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Effectiveness of *Aloe vera* Gel Coating on the Shelf Life of Cherry Tomato (*Solanum lycopersicum* Var. *cerasiforme*) Fruit Subjected to Preharvest Bagging

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Abstract. **Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) is a popular and economically important fruit due to its nutritional value. However, cherry tomato is susceptible to environmental stress, which affects fruit quality. Preharvest bagging is an effective technique used to protect fruit from external factors such as pest infestation and adverse weather conditions, including strong winds and hail damage. However, it has the disadvantage of shortening fruit shelf life due to accelerated maturity. This study aimed to assess the effect of *Aloe vera* gel (AVG) coating on the postharvest quality of 'Romanita' and 'Tinker' cherry tomato fruit subjected to preharvest bagging during 18 days of shelf life at ambient conditions. Cherry tomato fruit clusters per cultivar were bagged using a transparent plastic with 20-μm density, harvested at the green maturity stage and thereafter coated with AVG coating (15%, 30%, and 45%). Uncoated fruit were used as control. The coated (AVG 15%, 30%, and 45%) fruit exhibited high firmness, titratable acidity (TA), total chlorophyll content (TCC), total phenolic content (TPC), and total antioxidant activity (TAA), and low total soluble solids (TSS) and lycopene content. Furthermore, the coatings reduced weight loss, and delayed color changes during shelf life compared with the control. Our findings indicated that AVG 45% coating was the most effective and significantly enhanced the overall quality of fruit compared with AVG 15% and 30% and control. Therefore, AVG coating can be applied to improve postharvest quality and extend shelf life of cherry tomato subjected to preharvest bagging.**

Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) fruit is consumed worldwide, and its demand has been increasing due to high nutrient content such as antioxidant compounds, including lycopene, minerals, and vitamins (Buthelezi et al. 2023; Mustapha et al. 2020). During its production, cherry tomato is affected by a variety of factors such as abiotic stresses including extreme temperatures and biotic stresses such as pests and disease infestation (Buthelezi et al. 2021; Zhang et al. 2022). These could reduce the commercial value of cherry tomato thereby causing significant yield and economic losses.

To reduce the detrimental effects of pest and disease infestation and limit the use of pesticides, preharvest bagging is an alternative technique during production (Buthelezi et al. 2021). During preharvest bagging, fruit clusters are covered with bags to protect them from harsh environmental conditions, pest attacks, and pesticide residues (Sharma and Sanikommu 2018). This technique modifies the microenvironment around the fruit during its critical stages of growth; hence, accelerating maturity and improving the physical and chemical quality of the fruit (Santosh et al. 2017). A study by Sharma et al. (2020) showed that preharvest bagging of 'Allahabad Safeda' guava (*Psidium guajava* L.) using PP non-woven bags, effectively improved fruit quality, including fruit size and color. Although this method helps improve fruit quality, it has the disadvantage of shortening the shelf life after harvest due to accelerated fruit maturity.

Various postharvest treatments, including controlled atmosphere (CA) and modified atmosphere packaging (MAP) have been used to minimize the negative effect of both abiotic and biotic stress and preserve the postharvest quality of horticultural produce (Ncama et al. 2018). Although CA and MAP technologies are considered highly effective with successful and extensive applications, they can be costly (Oduro 2021). In addition, CA technologies may have an impact on the volatile content of the room atmosphere, which as a result could affect ripe fruit's volatile production (Haines 2021). As opposed to the use of synthetic packaging, which takes years to decompose thus posing a negative effect on the environment and human health, edible coatings can be used as an alternative method for preserving the postharvest quality of fresh produce (Hassan et al. 2018; Seun et al. 2022). Edible coatings are thin layers of edible material applied on the fruit surface that form a barrier to oxygen and microbes (Raghav et al. 2016; Yadav et al. 2022). Various plant-based materials are used as edible coatings, including polysaccharides such as chitosan and gum arabic, and plant materials such as moringa leaf extracts and cassava starch, as well as AVG (Ncama et al. 2018).

Aloe vera, a succulent plant renowned for its numerous health benefits, has gained attention for its potential role in enhancing the shelf life of fruits and vegetables (Saleem et al. 2022). Its gel contains bioactive compounds such as polysaccharides, vitamins, and antioxidants that possess antimicrobial, antioxidant, and anti-inflammatory properties (Kator et al. 2018). These qualities make AVG a promising option for extending the shelf life of cherry tomato. Several studies have demonstrated that AVG has the potential to enhance physical and chemical quality of fruit such as litchi (*Litchi chinensis* Sonn.), mango (*Mangifera indica*), and persimmon (*Diospyros kaki*) fruit (Islam et al. 2017; Purbey and Kumar 2015; Saleem et al. 2022). However, little is known about the impact of AVG coating on postharvest quality of cherry tomato fruit subjected to preharvest bagging; hence, the current study investigated the effect of AVG on postharvest quality of cherry tomato subjected to preharvest bagging.

Materials and Methods

Field experiment. Two cultivars of cherry tomato seedlings namely, 'Romanita' and 'Tinker' were obtained from ZZ2 commercial farm in Mooketsi, Limpopo, South Africa (lat. 23°36′11.5″S, long. 30°06′18.1″E) and used to conduct the experiment at the University of Limpopo, Aquaculture Research Unit, South Africa (lat. 23°53′10″S, long. 29°44′15″E) on a microplot during the spring season, Sep–Nov 2022. An area of 38 m^2 was prepared using a hand hoe and then covered with a black plastic to suppress weed growth. A total of 150 seedlings per cultivar were transplanted into 30-cm black polyethylene plastic bags that contained superphosphate fertilizer (5 g) and steam-pasteurized sandy loam soil (300 °C for 45 min). The plants were watered daily with 3 L of tap water and a weekly 500-mL fertilizer containing 50 g of monoammonium phosphate, potassium nitrate (KNO_3),

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and calcium nitrate ($CaNO_3$) per 25 L of water, was applied to the plants (Buthelezi et al. 2023). Whitefly (*Trialeurodes vaporariorum*) and bollworm (*Pectinophora gossypiella*) pests were controlled by the application of cypermethrin (15 mL per 16 L of water) and protek complete (5 mL per 5 L of water), respectively at 14-d interval. Fruit per plant per cultivar were bagged with a transparent plastic of 20-μm density, 25.8-cm length, and 15.3-cm width, 16 d after fruit set (Buthelezi et al. 2023).

Coating preparation. The coating was prepared as per the method of Saleem et al. (2022) with slight modifications. Mature leaves of the cape aloe plant (*Aloe vera*) were harvested, washed with distilled water, and then dipped in 0.1% sodium hypochlorite (NaClO) for 3 min. Thereafter, the leaves were wiped dry with a mutton cloth. The leaves' external cortex was peeled off with a stainless-steel knife to extract the colorless hydro parenchyma gel matrix. The gel was then homogenized using a blender and filtered through a sterile muslin cloth to eliminate fibers. Citric acid was used to adjust the gel's pH to 3.75. Thereafter, the gel was pasteurized at 65 °C for 30 min and cooled at room temperature for 1 h. Distilled water was used to dilute the gel at a 1:1 (v/v) ratio. Glycerol (1%) was added as a plasticizer. Glass bottles were used to store the AVG solution at 4 °C. To acquire the desired different concentrations (15%, 30%, and 45%), the stored gel was diluted with distilled water (v/v).

Experimental design and treatments. The experiment was carried out in a completely randomized design, and the different concentrations of AVG at 15%, 30%, and 45% were used as three distinct treatments and uncoated fruit represented control.

Sampling procedure. At green maturity stage, fruit clusters from each cultivar with no visible blemishes were harvested, packed in boxes, and transferred to the Postharvest Laboratory at the University of Limpopo for sorting and coating. Fruit were coated by dipping in the different coating concentrations for 3 min. Uncoated fruit were used as control. The fruit were then stored at ambient temperature (21 ± 1 °C and 60.0% ± 5% relative humidity) for a total of 18 d and sampled at 6-d intervals for physical and chemical quality.

