipped) fruits (Table 5). Maximum reduction in total phenols (~36%) was observed in fruits that were treated in the laboratory after transportation followed by those treated on-farm. While all the coatings led to higher retention of total phenols, lac based was found to be the best followed by Semperfresh™ and vegetable wax coatings. These changes in total phenols can be attributed to the delay of fruit senescence in coated fruits. There was inhibition of the ripening process because of application of coating before transportation that resulted in lower total phenols in on-farm treated samples as compared to fruits treated after transportation. These results are in agreement with findings of Sanchez-Gonzalez *et al.* (10) on grapes.

An increase in the total anthocyanins content in the plum fruits was observed with the advancement of storage period (Table 6), however, the coated fruits displayed a delay in rate of increase. Fruits treated with lac based wax and Semperfresh™ showed the slowest rise in total anthocyanin content until the termination of storage period. After 15 days of storage, lac based coated fruits showed ~13 and ~7% lower anthocyanin content, Semperfresh™ coated fruits showed ~12 and ~6% and vegetable wax coated showed ~7 and ~5% lower anthocyanin content as compared to control for on-farm and off-farm treated, respectively. The levels of anthocyanin in plums increased progressively with the increase in storage period primarily because there was progressive ripening and thereby development of colour. Reduced rate of anthocyanin development in fruits treated on-farm and those that were coated maybe due to reduction of respiratory activity and suppression of anthocyanin synthesis associated with postharvest ripening. Fruits treated with lac based and Semperfresh™ coating showed the slowest rise in anthocyanin content. The results confirm the previous

Table 1. Effect of on-farm and off-farm application of edible coatings on TSS (ºB) in plum cv. Santa Rosa stored at 20 ± 2°C.

Treatment	On-farm							Off-farm						
Storage days	0	3	6	9	12	15	Mean	0	3	6	9	12	15	Mean
Control	12.46^{fgih}	13.06^{fgedi}	13.56^{fedc}	13.40^{fgedc}	12.53^{fgih}	9.53^{kl}	12.42^{c}	12.30^{ighf}	12.56^{eghf}	12.90^{egdf}	13.06^{edf}	12.60^{egf}	9.90^{j}	12.22^{c}
Vegetable wax	14.00^{bedc}	15.13^{ba}	15.83^{a}	13.03^{fgedih}	10.76^{kj}	9.00^{l}	12.96^{b}	14.03^{bc}	14.56^{ba}	15.03^{a}	12.00^{igh}	10.46^{j}	8.56^{k}	12.44^{cb}
Lac based	12.03^{gjih}	13.23^{fgedc}	14.10^{bedc}	14.46^{bac}	14.33^{bdc}	12.00^{jih}	13.36^{a}	12.06^{igh}	13.53^{dc}	14.00^{bc}	14.33^{bac}	14.33^{bac}	11.66^{ih}	13.32^{a}
Semperfresh™	11.93^{jih}	12.76^{fgeih}	13.50^{fedc}	13.75^{fbedc}	13.42^{fedc}	11.76^{ji}	12.85^{b}	12.13^{igh}	12.53^{eghf}	12.86^{egdf}	13.40^{edc}	12.72^{egdf}	11.56^{i}	12.53^{b}
Mean	12.60^{c}	13.55^{b}	14.25^{a}	13.66^{b}	12.76^{c}	10.57^{d}		12.63^{c}	13.30^{b}	13.70^{a}	13.20^{b}	12.53^{c}	10.42^{d}	

Means with same superscript are not significantly different.

Table 2. Effect of on-farm and off-farm application of edible coatings on titratable acidity (%) in plum cv. Santa Rosa stored at 20 ± 2°C.

Treatments	On-farm							Off-farm						
Storage days	0	3	6	9	12	15	Mean	0	3	6	9	12	15	Mean
Control	1.60^{a}	1.44^{bac}	1.34^{bdac}	1.01^{ebdc}	0.94^{edc}	0.82^{e}	1.19^{b}	1.62^{ba}	1.41^{ebdac}	1.31^{ebdacf}	1.01^{edhgf}	0.93^{hgf}	0.74^{h}	1.17^{b}
Vegetable wax	1.60^{a}	1.18^{ebdac}	1.36^{bdac}	1.14^{ebdac}	1.12^{ebdac}	0.87^{ed}	1.16^{b}	1.60^{da}	1.44^{bdac}	1.32^{ebdacf}	1.11^{edhgcf}	0.86^{hg}	0.76^{h}	1.13^{b}
Lac based	1.63^{a}	1.47^{ba}	1.45^{bac}	1.31^{ebdac}	1.23^{ebdac}	1.11^{ebdac}	1.37^{a}	1.62^{ba}	1.53^{bac}	1.43^{ebdac}	$1.27^{ebdagcf}$	1.21^{ebdgcf}	1.01^{ehgf}	1.34^{a}
Semperfresh™	1.63^{a}	1.53^{ba}	1.43^{bac}	1.31^{ebdac}	1.16^{ebdac}	1.08^{ebdc}	1.35^{a}	1.68^{a}	1.51^{bac}	1.34^{ebdacf}	$1.30^{ebdagcf}$	1.12^{edhgcf}	1.01^{ehgf}	1.33^{a}
Mean	1.53^{a}	1.40^{a}	1.39^{ba}	1.19^{bc}	1.11^{dc}	0.97^{d}		1.55^{a}	1.47^{ba}	1.35^{b}	1.17^{c}	1.03^{dc}	0.88^{d}	

