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ORIGINAL RESEARCH ARTICLE



Hexanal and Salicylic acid: Improves postharvest quality and shelf life of strawberry (*Fragaria ananassa* cv. Winter Dawn) under low storage temperature

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ABSTRACT

Postharvest quality and shelf life of strawberry are highly susceptible to rapid ripening and decay, leading to significant economic losses from grower's perspective. Therefore, study was conducted to evaluate the effects of hexanal and salicylic acid as dip treatment under different storage temperatures on physico-chemical and biochemical attributes of strawberry (*Fragaria ananassa* cv. Winter Dawn) fruits. The study consisted ten treatments combinations and three replications. Fruits were treated with hexanal @ 4mM, stored at 6 °C temperatures and exhibited highest shelf life (24 days), reduced physiological weight loss (7.52%), lower decay incidence (26.66%), better firmness retention (3.96 kg/cm²), higher retention of ascorbic acid (47.42mg/100gm), phenolic compounds (288.37 mg GE/100g), and antioxidant activity (64.19% DPPH inhibition) at 16 DAS. Salicylic acid also extended shelf life (14 days) and maintained biochemical properties compared to control. These effects are associated with reduced enzymatic activity related to ripening, lower respiration rates, and modulation of oxidative processes, hence can be recommended as a practical and efficient postharvest handling tools to extend shelf life and biochemical properties of strawberry.

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INTRODUCTION

Strawberry (*Fragaria × ananassa* Duch.) is one of the most commercially important small fruits, widely consumed for its appealing sensory attributes, high nutritional value, and diverse health-promoting phytochemicals (Bhat & Stamminger, 2015; Mao et al., 2022). Its biochemical and nutritional composition is strongly influenced by cultivar, environmental factors, harvest maturity, and pre- and postharvest handling practices (Aaby et al., 2012; Wang et al., 2024). Strawberry is one of the most important fruits from health perspective as it is rich in bioactive compounds like flavonoids, polyphenols such as anthocyanin's, phenols and antioxidants that helps to neutralize free radicals in human body (Afrin et al., 2016; Lv et al., 2021). However, strawberries remain one of the most perishable horticultural com-

modities due to their delicate texture, high respiration rate, susceptibility to mechanical injury, and vulnerability to fungal pathogens, all of which accelerate softening, decay, and nutrient degradation (Vu et al., 2010). These challenges significantly limit their storage stability and market availability beyond the production season. However, such limitations could be mitigated by combined use of chemicals like hexanal and salicylic acid at different storage temperatures. Hexanal, a naturally occurring plant aldehyde formed during lipid oxidation, has recently attracted interest as a safe postharvest treatment due to its ability to inhibit phospholipase D (PLD) activity, delay membrane deterioration, and reduce senescence (Sharma et al., 2010; Cheema et al., 2016; Feng et al., 2022). It also possesses antifungal activity against *Alternaria alternata*, *Botrytis cinerea*, and *Penicillium expansum*, while contributing positively to fruit

aroma (Archbold et al., 1999). Recent findings further demonstrate that hexanal formulations can down-regulate PLD-related genes and reduce structural deterioration in strawberries (El-Kayal et al., 2017). Salicylic acid (SA), another natural compound involved in plant defense signaling, has also shown potential to delay fruit ripening, modulate ethylene biosynthesis, and enhance antioxidant responses through the regulation of lipoxygenase and allene oxide synthase pathways (Wang et al., 2024). Though various studies have been done to enhance shelf life and postharvest quality of berry fruits, our current understanding of easily operative, safe, effective and consumer friendly strategies to improve postharvest quality of strawberry fruits remains fragmentary and could be improved by application of hexanal and salicylic acid formulations at different storage temperatures. Therefore, this study aims to investigate the influence of postharvest applications of hexanal and salicylic acid on physicochemical quality, biochemical behavior, and shelf life of strawberry cv. Winter Dawn.

MATERIALS AND METHODS

The experiment was conducted in a factorial completely randomized design (FCRD) with three replications consisting of ten treatment combinations having two factors viz., post harvest chemicals application at five levels P₁: Control (Tap water), P₂: Hexanal @ 2mM, P₃: Hexanal @ 4mM, P₄: Salicylic acid @ 2mM and P₅: Salicylic acid @ 4mM and different storage temperatures at two levels (S₁: 3 °C temperature and S₂: 6 °C temperature).