Fruit color. The skin color of the fruit was measured using a handheld chromameter (CR-400; Konica Minolta, Sensing Incorporation, Tokyo, Japan). Before taking color measurements, a standard white tile was used to calibrate the chromameter. The assessed color values included L* (lightness), a* (green-red), and b* (blue-yellow). The total color difference was calculated using Eq. [1] as follows:

$$\Delta E = (\Delta L^2 + \Delta a^2 + \Delta b^2)^{\frac{1}{2}}, \quad [1]$$

where $\Delta L = L^*_{standard-}\ L^*_{sample}$, $\Delta a = a^*_{standard-}a^*_{sample}$, $\Delta b = b^*_{standard}\ -\ b^*_{sample}$ (Mafotja 2022).

Weight loss. In this study, fruit weight loss was measured using a weighing balance (HCB 1002; Adam Equipment, Shanghai, China) at harvest and at 6-d intervals during the shelf life. The percentage of fruit weight loss was calculated as the difference between initial weight and final weight to the initial weight of fruit using Eq. [2] as follows:

$$\text{Weight loss}\ (\%) = \frac{W_i - W_f}{W_i} \times 100, \quad [2]$$

where W_i is the initial weight of cherry tomato fruit (day 0) and W_f is the final weight on days of observation (6-interval) as previously assessed by Saleem et al. (2021).

Firmness. Fruit firmness was assessed using a penetrometer (FT 40; Wagner Instruments, Greenwich, CT, USA) on three sides of the fruit surface and the average was taken and the results were expressed as newtons (N) (Zhang et al. 2019).

Total soluble solids. The TSS was determined using a digital refractometer (PAL-1; ATAGO, Tokyo, Japan) and results were expressed as Brix % (Gan et al. 2022).

Titratable acidity. The TA was determined following a method previously described by AOAC (2000), with slight modification. A 2-mL amount of tomato juice was diluted with distilled water to create a total volume of 5 mL. The solution was titrated with 0.1 M NaOH using 1% phenolphthalein as an indicator. The results were presented as citric acid percentage and calculated using Eq. [3] as follows:

$$\text{TA}(\%) = \frac{V1 -\ \ 0.1\ \ \times 0.064}{V2} \times 100, \quad [3]$$

where 0.1 is the NaOH (N) normality, 0.064 is the equivalent weight of citric acid, V_1 is the volume of required NaOH (mL) and V_2 is the volume of sample (2 mL).

Total chlorophyll content. The TCC was carried out according to the method described by Francesca et al. (2020), with some modifications. Briefly, 0.25 g of tomato sample was extracted with 24 mL of acetone:hexane (40:60 v/v). The mixture was then centrifuged (Mistral 1000; MSE, Leicestershire, UK) at 15,000 rpm for 5 min. Afterward, the supernatants were collected and stored at −20 °C until analysis. The absorbance was measured using a spectrophotometer (Jenway 7305; Bibby Scientific Ltd., Staffordshire, United Kingdom) at 663 and 645 nm for chlorophylls a and b, respectively. Results were converted into mg/100 g fresh weight (FW) and calculated according to Migliori et al. (2017) using Eqs. [4], [5], and [6] as follows:

$$\text{Chlorophyll a} = 11.75\ A_{663} – 2.350\ A_{645} \quad [4]$$

$$\text{Chlorophyll b} = 18.61\ A_{645} – 3.960\ A_{663} \quad [5]$$

$$\text{Total chlorophyll content} = \text{Chla} + \text{Chlb} \quad [6]$$

Lycopene content. Lycopene content was determined based on a method previously described by Nkolisa et al. (2019) with slight modification. Briefly, 0.5 g of tomato fruit sample was weighed and placed inside test tubes. Thereafter, 5 mL of 80% ethanol, 5 mL of acetone (containing 0.05% w/v of butylated hydroxytoluene), and 10 mL of hexane were added to the sample. The test tubes were covered with aluminum foil to protect from light exposure and were kept in a cooler on ice throughout extraction. Afterward, the mixture was shaken with a shaker (D 3006, GFL & Co., Deutschland, Germany) for 15 min. Then, 3 mL of distilled water was added and the solution was shaken for an additional 5 min. The solution was left at room temperature for 5 min to allow separation of hexane phases. The absorbance of the samples was measured at 503 nm using a ultraviolet-Vis Spectrophotometer (Jenway 7305, Bibby Scientific Ltd.). Lycopene was expressed as mg/kg FW and calculated using Eq. [7] as follows:

$$\text{Lycopene content} = \text{Abs}_{(503)} \times 137.4 \quad [7]$$

where $\text{Abs}_{(503)}$ is absorbance of sample at 503 nm and 137.4 = the constant coefficient of lycopene.

Total phenolic content. The TPC was determined using the Folin-Ciocalteu reagent method (Singleton et al. 1999), with some modifications. A 2.5 g of frozen tissue was homogenized with 5 mL of 80% methanol using mortar and pestle. It was then centrifuged (Mistral 1000, MSE) at 4 °C at 10,000 rpm for 15 min. A 0.2-mL supernatant was then collected. Thereafter, 0.5 mL of Folin-Ciocalteu was added to the supernatant, and it was left for 5 min at room temperature. Then, 1.5 mL of 5% Na_2CO_3 solution was added. After 30-min incubation at room temperature, the absorbance was measured at 765 nm using a ultraviolet-Vis spectrophotometer (Jenway 7305, Bibby Scientific Ltd.). The total phenolic content was expressed as gallic acid equivalent based on the gallic acid content from the standard curve.

Total antioxidant activity. The TAA was measured by determining the free radical scavenging effect of 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical as previously described by Odriozola-Serrano et al. (2008), with slight modifications. Fruit samples were homogenized in 60% (v/v) methanol and centrifuged (Mistral 1000, MSE) at 6000 g_n for 10 min. Afterward, 0.2 mL of the fruit extract was mixed with 2.8 mL of DPPH. The solution was then vigorously shaken using a shaker (D 3006, GFL & Co.) and kept in darkness, at room temperature for 30 min. The absorption was measured at 515 nm using a ultraviolet-Vis spectrophotometer (Jenway 7305, Bibby Scientific Ltd.). The results were expressed as DPPH radical inhibition percentage (DPPH %) using Eq. [8] as follows:

$$\text{DPPH}\ (\%) = \left[1 - \left(\frac{Abs_{515}\ \text{sample}}{Abs_{515}\ \text{blank}}\right)\right] \times 100 \quad [8]$$

Statistical analysis. The collected data were subjected to analysis of variance using Genstat® Version 18th (VSN International, Hemel Hempstead, UK). Duncan's multiple range test was used to compare the means at 5% ($P < 0.05$) level of significance.

Results

Fruit color. Table 1 shows that AVG coating significantly affected ($P < 0.05$) fruit color of 'Romanita' and 'Tinker' cherry tomato during shelf life. 'Romanita' and 'Tinker' cherry tomato fruit coated with the AVG45% had higher L* values (55.01 and 54.09) followed by AVG30% (53.22 and 51.55) and then AVG15% (52.91 and 51.51) at the end of shelf life compared with uncoated fruit (51.13 and 50.80), respectively. From Table 1, it can be observed that AVG coating significantly ($P < 0.001$) delayed the increase in a* values of 'Romanita' during shelf life compared with uncoated fruit. Fruit coated with the AVG45% and 30% had significantly ($P < 0.001$) lower a* values (9.15 and 8.83 and 11.34 and 10.69) at the end of shelf life compared with AVG15% (15.23 and 10.68) and control fruit (19.85 and 14.06). This is further supported by the total color difference (ΔE^*) in both 'Romanita' and 'Tinker' cherry tomato coated with AVG, which was significantly ($P < 0.001$) delayed during shelf life compared with control (Table 1).

Weight loss. During shelf life, the weight loss was significantly ($P < 0.001$) reduced in coated cherry tomato fruit of both cultivars compared with uncoated fruit (Table 2). 'Romanita' and 'Tinker' fruit coated with the AVG45% had lower weight loss (7.58 and 6.30%) compared with fruit coated with the AVG30% (8.06% and 6.43%), AVG15% (8.12% and 6.88%) and uncoated fruit (8.50% and 7.31%), respectively, at the end of shelf life.