Means with same superscript are not significantly different.

Table 3. Effect of on-farm and off farm application of edible coatings on total antioxidant activity (μmol Trolox g^{-1}) in plum cv. Santa Rosa stored at 20 ± 2°C.

Treatment	On-farm							Off-farm						
Storage days	0	3	6	9	12	15	Mean	0	3	6	9	12	15	Mean
Control	14.20^{egf}	16.20^{ebdac}	15.41^{ebdcf}	14.70^{edgcf}	13.18^{gf}	12.08^{g}	14.29^{c}	14.20^{bdec}	16.10^{bdac}	14.34^{bdec}	14.10^{dec}	13.26^{de}	11.23^{e}	13.87^{c}
Vegetable wax	14.50^{edgf}	17.50^{bac}	16.55^{ebdac}	16.39^{ebdac}	15.31^{ebdcf}	14.61^{edgcf}	15.81^{b}	14.20^{bdec}	16.50^{bac}	16.24^{bdac}	15.78^{bdac}	15.01^{bdac}	14.21^{bdec}	15.32^{b}
Lac based	15.30^{ebdcf}	18.84^{bac}	18.72^{a}	18.62^{a}	17.45^{bdac}	16.01^{ebdacf}	17.49^{a}	14.90^{bdac}	17.47^{a}	17.26^{ba}	17.18^{bac}	17.15^{bac}	15.02^{bdac}	16.49^{a}
Semperfresh™	15.53^{ebdcf}	17.80^{ba}	17.12^{ebdac}	17.36^{ebdac}	15.78^{ebdcf}	14.46^{edgf}	16.34^{b}	14.90^{bdac}	17.60^{a}	15.69^{bdac}	15.92^{bdac}	15.02^{bdac}	13.23^{de}	15.39^{b}
Mean	14.88^{cb}	17.59^{a}	16.95^{a}	16.77^{a}	15.43^{b}	14.29^{c}		14.55^{dc}	16.92^{a}	15.88^{ba}	15.75^{bac}	15.11^{bc}	13.42^{d}	

Means with same superscript are not significantly different.

Table 4. Effect of on-farm and off farm application of edible coatings on ascorbic acid (mg/100 g) in plum cv. Santa Rosa stored at 20 ± 2°C.

Treatments	On-farm							Off-farm						
Storage days	0	3	6	9	12	15	Mean	0	3	6	9	12	15	Mean
Control	3.14^{bac}	2.99^{bac}	2.84^{bac}	2.56^{bc}	2.42^{c}	2.57^{bc}	2.75^{c}	3.14^{bac}	2.75^{bac}	2.71^{bac}	2.40^{bc}	2.36^{bc}	2.02^{c}	2.56^{c}
Vegetable wax	3.57^{bac}	3.42^{bac}	3.28^{bac}	3.14^{bac}	2.99^{bac}	2.70^{bac}	3.18^{bc}	3.41^{bac}	3.41^{bac}	3.21^{bac}	3.09^{bac}	2.51^{bac}	2.56^{bac}	3.03^{b}
Lac based	4.29^{a}	4.14^{ba}	4.00^{bac}	3.84^{bac}	3.71^{bac}	3.57^{a}	3.92^{a}	4.09^{a}	3.92^{ba}	3.80^{ba}	3.79^{ba}	3.65^{ba}	3.41^{bac}	3.77^{a}
Semperfresh™	3.85^{bac}	3.71^{bac}	3.57^{bac}	3.52^{bac}	3.26^{bac}	3.14^{bac}	3.50^{ba}	3.76^{ba}	3.63^{bac}	3.40^{bac}	3.46^{bac}	3.10^{bac}	3.03^{bac}	3.39^{ba}
Mean	3.71^{a}	3.57^{ba}	3.42^{ba}	3.27^{ba}	3.10^{ba}	3.00^{bac}		3.60^{a}	3.43^{ba}	3.28^{bac}	3.19^{bac}	2.91^{bc}	2.76^{c}	

Means with same superscript are not significantly different.

