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Study of the effect of *Aloe vera* gel coating on weight loss of bell pepper (*Capsicum annum* L.) Stored under different temperature levels

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Abstract-*Bell pepper (Capsicum annum L.) belonging to family Solanaceae is a popular commercial vegetable growing in Sri Lanka due to its high profit margin. The quick postharvest weight loss is one of the major problems faced by the bell pepper growers in Sri Lanka which causes sevier economic losses. Water loss is the main cause for the postharvest weight loss of bell pepper. Therefore, this study was carried out to investigate the influence of Aloe vera gel coating on postharvest water loss of bell pepper. Healthy 100 bell peppers were randomly selected for the study from a local farmer cultivated under greenhouse conditions. The fruits were rinsed with 25% NaCl solution and air dried. The air dried 100 fruits were randomly divided into 10 sets of 10 bell pepper fruits in each. Four sets were coated with different concentrations of Aloe vera aqueous solutions i.e. 25%, 50%, 75%, 100% respectively and one set without coating was set aside as control and all five sets were stored under ambient temperature (28*℃) . *Other four sets out of five sets were coated with same concentration of Aloe vera aqueous solutions as done in above. The remaining set was kept uncoated as control and all five sets were stored under refrigerator conditions (*4℃). *Coating was performed by hand with the help of clean piece of cloth. All treated fruits under each treatment were air dried for few minutes. Just before storage the fruits were packed separately by using properly punched low-density polypropylene bags and weighed. Each fruit were given an identification number to facilitate data recording. Weight loss in grams of each fruit were recorded once in three days from the commencement of storage (day zero) up to 18 days in bell pepper stored under ambient temperature (28 ^{0}C) and once in seven days up to 49 days in bell pepper stored under refrigerator conditions (4 ^{0}C). The present study revealed that there is a potential for the use of Aloe vera gel coating to minimize postharvest weight loss of bell pepper. It has been proven that the increase of Aloe vera gel concentration used for the coating reduces the weight loss from bell pepper in both storage temperature levels. Pure Aloe vera gel is more effective in reducing weight loss. Further reduction of weight loss can achieve through storing Aloe vera gel coated bell pepper under refrigerator conditions.*

Key words**:** *Aloe vera* wax, *Bell pepper*, water loss

1 INTRODUCTION

Bell pepper (*Capsicum annum* L.) belonging to family Solanaceae is a popular commercial vegetable grow all over the world. The crop originated in central and south America and spread throughout the world in the late 1400s (Bell, 2008).

The edible part of the crop is a three to four lobed fruit having a colour range from green, yellow, orange, purple to red. The fruit can be used in a variety of dishes since its different colors, different taste in ripped and unripe fruits and less pungency. Nutritive value of the food is high since bell pepper can be consumed uncooked or as a salad crop. It is rich in vitamin A, E, C, B6 and Potassium (Arnarson, 2016). Bell peppers are a good source of a mixture of antioxidants including ascorbic acid, carotenoids, flavonoids and polyphenols (Muhammad *et. al.*,2011).

In Sri Lanka this high value crop is cultivated successfully throughout the island specially in protected houses and some open fields. Though the initial cost for the establishment of this crop is relatively high there is a growing interest on cultivation of bell pepper among the farmers due to its high profit margin. The demand for the crop is high both in the local market specially from hotels that cater to tourists and supermarkets as well as the export market.

Though this is a high value crop, it is highly perishable. The quick weight loss of harvested fruits is one of the major problems faced by the growers in Sri Lanka. Water loss is the reason for quick postharvest weight loss which causes severe economic losses to growers. Further water loss causes shrinkage, wilting, softening and subsequent decay of bell pepper. Weight loss also induces senescence and subsequent deterioration. Transpiration and decay are found as the two main causes of deterioration of bell pepper (Kader 1983).

Therefore, it is important to control water loss to minimize postharvest weight loss and ensure postharvest quality of bell pepper. There are techniques to overcome these problems. However, selection of easily available, viable as well as feasible techniques is important (Pandey *et. al.,* 2010).
Coating wax is an age-old practice adopted to protect and ensure extended shelf life of fruits and vegetables (Hardenburg, 1967; Kester and Fennema,1986).