Firmness. Table 2 shows that AVG coating significantly ($P < 0.001$) improved the firmness of 'Romanita' and 'Tinker' cherry tomato fruit during shelf life. 'Romanita' and 'Tinker' cherry tomato coated with the AVG45% had significantly ($P < 0.001$) firmer fruit (50.25 N and 52.10 N) and at the end of shelf life days followed by AVG30% (48.29 N and 48.18 N) and AVG15% (47.52 N and 46.87 N) compared with uncoated fruit (41.20 N and 40.66 N), respectively.

Titratable acidity. Coating with AVG did not affect ($P > 0.050$) the TA of both cultivars during shelf life (Table 2). However, the TA of the coated cherry tomato fruit was slightly higher than the control. 'Romanita' and 'Tinker' fruit coated with the AVG45% had higher TA (1.35 and 1.78%) compared with fruit coated with the AVG30% (1.56% and 1.49%), AVG15% (1.17% and 1.42%), and uncoated fruit (1.14% and 1.39%) at the end of shelf life, respectively.

Total soluble solids. In our study the AVG coating significantly ($P < 0.001$) slowed down the increase in TSS in both cultivars during shelf life (Table 2). In addition, 'Romanita' and 'Tinker' fruit coated with the AVG45% had higher TSS (7.47 and 6.3%) compared with AVG30% (7.39% and 6.39%), AVG15% (7.69% and 7.42%) and control (7.80% and 7.87%), respectively, at the end of shelf life.

Total chlorophyll content. The TCC of cherry tomato fruit decreased with increasing

Table 1. Effect of *Aloe vera* gel (AVG) coating on color changes [L* (lightness), a* (green-red), b* (blue-yellow), and ΔE* (total color difference)] of 'Tinker' and 'Romanita' cherry tomatoes during 18 d of shelf life at 21 °C.

		L*		a*		b*		ΔE*	
Treatment	Shelf life	'Romanita'	'Tinker'	'Romanita'	'Tinker'	'Romanita'	'Tinker'	'Romanita'	'Tinker'
Control	0	64.67 ± 0.50 fg	63.61 ± 0.63 h	−8.190 ± 0.47 a	−8.86 ± 0.21 a	12.40 ± 1.32 a	11.15 ± 0.27 ab	30.64 ± 0.85 a	30.95 ± 0.14 a
	6	61.41 ± 2.44 de	56.49 ± 2.04 f	−9.958 ± 0.06 a	−5.49 ± 0.10 a	17.26 ± 0.11 b	16.29 ± 0.45 c	35.84 ± 0.09 b	37.89 ± 0.82 b
	12	58.39 ± 6.15 c	54.73 ± 3.37 e	2.998 ± 1.30 b	9.47 ± 1.53 cd	23.41 ± 0.52 cd	25.08 ± 0.30 def	40.55 ± 2.40 c	44.40 ± 3.60 d
	18	51.13 ± 0.71 a	50.80 ± 1.32 c	19.854 ± 1.37 e	14.06 ± 0.89 ef	32.47 ± 0.36 e	30.49 ± 3.24 ghi	54.51 ± 2.46 e	47.08 ± 2.99 e
AVG15%	0	65.41 ± 0.13 g	62.95 ± 0.34 h	−8.284 ± 0.27 a	−8.33 ± 0.20 a	13.04 ± 0.44 a	11.18 ± 0.37 ab	30.20 ± 0.67 a	31.53 ± 0.26 a
	6	62.45 ± 0.37 ef	57.39 ± 4.35 fg	−9.366 ± 0.19 a	−6.11 ± 0.13 a	17.11 ± 0.17 b	15.11 ± 0.43 c	34.74 ± 0.07 b	38.09 ± 0.49 b
	12	59.49 ± 5.32 cd	55.00 ± 7.25 e	−4.439 ± 2.14 a	6.62 ± 1.53 bcd	22.68 ± 0.37 cd	24.45 ± 0.73 de	39.84 ± 4.70 c	44.49 ± 3.61 d
	18	52.91 ± 3.58 ab	51.51 ± 4.54 cd	15.232 ± 3.19 de	10.68 ± 0.78 de	30.79 ± 1.82 e	29.91 ± 1.21 ghi	51.74 ± 3.60 d	46.11 ± 1.72 e
AVG30%	0	66.30 ± 0.42 g	63.71 ± 0.27 h	−8.997 ± 0.07 a	−8.38 ± 0.12 a	14.14 ± 0.11 ab	11.29 ± 0.13 ab	30.01 ± 0.37 a	30.89 ± 0.16 a
	6	62.55 ± 1.47 ef	58.52 ± 2.19 g	−9.713 ± 0.24 a	−6.77 ± 0.28 a	17.03 ± 0.22 b	14.20 ± 0.46 bc	34.71 ± 0.36 b	36.81 ± 0.67 b
	12	59.65 ± 6.76 cd	56.87 ± 5.84 f	−5.995 ± 1.85 a	6.04 ± 0.90 bc	21.04 ± 0.97 c	24.61 ± 0.64 de	39.48 ± 3.39 c	42.64 ± 2.05 c
	18	53.22 ± 1.02 ab	51.55 ± 4.79 cd	11.337 ± 1.25 cd	10.69 ± 1.24 cde	30.00 ± 2.86 e	28.04 ± 0.24 fgh	51.11 ± 9.77 d	45.98 ± 3.51 e
AVG45%	0	66.75 ± 6.87 g	62.77 ± 0.47 h	−8.621 ± 0.04 a	−8.74 ± 1.49 a	13.79 ± 0.19 ab	9.79 ± 1.42 a	29.37 ± 0.31 a	31.82 ± 0.09 a
	6	62.27 ± 0.78 e	58.60 ± 3.97 g	−9.421 ± 0.11 a	−6.65 ± 0.14 a	16.87 ± 0.14 b	15.31 ± 0.61 c	34.80 ± 0.37 b	37.60 ± 0.04 b
	12	59.48 ± 7.01 cd	57.43 ± 10.75 g	−7.173 ± 1.19 a	3.06 ± 0.78 b	20.76 ± 1.37 c	23.88 ± 0.48 d	40.95 ± 3.49 c	41.84 ± 2.09 c
	18	55.01 ± 1.97 b	54.09 ± 5.97 e	9.146 ± 3.02 c	8.83 ± 0.93 cd	25.90 ± 1.23 d	27.39 ± 0.25 efg	50.40 ± 4.53 d	44.40 ± 2.11 d
		SD $P < 0.001$	SD $P < 0.001$	SD $P < 0.001$	SD $P < 0.001$	SD $P < 0.001$	SD $P < 0.001$	SD $P < 0.001$	SD $P < 0.001$
		T $P = 0.006$	T $P < 0.001$	T $P = 0.003$	T $P = 0.003$	T $P = 0.073$	T $P = 0.021$	T $P = 0.008$	T $P < 0.001$
		SD*T $P = 0.733$	SD*T $P < 0.001$	SD*T $P = 0.085$	SD*T $P = 0.711$	SD*T $P = 0.084$	SD*T $P = 0.896$	SD*T $P = 0.173$	SD*T $P = 0.018$
		LSD = 1.841	LSD = 1.343	LSD = 4.664	LSD = 3.520	LSD = 3.539	LSD = 3.154	LSD = 3.240	LSD = 1.244

Values are the mean ± standard error. Means within a column of the same parameter with different letters are significantly different ($P < 0.001$). LSD = least significant difference; S = shelf life days; T = treatments; S*T = shelf life days and treatments.

Table 2. Effect of *Aloe vera* gel (AVG) coating on weight loss (WL), firmness (F), titratable acidity (TA), and total soluble solids (TSS) of 'Tinker' and 'Romanita' cherry tomatoes during 18 d shelf life at 21 °C.