Table 5. Effect of on-farm and off farm application of edible coatings on total phenols (mg/100 g) in plum cv. Santa Rosa under stored at 20 ± 2°C.

Treatments	On-farm							Off-farm						
Storage days	0	3	6	9	12	15	Mean	0	3	6	9	12	15	Mean
Control	152.0^{ba}	172.54^{ba}	219.56^{ba}	189.65^{ba}	154.25^{ba}	101.25^{b}	164.87^{b}	150.45^{ba}	167.25^{ba}	214.25^{bac}	184.25^{bac}	149.25^{bc}	96.25^{c}	160.28^{b}
Vegetable wax	152.16^{a}	172.12^{a}	220.25^{ba}	211.21^{ba}	170.56^{ba}	121.25^{ba}	174.59^{ba}	150.48^{ba}	167.15^{ba}	215.41^{bac}	206.21^{bac}	165.41^{bac}	114.25^{bac}	169.81^{ba}
Lac based	152.45^{a}	171.01^{a}	190.56^{ba}	215.15^{ba}	211.25^{ba}	130.52^{ba}	178.49^{a}	151.45^{ba}	164.25^{a}	185.14^{bac}	210.24^{bac}	106.25^{bac}	125.41^{a}	157.12^{a}
Semperfresh™	152.34^{ba}	171.25^{a}	189.65^{ba}	213.54^{ba}	206.22^{ba}	126.56^{ba}	176.59^{a}	151.45^{ba}	166.25^{ba}	184.45^{bac}	207.48^{bac}	201.14^{bac}	121.25^{bac}	172.00^{a}
Mean	152.24^{a}	171.73^{a}	205.00^{a}	207.38^{ba}	185.57^{bc}	119.89^{c}		150.95^{a}	166.22^{a}	199.812^{a}	202.04^{ba}	155.51^{bc}	114.29^{c}	

Means with same superscript are not significantly different.

Table 6. Effect of on-farm and off farm application of edible coatings on total anthocyanins content (mg/kg) in plum cv. Santa Rosa under stored at 20 ± 2°C.

Treatments	On-farm							Off-farm						
Storage days	0	3	6	9	12	15	Mean	0	3	6	9	12	15	Mean
Control	112.25^{jik}	120.65^{hgf}	128.25^{a}	149.85^{a}	169.56^{b}	198.25^{cb}	153.31^{a}	113.02^{lmk}	122.52^{hfge}	130.65^{a}	151.24^{ba}	161.25^{bc}	200.12^{dce}	146.46^{a}
Vegetable wax	112.35^{k}	119.56^{hgi}	126.52^{cefd}	114.25^{cebd}	161.25^{cb}	191.54^{b}	142.62^{b}	113.54^{lm}	121.32^{ihkj}	128.42^{dfce}	116.35^{dce}	163.24^{bc}	193.54^{bc}	139.40^{b}
Lac based	112.52^{jk}	117.25^{hji}	121.58^{hgf}	111.4^{hgef}	152.25^{cefd}	185.26^{cb}	133.37^{c}	113.98^{lm}	119.52^{ilkj}	123.45^{ihfg}	113.42^{ihfge}	154.25^{dfge}	187.41^{dc}	135.33^{c}
Semperfresh™	112.56^{k}	118.56^{jik}	123.54^{hgi}	113.54^{hgefd}	156.42^{gefd}	187.56^{cbd}	135.36^{d}	113.74^{m}	120.65^{lmkj}	125.41^{ihgj}	115.62^{ihfge}	158.65^{hfge}	189.74^{dce}	137.30^{d}
Mean	112.42^{d}	119.005^{c}	124.97^{b}	122.26^{ba}	159.87^{ba}	190.65^{a}		113.57^{d}	121.00^{c}	126.98^{b}	124.15^{ba}	159.34^{ba}	192.70^{a}	

Means with same superscript are not significantly different.

findings of Serrano *et al*. (11) and Diaz-Mula *et al*. (5) in plums.

The maximum mean overall acceptability score was obtained for fruits coated on the farm with lac based coating (7.25) followed by Semperfresh™ (7.16) coated fruits. However, control fruits registered the minimum mean sensory score (5.99). For both on-farm and off-farm treated fruits, the sensory quality gradually increased in control (uncoated) fruits up to 6 days (7.66 and 7.45, respectively) and thereafter it declined and fruits registered a score of 4.11 and 4.06, respectively at end of 15 days of storage. It was noticed that plum fruits coated with lac based and Semperfresh™ coatings developed better sensory quality, which may be due to modifications of internal atmosphere of coated fruits and also the simultaneous retention of better firmness. Previously, El-Anany *et al*. (6) also reported better overall acceptability of coated apple fruits as compared to uncoated fruits.

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