Coating bell pepper using oilseed derived lipid films reduces water loss remarkably (Beaulieu *et. al.*,2009). Chitosan, a biodegradable non-toxic natural substance coating reduced the weight loss and respiration of bell pepper and cucumber and improved appearance (Ahmed *et. al.,* 1991). Application of chitosan inhibits the fungal infections and reduces severity of diseases as well as improve the defense responses in bell pepper (Edirisinghe *et al.,* 2014). Application of edible coatings formulated with arabic, xanthan and pectin gums, candelilla wax and tar bush extract extended the shelf life of bell pepper (Emilio Ochoa Reyes *et. al.,* 2013).

In Sri Lanka too, it is timely to study more and find promising substances to reduced postharvest weight loss of bell pepper, due to the growing interest in bell pepper cultivation and increasing production.

Therefore, this study was carried out to investigate the potential of *Aloe vera* gel as an edible coating to prevent postharvest weight loss of bell pepper.

2 MATERIALS AND METHODOLOGY

2.1 Experimental site

The experiment was conducted in the microbiology laboratory at food research division of Horticultural Research and Development Institute, Gannoruwa, Peradeniya, Sri Lanka.

2.2 Selection of bell pepper

Variety Indra was selected for the trial since it is a productive variety with high quality. The bell peppers were collected from a local farmer who cultivated bell pepper under greenhouse conditions at Pilimathalawa in Kandy District. Randomly selected pest and disease-free healthy bell pepper fruits were hand harvested at the correct maturity. Harvested fruits were properly packed and carefully transported to the laboratory at the food research division.

2.3 Preparation of *Aloe vera* wax

The wax was extracted from the leaves of well matured *Aloe vera* plants grown in a home garden. Harvested leaves were washed thoroughly with 25% NaCl solution to disinfect and the gel matrix was separated (color less hydro parenchyma) from the outer cortex of the leaves. Separated gel matrix was ground thoroughly with the help of a blender and the pulp was filtered using a muslin cloth to remove the fibers and other solid particals. The pulp was pasteurized at 70 ^{0}C for 45 minutes in an electric water bath. Finally, four different aqueous solutions of *Aloe vera* having concentrations of 25%, 50%, 75%, and 100% were prepared by mixing distilled water to the extracted *Aloe vera* pulp. To adjust the pH value of the solutions into 4 citric acid was used. To improve coating efficiency commercial gelling agent Gelatin 1 % was added to the solutions.

2.4 Coating bell pepper

All harvested bell peppers were checked visually for mechanical injuries, disease incidence and any other deformations and altogether 100 equal sized healthy fruits were randomly selected for the trial. Selected fruits were rinsed with 25% NaCl solution to disinfect and air dried. The air dried 100 fruits were randomly divided into 10 sets of 10 bell pepper fruits in each.

Four sets were coated with different concentrations of *Aloe vera* aqueous solution i.e. 25%, 50%, 75%, 100% respectively and one set without coating was set aside as control and all five sets were stored under ambient temperature (28℃) . Other four sets out of five sets were coated with same concentration of *Aloe vera* aqueous solutions as done in above. The remaining set was kept uncoated as control and all five sets were stored under refrigerator conditions (4℃).

Coating was performed by hand with the help of clean piece of cloth ensuring the formation of uniform *Aloe vera* wax film on the entire surface of bell pepper fruits. All treated fruits were air dried for few minutes before storage.

Before storage all 100 fruits were packed separately by using properly punched low-density polypropylene bags. Each fruit was given an identification number with the help of a sticker paste on polypropylene bag to facilitate data recording. Each packed bell pepper fruit was weighed before storage.

2.5 Experimental design and data analysis

Complete Randomized Design (CRD) was adopted in this trial. Data were analyzed by ANOVA using SPSS software. A probability of 0.05% was considered as statistically significant.