Preparation of hexanal formulation

Stock hexanal formulation was prepared by mixing pure hexanal (1% v/v), geraniol (1%), α -tocopherol (1% w/v), ascorbic acid (1% w/v) and tween 20 (10% v/v). The final volume was prepared up to 100 ml with distilled water. Stock hexanal solution of 0.2ml was dissolved in 1 litre water prior to application to provide hexanal concentration of 2mM/0.02 % EFF (Enhanced Fresh Formulation). Similarly, 0.4 ml of stock hexanal solution was dissolved in 1 litre water prior to application to provide hexanal concentration of 4mM/0.04 % EFF (Enhanced Fresh Formulation) (El-Kayal et al., 2017).

Preparation of different concentrations of salicylic acid

A total of 276.24 mg of salicylic acid was dissolved in 1litre of 0.1N NaOH to give strength of 2 mM SA solution and 552.48 mg of salicylic acid was dissolved in 1litre of 0.1N NaOH to give strength of 4 mM SA solution. The powdered form of salicylic acid does not dissolve in water so firstly, it was dissolved in 0.1N NaOH solution (Kaviani et al., 2012).

Postharvest treatment, packaging and storage

Post harvest application of chemicals (dip treatment) were done for 5 minutes to the uniform sized fruits (Figure 1a) and were shade dried over blotting paper for one and half hour to remove moisture from the fruits surface. The fruits were packed treatment wise (each treatment consisted of 20 fruits) in plastic boxes @ 0.5 % ventilation and stored at two different conditions at 3 °C and 6 °C. Shelf life was determined based on 50% fruit decay. Observations on physical and bio-chemical parameters were recorded at regular intervals of 4 days after storage (DAS).

Physio-chemical parameters

Shelf life (Days), decay incidence (%), physiological loss in weight (%), fruit firmness (kg/cm²), titrable solid (Ranganna, 1986), total soluble solid (°Brix), total sugars (Latimer, 2023), ascorbic acid (mg/100g) (Ranganna, 1986), total anthocyanin content (mg/100g) (Lees & Francis, 1972), total phenolic content (mg GE/100g) (Mashora et al., 2021) and antioxidant activity (% DPPH Inhibition) were analysed following Eghdami & Sadeghu (2010).

Statistical analysis

Data obtained from the experiment were compiled and analyzed using the Excel-based statistical analysis tool developed by G.B. Pant University of Agriculture and Technology, Pantnagar, India. The dataset was subjected to analysis of variance (ANOVA) to determine the significance of treatment effects on postharvest quality attributes of strawberry. Mean comparisons were performed using Duncan's Multiple Range Test (DMRT) at a 5% level of significance ($p \leq 0.05$) to separate treatment means. Results are presented as mean \pm standard error (SE).