		WL		F		TA		TSS	
Treatment	Shelf life	'Romanita'	'Tinker'	'Romanita'	'Tinker'	'Romanita'	'Tinker'	'Romanita'	'Tinker'
Control	0	0.00 ± 0.00 a	0.00 ± 0.00 a	85.24 ± 0.93 g	69.98 ± 2.29 fg	2.74 ± 0.04 e	2.67 ± 0.06 a	4.71 ± 0.28 a	5.08 ± 0.27 a
	6	3.06 ± 0.05 c	2.49 ± 0.19 b	72.59 ± 1.80 def	56.79 ± 5.57 bcde	1.99 ± 0.20 cd	1.81 ± 0.18 abcd	5.65 ± 0.13 bc	5.90 ± 0.27 bcd
	12	5.89 ± 0.08 f	4.98 ± 0.38 e	55.70 ± 0.58 bc	49.38 ± 1.24 abc	1.60 ± 0.16 abcd	1.56 ± 0.53 a	6.90 ± 0.29 fg	6.65 ± 0.19 e
	18	8.50 ± 0.10 i	7.31 ± 0.43 h	41.20 ± 2.66 a	40.66 ± 1.07 a	1.14 ± 0.16 a	1.39 ± 0.40 a	7.80 ± 0.27 h	7.87 ± 0.24 f
AVG15%	0	0.00 a	0.00 ± 0.00 a	85.24 ± 0.93 g	69.98 ± 2.29 fg	2.74 ± 0.04 e	2.67 ± 0.06 a	4.71 ± 0.28 a	5.08 ± 0.27 a
	6	2.75 ± 0.09 bc	2.43 ± 0.02 b	74.01 ± 6.84 efg	59.95 ± 2.30 def	2.10 ± 0.26 cd	2.06 ± 0.37 abcd	5.71 ± 0.03 bcd	5.31 ± 0.09 ab
	12	5.36 ± 0.02 e	4.69 ± 0.06 de	62.02 ± 2.08 cd	53.52 ± 4.45 abcd	1.64 ± 0.20 abcd	1.74 ± 0.52 ab	6.67 ± 0.56 ef	6.50 ± 0.03 de
	18	8.12 ± 0.16 h	6.88 ± 0.17 gh	47.52 ± 5.78 ab	46.87 ± 3.95 ab	1.17 ± 0.30 a	1.42 ± 0.37 a	7.69 ± 0.30 h	7.42 ± 0.28 f
AVG30%	0	0.00 a	0.00 ± 0.00 a	85.24 ± 0.93 g	69.98 ± 2.29 fg	2.74 ± 0.04 e	2.67 ± 0.06 a	4.71 ± 0.28 a	5.08 ± 0.27 a
	6	2.75 ± 0.05 bcd	2.22 ± 0.07 b	76.41 ± 3.61 fg	62.13 ± 3.12 defg	2.17 ± 0.19 d	2.17 ± 0.2 abcd	5.11 ± 0.19 ab	5.29 ± 0.14 ab
	12	5.51 ± 0.13 e	4.32 ± 0.15 cd	62.57 ± 1.54 cde	53.30 ± 4.25 abcd	1.88 ± 0.28 bcd	1.74 ± 0.28 abc	6.15 ± 0.01 cde	6.07 ± 0.14 cde
	18	8.06 ± 0.21 h	6.43 ± 0.20 fg	48.29 ± 4.81 ab	48.18 ± 1.23 abc	1.56 ± 0.07 abc	1.49 ± 0.16 a	7.39 ± 0.06 gh	6.39 ± 0.26 cde
AVG45%	0	0.00 a	0.00 ± 0.00 a	85.24 ± 0.93 g	69.98 ± 2.29 fg	2.74 ± 0.04 e	2.67 ± 0.06	4.71 ± 0.28 a	5.08 ± 0.27 a
	6	2.55 ± 0.07 b	2.13 ± 0.05 b	81.31 ± 3.75 fg	64.42 ± 1.15 efg	2.10 ± 0.14 cd	2.28 ± 0.23 abcd	5.51 ± 0.14 bc	5.19 ± 0.07 a
	12	5.33 ± 0.05 e	4.15 ± 0.06 c	64.20 ± 6.52 cde	57.66 ± 5.23 cde	1.71 ± 0.02 abcd	1.99 ± 0.28 abcd	6.33 ± 0.02 def	5.82 ± 0.14 bc
	18	7.58 ± 0.25 g	6.30 ± 0.09 f	50.25 ± 6.05 ab	52.10 ± 2.00 abcd	1.35 ± 0.50 ab	1.78 ± 0.15 abcd	7.47 ± 0.06 gh	6.30 ± 0.05 cde
		T $P < 0.001$	T $P <0.001$	T $P = 0.113$	T $P = 0.106$	T $P = 0.316$	T $P = 0.432$	T $P = 0.039$	T $P < 0.001$
		S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$
		S*T $P = 0.029$	S*T $P = 0.197$	S*T $P = 0.956$	S*T $P = 0.974$	S*T $P = 0.984$	S*T $P = 0.998$	S*T $P = 0.834$	S*T $P = 0.012$
		LSD = 0.309	LSD = 0.617	LSD = 10.776	LSD = 8.512	LSD = 0.502	LSD = 0.776	LSD = 0.625	LSD = 0.319

Values are the mean ± standard error. Means within a column of the same parameter with different letters are significantly different ($P < 0.001$). LSD = least significant difference; S = shelf life days; T = treatments; S*T = shelf life days and treatments.

shelf life days (Table 3). The coating significantly ($P < 0.001$) maintained the TCC of 'Romanita' and 'Tinker' cherry tomato fruit during shelf life (Table 3). 'Romanita' and 'Tinker' and cherry tomato coated with AVG45% gel had slightly higher TCC (1.42 and 1.05 $mg \cdot g^{-1}$ FW) followed by fruit coated with AVG30% (1.37 and 0.70 $mg \cdot g^{-1}$ FW) and AVG15% (0.45 and 0.68 $mg \cdot g^{-1}$ FW) compared with control fruit (0.32 and 0.50 $mg \cdot g^{-1}$ FW), respectively.

Lycopene content. The lycopene content significantly ($P < 0.001$) increased during shelf life of 18 d (Table 3). 'Romanita' and 'Tinker' and cherry tomato fruit coated with AVG45% had significantly ($P <0.001$) lower lycopene values of 42.01 and 33.09 mg/100 g FW, followed by fruit coated with the AVG30% (46.36 and 28.79 mg/100 g FW) and AVG15% (54.00 and 35.68 mg/100 g FW) at the end of shelf life compared with control fruit (67.47 and 37.83 mg/100 g FW), respectively.

Total phenolic content. The TPC slowly ($P < 0.001$) increased in the coated cherry tomato fruit compared with the uncoated during shelf life (Table 3). 'Romanita' and 'Tinker' cherry tomato fruit coated with 45% AVG showed minor ($P < 0.001$) increase of phenols (0.30 to 0.40 and 0.21 to 0.31 mg GAE/100 g FW) followed by AVG30% (0.30 to 0.33 and 0.21 to 0.35 mg GAE/100 g FW) and AVG15% (0.30 to 0.44 and 0.21 to 0.35 mg GAE/100 g FW) during shelf life compared with control fruit (0.30 to 0.52 and 0.211 to 0.36 mg GAE/100 g FW), respectively.

Total antioxidant activity. Coating significantly ($P < 0.001$) maintained the TAA of 'Romanita' and 'Tinker' cherry tomato during shelf life (Table 3). 'Romanita' and 'Tinker' cherry tomato coated with AVG30% (76.45% and 90.79%) and AVG45% (70.24% and 93.38%) had higher TAA followed by fruit coated with the AVG15% (59.11% and 87.01%) at the end of shelf life compared with control (59.79% and 69.12%), respectively.

Discussion

Exocarp color is an important quality parameter of tomato and is normally the first attribute that potential customers notice, making it a valuable quality trait for marketing purposes (Roy and Karmakar 2019; Peralta-Ruiz et al. 2020). Fruit coated with AVG displayed an overall delay in the progression of color coordinates (Tables 1 and 4). This could be attributed to the presence of a thicker layer around the fruit, formed by the coating, which caused an increase in CO_2 and inhibited ethylene production, thus slowing the ripening process of the fruit (Bhan et al. 2022). The slow decline in L* values could be due to the delayed darkening of the red color in cherry tomato (Buthelezi et al. 2023). The coating may have also reduced the chlorophyll degradation and carotenoid synthesis in fruit and thus delayed ripening and the change of color from green to red (Jati et al. 2022). This is further supported by the total color difference (ΔE*) (Table 1) in

Table 3. Effect of *Aloe vera* gel (AVG) coating on the total chlorophyll content (TCC), lycopene content (LC), total phenolic content (TPC), and total antioxidant activity (TAA) during 18 d of shelf life at 21 °C.