2.6 Data Recorded

Weight loss in grams were recorded once in three days from the commencement of storage (day zero) up to 18 days in bell pepper stored under ambient temperature (28 ^{0}C) and once in seven days up to 49 days and once in 14 days from day 49 up to day 77 in the fruits stored under refrigerator conditions (4 ^{0}C).

2.7 Determination of weight loss

Each bell pepper subjected to different treatments was weighed at the beginning of the trial to record the initial weight (IW) and again at the indicated time gaps above during the storage period to record the subsequent weight (SW) of bell peppers. Percentage weight loss (WL) each fruit was calculated by using the following formula.

$$\% \text{ Weight loss (WL)} = \frac{IW - SW}{IW} \times 100$$

3 RESULTS AND DISCUSSION

Water loss is the main cause of postharvest losses in bell pepper. Beauliea *et al.,* (2009) showed that the effective retardation of transfer of water vapor across the skin of bell pepper coated with oilseed derived lipid films from soapstocks. Emilio *et al.,* (2013) revealed the potential of minimizing water loss from bell pepper using edible film coatings formulated with biopolymers (Arabic, Xanthan and Pectin gums), Candedilla wax and tar bush extract. Similar results have been demonstrated by Ahmed *et al*., (1991) by using Chitosan coating for bell pepper in reducing water loss.

The present study too showed us similar results i.e. the retardation of water loss from the bell pepper coated with *Aloe vera* gel. It was obvious that the percentage weight loss was increased with the storage period in all bell peppers coated and uncoated (control) stored under both the temperature levels i.e ambient (28 ^{0}C) and refrigerator (4 ^{0}C) conditions.

However, in both instances i.e ambient temperature (28 ^{0}C) and refrigerator temperature (4 ^{0}C) the percentage weight loss was significantly ($P< 0.05$) less in all treated bell peppers when compared with untreated (control) bell peppers.

3.1 Percentage weight loss of bell peppers coated with *Aloe vera* gel and stored under ambient temperature

The percentage weight loss with the storage period of treated bell peppers stored under ambient temperature are shown in Figure 1. The results showed a significant ($P< 0.05$) variation of weight loss of bell peppers due to different treatments.

The results revealed that the weight loss of bell pepper coated with 100% aqueous solutions of *Aloe vera* gel was less (2.5%) compared to the control where the weight loss was (3%). It is clear with the increment of *Aloe vera* gel concentration i.e. 25%, 50%, 75% and 100% the weight loss is significantly (P< 0.05) reducing from 3% to 2.5% at the 18th day of storage (Figure 1).

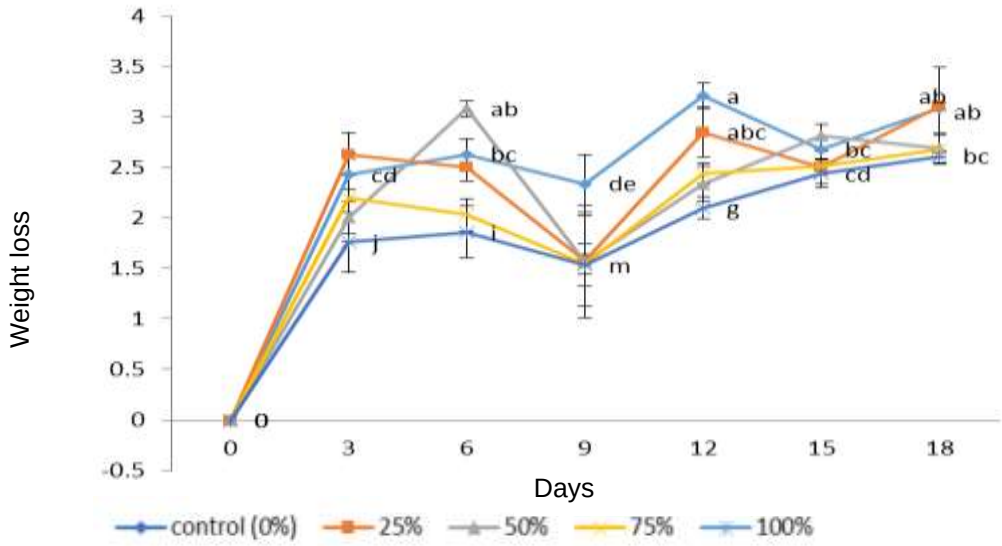

Fig. 1. Change in weight loss (%) of bell pepper treated with different concentrations of *Aloe vera* gel and stored under ambient temperature