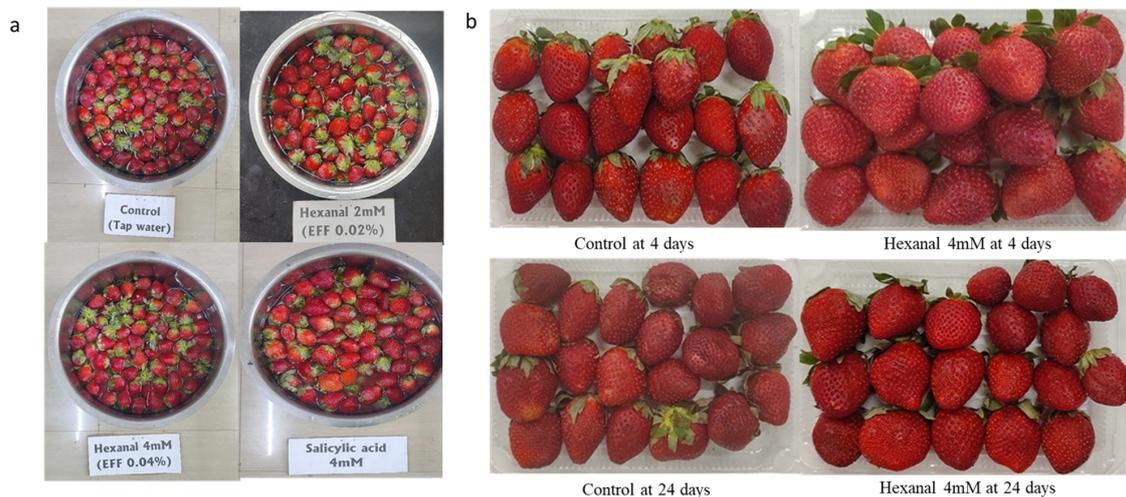


Figure 1. Dip treatment of fruits with chemicals (a), strawberry fruits shelf life at different storage periods (b).

RESULTS AND DISCUSSION

Shelf life, decay incidence, PLW and firmness of strawberry treated with hexanal and salicylic acid, stored at different temperatures

Significant variation was observed among treatments for fruits shelf life (Table 1 & Figure 1b). Fruits treated with 4mM hexanal, stored at 6 °C (P₃S₂) exhibited the highest shelf life (24 days), which was nearly double that of the control. This extended storability could be associated with lower decay incidence (26.66%), reduced physiological weight loss (7.52%), retention of firmness (3.96 kg/cm²) and high phenolic content (288.37 mg GE/100g) at 16 DAS (Tables 1, 4). Hexanal application is known to suppress Phospholipase-D activity and other ripening-related enzymes, thereby slowing membrane degradation and delaying softening, as reported by (El-Kayal et al., 2017). Decay incidence increased gradually during storage in all treatments (Table 1), however exhibited lowest (26.66%) under hexanal treatment (P₃S₂), could be due to slower moisture loss, better firmness retention, and higher antioxidant and phenolic levels, which collectively strengthen resistance to fungal invasion. In other hand, fruits stored at 3 °C exhibited shriveling and surface pitting attributable to chilling injury, accelerating senescence and decay, consistent with earlier observations in strawberry (Ayala-Zavala et al., 2004). These results align with previous reports in strawberry and blueberry (Rahman & Rahman, 2017). Physiological loss in weight increased with prolonged storage (Table 1), but was significantly minimized (7.52%) in (P₃S₂) treatment at 16 DAS, could be due to reduced respiration and transpiration. Higher weight loss in control fruits (15.76%) was associated with rapid firmness decline and enhanced susceptibility to decay, supporting earlier findings in strawberry (Lv et al., 2021). Firmness decreased across all treatments, though best recorded in fruits (3.96 kg/cm²) at 16 DAS treated with hexanal, stored at 6 °C (P₃S₂) where phenolic content was highest (Tables 1, 4). This indicates that hexanal may suppress LOX, PG, and PME activi-

ties, thereby slowing cell wall degradation (Feng et al., 2022). Similar associations between enzyme inhibition, firmness retention, and delayed softening have been documented in strawberry (Lv et al., 2021).

Biochemical responses of strawberry fruits to hexanal and salicylic acid under different storage temperatures

TSS increased during the initial storage period in all fruits and later declined (Table 2), signifying early concentration of sugars due to moisture loss and later utilization of soluble solids during respiration. Similar trends have been reported in guava (Kumar et al., 2014). Control fruits showed a rapid increase in TSS (8.36 °Brix) at 8 DAS, consistent with high PLW (8.31%), faster respiration, and advanced ripening. On the other hand, fruits treated with hexanal, stored at 6 °C (P₃S₂) exhibited significantly gradual increase in TSS (1.10 °Brix to 8.65 °Brix) by 16 DAS, indicating delayed ripening, as also observed in sweet cherry (Gholami et al., 2010). Titratable acidity decreased steadily across all treatments (Table 2), following the typical pattern of organic acid utilization as respiratory substrates during ripening. Higher acidity retention (0.94%) in hexanal-treated fruits (P₃S₂) at 16 DAS suggests reduced metabolic turnover and restricted gas exchange, delaying the conversion of acids to sugars. Similar maintenance of acidity under delayed-ripening conditions has been reported in strawberry (Vahdat et al., 2010). Lower acidity in control fruits (0.81%) at 16 DAS could be due to enhanced respiration, greater PLW, and faster senescence. Total sugars followed a pattern similar to TSS, increased initially and then declined at final storage days (Table 2). Control fruits (P₁S₁) significantly recorded high sugar content (10.42%) at 8 DAS and then decreased at later storage days, could be associated with accelerated softening, higher decay, and rapid ripening. Fruits treated with hexanal (P₃S₂) showed a slower and later rise in sugars (10.13%) at 16 DAS could be due to suppressed enzymatic activity and moderated respiration. The findings are akin with the result of Garcia et al. (2012) in strawberry. Ascorbic acid