		TCC		LC		TPC		TAA	
Treatment	Shelf life	'Romanita'	'Tinker'	'Romanita'	'Tinker'	'Romanita'	'Tinker'	'Romanita'	'Tinker'
Control	0	4.85 ± 0.02 g	3.45 ± 0.27 d	7.21 ± 1.54 a	5.49 ± 1.31 a	0.30 ± 0.01 cd	0.21 ± 0.04 ab	49.26 ± 0.19 a	65.56 ± 0.42 bcd
	6	2.63 ± 0.10 ef	2.84 ± 0.22 bcd	23.50 ± 2.49 ab	8.99 ± 2.74 a	0.31 ± 0.04 cd	0.22 ± 0.02 ab	56.10 ± 0.27 ab	76.25 ± 0.91 ef
	12	1.51 ± 0.06 bcde	0.69 ± 0.18 a	67.48 ± 1.3 defg	19.00 ± 5.44 ab	0.39 ± 0.05 ef	0.25 ± 0.01 b	79.89 ± 0.07 e	80.88 ± 3.55 f
	18	0.05 ± 0.15 a	0.50 ± 0.26 a	85.85 ± 5.44 g	37.83 ± 12.33 abc	0.52 ± 0.02 g	0.36 ± 0.04 c	59.79 ± 1.34 abcd	44.13 ± 3.80 a
AVG15%	0	4.85 ± 0.02 g	3.47 ± 0.04 d	7.21 ± 1.60 a	5.49 ± 1.31 a	0.30 ± 0.01 cd	0.21 ± 0.00 ab	49.26 ± 0.19 a	65.56 ± 0.42 bcd
	6	2.83 ± 0.06 f	3.66 ± 0.27 d	15.93 ± 1.22 a	1.52 ± 0.03 a	0.29 ± 0.01 bc	0.21 ± 0.02 ab	75.64 ± 0.23 cde	71.83 ± 3.10 cdef
	12	2.19 ± 0.01 cdef	1.23 ± 0.22 a	52.33 ± 1.31 cde	12.08 ± 6.82 ab	0.35 ± 0.01 de	0.23 ± 0.00 ab	73.49 ± 0.18 bcde	77.02 ± 2.47 f
	18	0.45 ± 1.33 ab	0.68 ± 0.26 a	78.33 ± 6.82 fg	35.68 ± 12.40 abc	0.44 ± 0.04 f	0.35 ± 0.03 c	59.11 ± 0.23 abc	63.02 ± 0.08 bcd
AVG30%	0	4.85 ± 0.02 g	3.47 ± 0.27 d	7.21 ± 2.36 a	5.49 ± 1.31 a	0.30 ± 0.01 bcd	0.21 ± 0.01 ab	49.26 ± 0.19 a	65.56 ± 0.42 bcd
	6	3.10 ± 0.11 f	3.32 ± 0.14 bd	14.84 ± 2.37 a	3.43 ± 0.47 a	0.24 ± 0.02 a	0.22 ± 0.02 ab	60.41 ± 0.25 abcd	59.14 ± 0.70 b
	12	2.53 ± 0.06 def	2.27 ± 0. 20 b	43.02 ± 1.31 bc	13.02 ± 2.97 ab	0.32 ± 0.04 cd	0.22 ± 0.03 ab	77.63 ± 0.14 de	66.64 ± 0.70 bcde
	18	1.37 ± 0.07 abc	0.71 ± 0.25 a	73.25 ± 2.97 efg	28.79 ± 4.12 ab	0.33 ± 0.01 cd	0.35 ± 0.02 c	76.45± 0.22 cde	73.38 ± 2.76 def
AVG45%	0	4.85 ± 0.02 g	3.47 ± 0.27d	7.21 ± 1.49 a	5.49 ± 1.31 a	0.30 ± 0.01 bcd	0.21 ± 0.02 ab	49.26± 0.19 a	65.56 ± 0.42 bcd
	6	3.23 ± 0.07 f	3.60 ± 0.18 d	10.59 ± 1.38 a	5.21 ± 0.42 a	0.25 ± 0.01 ab	0.19 ± 0.04 a	70.44 ± 0.29 bcde	62.49 ± 00.43 bc
	12	2.15 ± 0.13 cdef	2.28 ± 0.19 bc	48.67 ± 0.42 cd	6.41 ± 1.74 a	0.34 ± 0.03 cd	0.20 ± 0.03 ab	77.17 ± 1.18 de	78.92 ± 0.43 f
	18	1.42 ± 0.10 abcd	1.05 ± 0.26 a	60.48 ± 1.77 cdef	29.76 ± 13.77 ab	0.40 ± 0.02 f	0.31 ± 0.05 c	70.24 ± 0.08 bcde	70.79 ± 2.37 cdef
		T $P = 0.057$	T $P = 0.031$	T $P = 0.049$	T $P = 0.664$	T $P < 0.001$	T $P = 0.100$	T $P = 0.487$	T $P = 0.337$
		S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$	S $P < 0.001$
		S*T $P = 0.765$	S*T $P = 0.306$	S*T $P = 0.758$	S*T $P = 0.999$	S*T $P = 0.001$	S*T $P = 0.935$	S*T $P = 0.167$	S*T $P < 0.001$
		LSD = 0.5041	LSD = 0.4473	LSD = 12.05	LSD = 43.04	LSD = 15.40	LSD = 8.855	LSD = 15.40	LSD = 8.855

Values are the mean ± standard error. Means within a column of the same parameter with different letters are significantly different ($P < 0.001$). LSD = least significant difference; S = shelf life days; T = treatments; S*T = shelf life days and treatments.

both 'Romanita' and 'Tinker' cherry tomato coated with AVG, which was delayed during shelf life, indicating a slow ripening rate compared with uncoated fruit. Our findings are similar to Firdous et al. (2020) who indicated that tomato fruit coated with 80% AVG displayed the least amount of color changes when compared with the control fruit during storage of 30 d at 10 °C. Also, Jati et al. (2022) reported a slower color change in tomatoes that were coated with AVG compared with the control during 12 d of storage at room temperature.

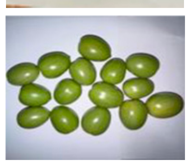
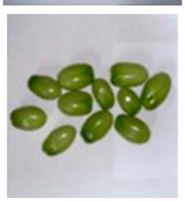
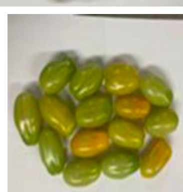
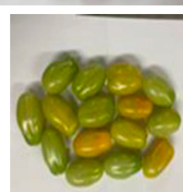
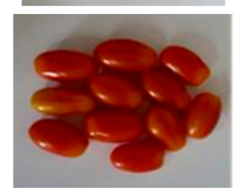
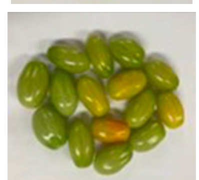
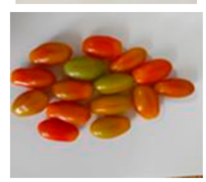
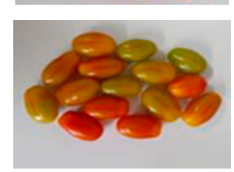
Fruits and vegetables have high water content at harvest that declines during storage and ripening (Fagundes et al. 2015; Moeng 2019). The reduced weight loss in the coated fruit could be due to the coating limiting the movement of moisture and O_2, hence lowering the respiration and transpiration rate of the fruit (Ates et al. 2022). A study by Martínez-Romero et al. (2013) showed that coating pomegranate (*Punica granatum*) with AVG was effective in minimizing water loss from products such as fruits during storage compared with control. Our findings are consistent with those of Alhassan and Ndomakaah (2024) who discovered that AVG reduced the weight loss of banana (*Musa* spp) fruit during 10 d of storage at 10 °C.