3.2 Percentage weight loss of bell peppers coated with *Aloe vera* gel and stored under refrigerator temperature

The results revealed that the weight loss of bell pepper coated with 100% aqueous solutions of *Aloe vera* gel was less (2%) compared to the control where the weight loss was (4%). It is clear that with the increment of *Aloe vera* gel concentration i.e. 25%, 50%, 75% and 100% the weight loss is significantly (P< 0.05) reducing from 4% to 2% at the 49th day of storage (Fig. 2).

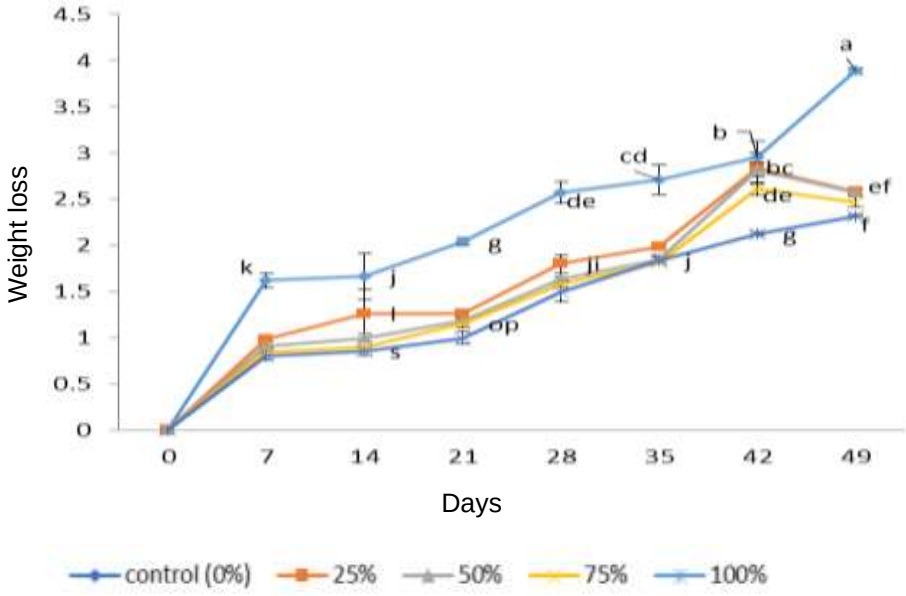

Fig. 2. Change in weight loss (%) of bell pepper treated with different concentrations *of Aloe vera* gel and stored under refrigeration temperature

When comparing the two storage conditions lesser weight loss was observed in bell pepper coated and stored under refrigerator conditions. The weight loss of bell pepper coated with 100% aqueous solutions of *Aloe vera* gel and stored in ambient temperature was 2.5% at the 18th day of storage while the weight loss of bell pepper coated with 100% aqueous solutions of *Aloe vera* gel and stored in refrigerator condition was below 1% at the 21st day of storage. (Fig. 1 and 2).

4 CONCLUSIONS

In conclusion the present study revealed that there is a potential of the use of *Aloe vera* gel coating to minimize postharvest water loss and subsequent weight loss of bell pepper variety Indra. It has been proven that the increase of *Aloe vera* gel concentration used for the coating reduces the water loss from bell pepper. Pure *Aloe vera* gel is more effective in reducing water loss. Further reduction of water loss can be achieved through storing *Aloe vera* gel coated bell pepper under refrigerator conditions.
Further investigations are recommended to study the influence of Aloe *vera* gel coating on postharvest quality parameters of bell pepper

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