Table 1. Effect of post-harvest application of chemicals and storage temperatures on Shelf life, decay incidence, physiological loss in weight (PLW) and fruit firmness of strawberry cv. Winter Dawn.

Treatments	Shelf life (days)	4 th day			8 th day			12 th day			16 th day		
		DI (%)	PLW (%)	Firmness (Kg/cm ²)	DI (%)	PLW (%)	Firmness (Kg/cm ²)	DI (%)	PLW (%)	Firmness (Kg/cm ²)	DI (%)	PLW (%)	Firmness (Kg/cm ²)
P ₁ S ₁	10.00	25.00	4.56	4.50	40.00	8.31	3.34	53.33	11.08	2.28	70.33	15.76	1.97
P ₁ S ₂	10.33	25.00	4.22	4.54	36.00	7.32	3.45	51.66	10.46	2.30	66.66	15.09	2.03
P ₂ S ₁	13.67	20.00	3.98	4.73	26.66	6.99	3.58	45.00	8.57	2.35	55.00	11.89	2.20
P ₂ S ₂	16.00	5.00	2.55	5.06	16.66	3.86	4.75	41.66	6.22	4.19	51.66	9.81	2.76
P ₃ S ₁	15.00	10.00	3.32	5.01	23.33	6.08	3.70	45.00	7.53	2.80	53.33	10.10	2.43
P ₃ S ₂	24.00	0.00	1.20	5.11	0.00	2.45	4.80	16.66	3.94	4.33	26.66	7.52	3.96
P ₄ S ₁	14.00	15.00	3.88	4.86	26.66	6.94	3.63	45.00	8.05	2.40	55.00	11.61	2.21
P ₄ S ₂	14.00	10.00	3.68	4.90	26.66	6.75	3.66	45.00	7.56	2.43	55.00	10.52	2.26
P ₅ S ₁	14.00	20.00	3.94	4.80	26.66	6.96	3.63	45.00	8.26	2.38	55.00	11.73	2.20
P ₅ S ₂	14.00	15.00	3.74	4.90	26.66	6.92	3.63	45.00	7.92	2.41	55.00	10.57	2.23
SEm ±	0.394	1.826	0.037	0.034	1.491	0.006	0.021	0.447	0.106	0.033	0.456	0.044	0.031
CD at 5 %	1.163	5.424	0.109	0.101	4.398	0.017	0.062	1.319	0.311	0.098	1.380	0.129	0.095

DI: Decay Incidence, PLW: Physiological Loss in Weight. P < 0.05%. P₁S₁: Control (Tap water) stored at 3 °C temperature, P₁S₂: Control (Tap water) stored at 6 °C temperature, P₂S₁: Hexanal 2mM stored at 3 °C temperature, P₂S₂: Hexanal 2mM stored at 6 °C temperature, P₃S₁: Hexanal 4mM stored at 3 °C temperature, P₃S₂: Hexanal 4mM stored at 6 °C temperature, P₄S₁: Salicylic acid 2mM stored at 3 °C temperature, P₄S₂: Salicylic acid 2mM stored at 6 °C temperature, P₅S₁: Salicylic acid 4mM stored at 3 °C temperature, P₅S₂: Salicylic acid 4mM stored at 6 °C temperature.

Table 2. Effect of post-harvest application of chemicals and storage temperatures on total soluble solids, titrable acidity and total sugars of strawberry cv. Winter Dawn.