Fruit firmness is affected by the ratio of pericarp to locular tissue and the skin (Chandran et al. 2021). In our study, the firmness preservation of the coated cherry tomato could be due to that the coating reduced the respiration rate of the fruit, thereby slowing the metabolic activity and ripening process (Nicolau-Lapeña et al. 2021). Also, the reduced firmness loss in coated fruit may be attributed to the low weight loss. Table 2 shows that coated fruit had reduced weight loss compared with uncoated fruit. In accordance with our findings, Masoom (2024) declared that guava fruit coated with AVG maintained their firmness during storage of 15 d at 23 °C. Furthermore, Bill et al. (2014) reported that AVG coatings combined with thyme oil helped retain the texture of avocado (*Persea americana*) fruit during 5 d of storage at 20 °C.

According to Aboagye-Nuamah et al. (2018), a decrease in acidity leads to a reduction in sourness and an improvement in the sweetness of the tomato juice. The acidity of cherry tomato imparts the sour taste of the fruit and decreases with ripening (Yadav et al. 2022). In our study, the AVG-coated fruit had high TA, which could be attributed to the effectiveness of the coating in reducing respiration rate and the degradation of organic acids during shelf life (Li et al. 2017). The low utilization of citric acid as respiration substrates leads to reduced ripening and an extended shelf life of fresh produce (Shehata et al. 2021). This can be supported by the findings of our study, which showed that coated fruit had low a* (Table 1) values, which indicated fast ripening during shelf life compared with control.

It has been documented that starch degrades during postharvest storage, and is converted into fructose, glucose, and galactose (Zuccarelli et al. 2021). The slower degradation of starch

Table 4. Effect of *Aloe vera* gel (AVG) coating on the cherry tomato fruit during 18 d of shelf life at 21 °C.

		Shelf life days			
	Treatment	Day 0	Day 6	Day 12	Day 18
‘Romanita’	Control				
	AVG 15%				
	AVG 30%				
	AVG 45%				
‘Tinker’	Control				
	AVG 15%				
	AVG 30%				
	AVG 45%				

in the cherry tomato fruit coated with AVG could be due to the CA around the fruit surface, which minimized the respiratory metabolism rate (Tadesse et al. 2015). The slow metabolism rate reduced the starch hydrolysis, leading to lower TSS values in coated fruit (Hazrati et al. 2017). Furthermore, the coated cherry tomato had low TSS (Table 2) and high TA (Table 2) during shelf life compared with uncoated fruit, implying a relatively slower ripening rate (Zhou et al. 2019). Similar to our findings, Tchinda et al. (2023) reported that a coating of AVG and 1.2% arabic gum kept the TSS content of coated banana fruit low during 17 d of storage at 24 ± 2 °C.

The initial green color of fruit is mainly due to the presence of chlorophyll, which undergoes degradation during maturation and ripening (Ebrahimi and Rastegar 2020; Paciulli et al. 2017; Tzortzakis et al. 2019). In the present study, the AVG coating lowered the ethylene production in fruit, thus causing a delay in chlorophyll degradation (Hajebi-Seyed et al. 2021). This further supports our findings, as coated fruit had high TCC and low a* values (Table 1), which shows that the coating delayed the transition of green to red color. Our observations of the reduced chlorophyll levels corresponded with those of an earlier study on guava (*Psidium gujava*) fruit coated with 40% and 60% AVG (Rehman et al. 2020).

Lycopene is a carotenoid and natural pigment responsible for the red color of tomato fruit (Salehi et al. 2019). The accumulation of lycopene content was reduced in the coated fruit during shelf life (Table 3), which can be attributed to the ability of the coating to reduce the carotenoid synthesis (Abebe et al. 2017). During ripening, the chlorophyll present in the thylakoids is degraded, and lycopene rapidly accumulates in the chromoplasts (Li et al. 2021), thus resulting in the red color of cherry tomato fruit (Jati et al. 2022). In our study, the low a* values (Table 1) and high TCC (Table 3) in the coated fruit indicated that the AVG slowed fruit ripening, hence the low lycopene values.

The TPC was slowly induced in the coated cherry tomato fruit compared with the uncoated during shelf life (Table 3), which indicated that the coating was able to provide a modified atmosphere around fruit and inhibited phenol oxidation and as a result retained the TPC of the coated cherry tomato fruit (Yadav et al. 2022). The effectiveness of AVG coating in maintaining the TPC, which has antimicrobial and antioxidant activities, improved the quality and shelf life of the coated fruit (Hosseinifarahi et al. 2020). However, the TPC in fruit coated with AVG45% was low, which could be attributed to the coating not being able to control the ripening rate. Previous studies by Panigrahi et al. (2017) and Khatri et al. (2020) reported that AVG coating maintained the phenolic content of tomato fruit compared with the control fruit.

The AVG coating was effective in maintaining the TAA of coated fruit during shelf life (Table 3). The preserved TAA in coated fruit may be due to the presence of the coating, which reduced the oxidation of phenolic compounds and lipid oxidation, thus improving both quality and shelf life of food products and delayed the onset of senescence (Manzoor et al. 2021; Yadav et al. 2022; Young and Lowe 2018). Similar to the trend of antioxidants, coated cherry tomato fruit had high chlorophyll content (Table 3) at the end of shelf life compared with control, which could be due to delayed ripening (Table 4). The AVG coating preserved the antioxidant activity of Andean blackberry fruits during 19 d of storage at 4 °C (Vélez et al. 2021).

Conclusion

The current study showed that the AVG coating (15%, 30%, and 45%) effectively improved postharvest quality and shelf life of 'Romanita' and 'Tinker' cherry tomato. Moreover, the 30% and 45% AVG coating performed better than AVG15% and control and could be recommended for maintaining the postharvest quality and shelf life of cherry tomato. Despite considerable findings of the present study, future studies should investigate the incorporation of other natural compounds in edible coatings including biosynthesized nanoparticles to further improve quality and shelf life of fresh produce. The combination of edible coating and biodegradable packaging materials can also be explored in future research for further enhancing the quality and shelf life of cherry tomato.

References Cited

Abebe Z, Tola YB, Mohammed A. 2017. Effects of edible coating materials and stages of maturity at harvest on storage life and quality of tomato (*Lycopersicon Esculentum* Mill) fruits. Afr J Agric Res. 12(8):550–565. https://doi.org/10.5897/AJAR2016.11648.

Aboagye-Nuamah F, Hussein YA, Ackun A, Faculty of Applied Sciences, Methodist University College Ghana, Wenchi, Ghana. 2018. Biochemical properties of six varieties of tomato from Brong Ahafo Region of Ghana as influenced by the ripening condition and drying. AJFAND. 18(01):13095–13109. https://doi.org/10.18697/ajfand.81.16975.

Alhassan N, Ndomakaah A. 2024. Aloe vera gel coating maintains physicochemical parameters, extends the storage life, and preserves the qualities of Lantundan and Cavendish bananas. J Hortic Postharvest Res. 7(3):287–300. https://doi.org/10.22077/jhpr.2024.7190.1357.

AOAC. 2000. Official method 942. Acidity (titratable) of fruit products read with A.O.A.C official method 920. 149. Preparation of test sample. Vitamins and Other Nutrients, Official Methods of Analysis. 15:16–20.

Ates U, Islam A, Ozturk B, Aglar E, Karakaya O, Gun S. 2022. Changes in quality traits and phytochemical components of blueberry (*Vaccinium Corymbosum* Cv. Bluecrop) fruit in response to postharvest *aloe vera* treatment. Int J Fruit Sci. 22(1):303–316. https://doi.org/10.1080/15538362.2022.2038341.

Bhan C, Asrey R, Meena NK, Rudra SG, Chawla G, Kumar R, Kumar R. 2022. Guar gum and chitosan-based composite edible coating extends the shelf life and preserves the bioactive compounds in stored Kinnow fruits. Int J Biol Macromol. 222(Pt B):2922–2935. https://doi.org/10.1016/j.ijbiomac.2022.10.068.

Bill M, Sivakumar D, Korsten L, Thompson AK. 2014. The efficacy of combined application of edible coatings and thyme oil in inducing resistance components in avocado (*Persea americana* Mill.) against anthracnose during postharvest storage. Crop Prot. 64:159–167. https://doi.org/10.1016/j.cropro.2014.06.015.

Buthelezi NMD, Olowoyo JO, Mafeo TP. 2023. Influence of preharvest bagging on maturity indices and postharvest quality of cherry tomato (*Solanum lycopersicum* var. *cerasiforme*). HortScience. 58(1):95–104. https://doi.org/10.21273/HORTSCI16844-22.