Treatments	4 th day			8 th day			12 th day			16 th day		
	TSS (°Brix)	Titrable Acidity (%)	Total Sugars (%)	TSS (°Brix)	Titrable Acidity (%)	Total Sugars (%)	TSS (°Brix)	Titrable Acidity (%)	Total Sugars (%)	TSS (°Brix)	Titrable Acidity (%)	Total Sugars (%)
P ₁ S ₁	7.27	0.94	9.84	8.36	0.90	10.42	8.26	0.87	9.74	8.00	0.81	9.32
P ₁ S ₂	7.25	0.94	9.82	8.33	0.91	10.40	8.26	0.88	9.78	7.87	0.83	9.39
P ₂ S ₁	7.22	0.95	9.72	8.26	0.94	9.98	8.50	0.92	10.58	8.10	0.85	9.44
P ₂ S ₂	7.17	1.03	9.48	7.35	0.95	9.67	8.42	0.94	10.00	8.38	0.90	9.68
P ₃ S ₁	7.20	0.98	9.55	8.15	0.94	9.69	8.43	0.92	10.09	8.08	0.87	9.64
P ₃ S ₂	7.14	1.10	9.46	7.23	0.98	9.64	8.24	0.97	9.98	8.65	0.94	10.13
P ₄ S ₁	7.21	0.96	9.64	8.24	0.94	9.85	8.49	0.92	10.25	8.10	0.86	9.49
P ₄ S ₂	7.20	0.98	9.58	8.17	0.94	9.75	8.46	0.92	10.12	8.11	0.86	9.56
P ₅ S ₁	7.21	0.96	9.65	8.24	0.94	9.95	8.49	0.92	10.54	8.10	0.86	9.48
P ₅ S ₂	7.20	0.98	9.64	8.20	0.94	9.78	8.47	0.92	10.14	8.11	0.86	9.54
S Em ±	0.005	0.021	0.006	0.008	0.006	0.094	0.006	0.006	0.020	0.006	0.007	0.008
CD at 5 %	0.015	0.062	0.017	0.022	0.019	0.277	0.017	0.017	0.058	0.017	0.019	0.023

P₁S₁ : Control (Tap water) stored at 3 °C temperature, P₁S₂ : Control (Tap water) stored at 6 °C temperature, P₂S₁ : Hexanal 2mM stored at 3 °C temperature, P₂S₂ : Hexanal 2mM stored at 6 °C temperature, P₃S₁ : Hexanal 4mM stored at 3 °C temperature, P₃S₂ : Hexanal 4mM stored at 6 °C temperature, P₄S₁ : Salicylic acid 2mM stored at 3 °C temperature, P₄S₂ : Salicylic acid 2mM stored at 6 °C temperature, P₅S₁ : Salicylic acid 4mM stored at 3 °C temperature, P₅S₂ : Salicylic acid 4mM stored at 6 °C temperature.

Table 3. Effect of post-harvest application of chemicals and storage temperatures on ascorbic acid and total anthocyanin content of strawberry cv. Winter Dawn.

Treatments	4 th day		8 th day		12 th day		16 th day	
	Ascorbic acid (mg/100gm)	Total Anthocyanin (mg/100gm)						
P ₁ S ₁	45.60	44.85	42.74	63.57	39.57	73.57	34.42	76.43
P ₁ S ₂	46.84	44.23	44.96	59.75	40.23	72.74	37.36	74.69
P ₂ S ₁	47.20	42.74	45.60	48.12	43.15	59.14	38.86	66.05
P ₂ S ₂	52.18	39.25	49.45	46.70	46.82	56.19	42.15	64.31
P ₃ S ₁	51.82	41.05	48.23	46.68	45.35	58.63	41.84	65.23
P ₃ S ₂	54.43	38.77	52.23	44.01	50.42	54.36	47.42	63.45
P ₄ S ₁	49.23	41.62	47.24	47.88	43.62	58.92	39.20	65.86
P ₄ S ₂	51.43	41.12	48.12	47.73	44.46	58.73	41.28	65.47
P ₅ S ₁	48.20	41.68	47.12	47.94	43.26	58.99	39.08	65.92
P ₅ S ₂	50.52	41.32	47.62	47.84	44.25	58.86	41.26	65.68
S Em ±	0.006	0.006	0.120	0.090	0.091	0.107	0.040	0.050
CD at 5 %	0.017	0.017	0.353	0.266	0.268	0.151	0.119	0.149