Buthelezi NMD, Mafeo TP, Mathaba N. 2021. Preharvest bagging as an alternative technique for enhancing fruit quality: A review. HortTechnology. 31(1):4–13. https://doi.org/10.21273/HORTTECH04658-20.

Chandran TT, Mini C, Anith KN. 2021. Quality evaluation of edible film coated tomato (*Solanum lycopersicum*) fruits. J Trop Agric. 58(2). https://jtropag.kau.in/index.php/ojs2/article/view/984.

Ebrahimi F, Rastegar S. 2020. Preservation of mango fruit with guar-based edible coatings enriched with *Spirulina platensis* and *Aloe vera* extract during storage at ambient temperature. Sci Hortic. 265:109–258. https://doi.org/10.1016/j.scienta.2020.109258.

Fagundes C, Moraes K, Pérez-Gago MB. 2015. Effect of active modified atmosphere and cold storage on the postharvest quality of cherry tomatoes. Postharvest Bio Technol. 109:73–81. https://doi.org/10.1016/j.postharvbio.2015.05.017.

Firdous N, Khan MR, Butt MS, Shahid M. 2020. Application of aloe vera gel based edible coating to maintain postharvest quality of tomatoes. Pak J Agric Sci. 57(1):245–249. https://doi.org/10.21162/PAKJAS/20.7746.

Francesca S, Arena C, Hay Mele B, Schettini C, Ambrosino P, Barone A, Rigano MM. 2020. The use of a plant-based biostimulant improves plant performances and fruit quality in tomato plants grown at eleavated temperatures. Agronomy. 10:363. https://doi.org/10.3390/agronomy10030363.

Gan L, Jiang G, Yang Y, Zheng B, Zhang S, Li X, Tian Y, Peng B. 2022. Development and characterization of levan/pullulan/chitosan edible films enriched with ε-polylysine for active food packaging. Food Chem. 388:132989. https://doi.org/10.1016/j.foodchem.2022.132989.

Hajebi-Seyed R, Rastegar S, Faramarzi S. 2021. Impact of edible coating derived from a combination of *Aloe vera* gel, chitosan and calcium chloride on maintain the quality of mango fruit at ambient temperature. Food Measure. 15(4):2932–2942. https://doi.org/10.1007/s11694-021-00861-6.

Hassan B, Chatha SAS, Hussain AI, Zia KM, Akhtar N. 2018. Recent advances on polysaccharides, lipids and protein based edible films and coatings: A review. Int J Biol Macromol. 109:1095–1107. https://doi.org/10.1016/j.ijbiomac.2017.11.097.

Hazrati S, Beyraghdar Kashkooli A, Habibzadeh F, Tahmasebi-Sarvestani Z, Sadeghi A. 2017. Evaluation of Aloe vera gel as an alternative edible coating for peach fruits during cold storage period. Gesunde Pflanzen. 69(3):131–137. https://doi.org/10.1007/s10343-017-0397-5.

Hosseinifarahi M, Jamshidi E, Amiri S, Kamyab F, Radi M. 2020. Quality, phenolic content, antioxidant activity, and the degradation kinetic of some quality parameters in strawberry fruit coated with salicylic acid and *Aloe vera* gel. J Food Process Preserv. 44(9):1–14. https://doi.org/10.1111/jfpp.14647.

Islam M, Rahman M, Shamsuzzoha M, Chowdhury A, Alom R. 2017. Influence of pre-harvest bagging on fruit quality of Mango (Mangifera indica L.) cv. Mishribhog. Int J Biosci. 11(3):59–68. http://dx.doi.org/10.12692/ijb/11.3.59-68.

Jati IRA, Setijawaty E, Utomo AR, Darmoatmodjo LMY. 2022. The application of *Aloe vera* gel as coating agent to maintain the quality of tomatoes during storage. Coatings. 12(10):1480. https://doi.org/10.3390/coatings12101480.

Kator L, Hosea ZY, Ene OP. 2018. The efficacy of Aloe-vera coating on postharvest shelf life and quality tomato fruits during storage. ARJA. 8(4):1–9. https://doi.org/10.9734/ARJA/2018/41540.

Khatri D, Panigrahi J, Prajapati A, Bariya H. 2020. Attributes of *Aloe vera* gel and chitosan treatments on the quality and biochemical traits of post-harvest tomatoes. Sci Hortic. 259:108837. https://doi.org/10.1016/j.scienta.2019.108837.

Li L, Sun J, Gao H, Shen Y, Li C, Yi P, He X, Ling D, Sheng J, Li J. 2017. Effects of polysaccharide-based edible coatings on quality and antioxidant enzyme system of strawberry during cold storage. Int J Polym Sci. 2017(1):1–8. https://doi.org/10.1155/2017/9746174.

Li Y, Liu C, Shi Q, Yang F, Wei M. 2021. Mixed red and blue light promotes ripening and improves quality of tomato fruit by influencing melatonin content. Environ Exp Bot. 185:104407. https://doi.org/10.1016/j.envexpbot.2021.104407.

Mafotja MP. 2022. Influence of bagging materials on maturity indices and post-harvest quality of 'Roma vf' and 'Tinker' cherry tomatoes. Mini-

Dissertation. University of Limpopo, South Africa.
Manzoor MF, Xu B, Khan S, Shukat R, Ahmad N, Imran M, Rehman A, Karrar E, Aadil RM, Korma SA. 2021. Impact of high-intensity thermosonication treatment on spinach juice: Bioactive compounds, rheological, microbial, and enzymatic activities. Ultrason Sonochem. 78:105740. https://doi.org/10.1016/j.ultsonch.2021.105740.
Martínez-Romero D, Castillo S, Guillén F, Díaz-Mula HM, Zapata PJ, Valero D, Serrano M. 2013. Aloe vera gel coating maintains quality and safety of ready-to-eat pomegranate arils. Postharvest Biol Tech. 86:107–112. https://doi.org/10.1016/j.postharvbio.2013.06.022.
Masoom M. 2024. Aloe vera gel coating emphasized the post-harvest life and quality of guava fruits (*Psidium guajava* L). Afr J Bio Sci. 6(12): 6560–6570. https://doi.org/10.48047/AFBJS.6.12.2024.656-6570.
Migliori CA, Salvati L, Di Cesare LF, Scalzo RL, Parisi M. 2017. Effects of preharvest applications of natural antimicrobial products on tomato fruit decay and quality during long-term storage. Sci Hortic. 222:193–202. https://doi.org/10.1016/j.scienta.2017.04.030.
Mustapha AT, Zhou C, Amanor-Atiemoh R, Ali TAA, Wahia H, Ma H, Sun Y. 2020. Efficacy of dual-frequency ultrasound and sanitizers washing treatments on quality retention of cherry tomato. Innov Food Sci Emerg Technol. 62:102348. https://doi.org/10.1016/j.ifset.2020.102348.
Ncama K, Magwaza LS, Mditshwa A, Tesfay SZ. 2018. Plant-based edible coatings for managing postharvest quality of fresh horticultural produce: A review. Food Packag Shelf Life. 16:157–167. https://doi.org/10.1016/j.fpsl.2018.03.011.
Nicolau-Lapeña I, Colàs-Medà P, Alegre I, Aguiló-Aguayo I, Muranyi P, Viñas I. 2021. *Aloe vera* gel: An update on its use as a functional edible coating to preserve fruits and vegetables. Prog Org Coat. 151:106007. https://doi.org/10.1016/j.porgcoat.2020.106007.
Nkolisa N, Magwaza LS, Workneh TS, Chimphango A, Sithole NJ. 2019. Postharvest quality and bioactive properties of tomatoes (*Solanum lycopersicum*) stored in a low-cost and energy-free evaporative cooling system. Heliyon. 5(8): e02266. https://doi.org/10.1016/j.heliyon.2019.e02266.
Odriozola-Serrano I, Soliva-Fortuny R, Gimeno-Añó V, Martín-Belloso O. 2008. Modeling changes in health-related compounds of tomato juice treated by high-intensity pulsed electric fields. J Food Eng. 89(2):210–216. https://doi.org/10.1016/j.jfoodeng.2008.04.019.
Oduro KOA. 2021. Edible coating. Postharvest technology - Recent advances, new perspectives and applications. IntechOpen. [per online source] https://doi.org/10.5772/intechopen.101283.
Paciulli M, Palermo M, Chiavaro E, Pellegrini N. 2017. Chlorophylls and colour changes in cooked vegetables, p 703–719. In: Yahia EM (ed). Fruit and vegetable phytochemicals: Chemistry and human health, 2nd Edition. John Wiley & Sons, Inc., Hoboken, NJ, USA.
Panigrahi J, Gheewala B, Patel M, Patel N, Gantait S. 2017. Gibberellic acid coating: A novel approach to expand the shelf-life in green chilli (*Capsicum annuum* L.). Sci Hortic. 225:581–588. https://doi.org/10.1016/j.scienta.2017.07.059.
Peralta-Ruiz Y, Tovar CDG, Sinning-Mangonez A, Coronell EA, Marino MF, Chaves-Lopez C. 2020. Reduction of postharvest quality loss and microbiological decay of tomato "Chonto" (*Solanum lycopersicum* L.) using chitosan-E essential oil-based edible coatings under low-temperature storage. Polymers (Basel). 12(8):1–22. https://doi.org/10.3390/polym12081822.
Purbey SK, Kumar A. 2015. Effect of pre harvest bagging on quality and yield of litchi (*Litchi chinensis* Sonn.) fruits. The Ecoscan: Int Quarterly J Environ Sci. 7:197–201.
Raghav PK, Agarwal N, Saini M. 2016. Edible coating of fruits and vegetables: A review. Education. 1(2):188–204.
Rehman MA, Asi MR, Hameed A, Bourquin LD. 2020. Effect of postharvest application of *Aloe vera* gel on shelf life, activities of anti-oxidative enzymes, and quality of 'Gola' guava fruit. Foods. 9(10):1361. https://doi.org/10.3390/foods9101361.
Roy A, Karmakar A, Dept. of Post Harvest Engineering Faculty of Agricultural Engineering, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal (741 252), India. 2019. Use of *Aloe vera* gel coating as preservative on tomato. Int J Bio-resource Stress Man. 10(5):461–466. https://doi.org/10.23910/IJBSM/2019.10.5.2022a.
Saleem MS, Anjum MA, Naz S, Ali S, Hussain S, Azam M, Sardar H, Khaliq G, Canan İ, Ejaz S. 2021. Incorporation of ascorbic acid in chitosan-based edible coating improves postharvest quality and storability of strawberry fruits. Int J Biol Macromol. 189:160–169. https://doi.org/10.1016/j.ijbiomac.2021.08.051.
Saleem MS, Ejaz S, Anjum MA, Ali S, Hussain S, Nawaz A, Naz S, Maqbool M, Abbas AM. 2022. *Aloe vera* gel coating delays softening and maintains quality of stored persimmon (*Diospyros kaki* Thunb.) fruits. J Food Sci Technol. 59(8):3296–3306. https://doi.org/10.1007/s13197-022-05412-5.
Salehi B, Lopez-Jornet P, Pons-Fuster López E, Calina D, Sharifi-Rad M, Ramírez-Alarcón K, Forman K, Fernández M, Martorell M, Setzer WN, Martins N, Rodrigues CF, Sharifi-Rad J. 2019. Plant-derived bioactives in oral mucosal lesions: A key emphasis to curcumin, lycopene, chamomile, *Aloe vera*, green tea and coffee properties. Biomolecules. 9(3):106. https://doi.org/10.3390/biom9030106.
Santosh DT, Tiwari KN, Reddy RG. 2017. Banana bunch covers for quality banana production—a review. Int J Curr Microbiol Appl Sci. 6(7): 1275–1291. https://doi.org/10.20546/ijcmas.2017.607.155.
Seun ET, Omolade AK, Josephine SO, Iyamah CPC, Olatunde EO, Lawrence OM, Adewumi F, Oke OA. 2022. Effects of *Psidium guajava* L. leaf powder and *Aloe vera* L. gel on shelf life of *Citrus sinensis* L. fruits. Eur J Nutr Food Saf. 14:35–40. https://doi.org/10.9734/EJNFS/2022/v14i730514.
Sharma RR, Nagaraja A, Goswami AK, Thakre M, Kumar R, Varghese E. 2020. Influence of on-the-tree fruit bagging on biotic stresses and postharvest quality of rainy-season crop of 'Allahabad Safeda' guava (*Psidium guajava* L.). Crop Pro. 135:105216. https://doi.org/10.1016/j.cropro.2020.105216.
Sharma RR, Sanikommu VR. 2018. Pre harvest fruit bagging for better protection and postharvest quality of horticultural produce, p 488–489. In: Siddiqui MW (ed). Preharvest modulation of postharvest fruit and vegetable quality. Academic Press, London. https://doi.org/10.1016/B978-0-12-809807-3.00016-0.
Shehata SA, Abdelrahman SZ, Megahed M, Abdeldaym EA, El-Mogy MM, Abdelgawad KF. 2021. Extending shelf life and maintaining quality of tomato fruit by 68 calcium chloride, hydrogen peroxide, chitosan, and ozonated water. Horticulturae. 7(9):309. https://doi.org/10.3390/horticulturae7090309.
Singleton VL, Orthofer R, Lamuela-Raventos RM. 1999. Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin−Ciocalteu reagent. Methods Enzymol. 299:152–178. https://doi.org/10.1016/S0076-6879(99)99017-1.
Tadesse TN, Ibrahim AM, Abtew WG. 2015. Degradation and formation of fruit color in tomato (*Solanum lycopersicum* L) in response to storage temperature. Am J Food Technol. 10(4): 147–157. https://doi.org/10.3923/ajft.2015.147.157.
Tchinda AN, Anoumaa M, Tazo FLT, Phounzong ET, Kenfack OJ, Lekeufack M, Doumdi RB, Nguemezi JA, Fonkou T. 2023. Edible coating formulated by optimization from *Aloe vera*, starch, and arabic gum improved the conservation of banana (*Musa acuminata*) fruits. Int J Food Sci. 2023(3):3746425–3746413. https://doi.org/10.1155/2023/3746425.
Vélez JPA, Álvarez GEG, Soto MCV, Hurtado NC, Pinzon MI, Villa CC. 2021. Aloe vera gel edible coating for shelf life and antioxidant properties preservation for Andean blackberry. Processes. 9(6):999. https://doi.org/10.3390/pr9060999.
Yadav A, Kumar N, Upadhyay A, Sethi S, Singh A. 2022. Edible coating as postharvest management strategy for shelf-life extension of fresh tomato (*Solanum lycopersicum* L.): An overview. J Food Sci. 87(6):2256–2290. https://doi.org/10.1111/1750-3841.16145.
Young AJ, Lowe GL. 2018. Carotenoids—antioxidant properties. Antioxidants. 7(2):28. https://doi.org/10.3390/antiox7020028.
Zhang Y, Zhao G, Cheng P, Yan X, Li Y, Cheng D, Wang R, Chen J, Shen W. 2019. Nitrite accumulation during storage of tomato fruit as prevented by hydrogen gas. Int J Food Prop. 22(1):1425–1438. https://doi.org/10.1080/10942912.2019.1651737.
Zhang H, Zhu J, Gong Z, Zhu JK. 2022. Abiotic stress responses in plants. Nat Rev Genet. 23(2):104–119. https://doi.org/10.1080/10942912.2019.1651737.
Zhou H, Yu Z, Ye Z. 2019. Effect of bagging duration on peach fruit peel color and key protein changes based on iTRAQ quantitation. Sci Hortic. 246:217–226. https://doi.org/10.1016/j.scienta.2018.10.072.
Zuccarelli R, Rodríguez-Ruiz M, Lopes-Oliveira PJ, Pascoal GB, Andrade SC, Furlan CM, Purgatto E, Palma JM, Corpas FJ, Rossi M, Freschi L. 2021. Multifaceted roles of nitric oxide in tomato fruit ripening: NO-induced metabolic rewiring and consequences for fruit quality traits. J Exp Bot. 72(3):941–958. https://doi.org/10.1093/jxb/eraa526.