P₁S₁ : Control (Tap water) stored at 3 °C temperature, P₁S₂ : Control (Tap water) stored at 6 °C temperature, P₂S₁ : Hexanal 2mM stored at 3 °C temperature, P₂S₂ : Hexanal 2mM stored at 6 °C temperature, P₃S₁ : Hexanal 4mM stored at 3 °C temperature, P₃S₂ : Hexanal 4mM stored at 6 °C temperature, P₄S₁ : Salicylic acid 2mM stored at 3 °C temperature, P₄S₂ : Salicylic acid 2mM stored at 6 °C temperature, P₅S₁ : Salicylic acid 4mM stored at 3 °C temperature, P₅S₂ : Salicylic acid 4mM stored at 6 °C temperature.

declined gradually in all treatments during storage (Table 3), reflecting its natural oxidation to dehydroascorbic acid by ascorbate oxidase. Higher retention of ascorbic acid (47.42 mg/100g) at 16 DAS in hexanal-treated fruits (P₃S₂) suggests delayed oxidative degradation due to reduced activity of ascorbate oxidase and peroxidase. Similar enhancement of ascorbic acid stability under postharvest treatments has been reported in strawberry and banana (Salari et al., 2012; Yumbya et al., 2019). Low ascorbic acid content (34.42 mg/100g) at 16 DAS in control fruits (P₁S₁) align with accelerated respiration, higher PLW (4.56%), and faster senescence observed at early storage days. Anthocyanin content increased gradually with storage time across treatments, consistent with progressive ripening and pigment accumulation (Table 3). Hexanal treated fruits

(P₃S₂) significantly maintained lower anthocyanin levels (63.45 mg/100g) at 16 DAS, which indicates delayed pigment synthesis and modified internal atmosphere due to reduced O₂ and increased CO₂ diffusion barriers (Paul & Pandey, 2014). This suppression of anthocyanin formation agrees with earlier findings in strawberry (Mao et al., 2022). These results correlate with slower softening, lower decay incidence, and reduced TSS accumulation reported under the same treatment. Total phenolic content and total antioxidant activity declined gradually during storage in all fruits, as phenolics are metabolized to neutralize reactive oxygen species during ripening (Table 4). However, hexanal-treated fruits (P₃S₂) retained higher levels of phenolics (288.37 mg GE/100g) and antioxidant activity (64.19 % DPPH inhibition) at 16 DAS, possibly due to enhanced phenylalanine

Table 4. Effect of post-harvest application of chemicals and storage temperatures on total phenolic content and total antioxidants of strawberry cv. Winter Dawn.

Treatments	4 th day		8 th day		12 th day		16 th day	
	Total Phenolic (mg GE/100g)	Total antioxidants (% DPPH Inhibition)	Total Phenolic (mg GE/100g)	Total antioxidants (% DPPH Inhibition)	Total Phenolic (mg GE/100g)	Total antioxidants (% DPPH Inhibition)	Total Phenolic (mg E/100g)	Total antioxidants (% DPPH Inhibition)
P ₁ S ₁	302.50	69.57	287.47	60.85	269.37	53.30	260.68	45.43
P ₁ S ₂	303.24	70.38	289.48	62.31	272.51	54.63	265.45	48.46
P ₂ S ₁	307.45	71.67	300.37	64.29	285.87	56.84	270.27	50.46
P ₂ S ₂	312.43	73.23	304.44	68.49	293.56	63.96	281.48	58.35
P ₃ S ₁	309.46	72.85	302.57	65.85	287.46	58.44	272.84	51.84
P ₃ S ₂	315.34	75.12	308.85	70.84	300.87	67.59	288.37	64.19
P ₄ S ₁	307.97	71.95	302.24	65.37	286.68	57.37	270.89	51.24
P ₄ S ₂	308.78	72.78	302.48	65.76	287.26	57.89	271.48	51.58
P ₅ S ₁	307.67	71.85	302.18	65.22	286.58	56.87	270.47	50.76
P ₅ S ₂	308.65	72.65	302.36	65.48	287.13	57.68	271.13	51.45
S Em ±	0.080	0.090	0.059	0.050	0.123	0.112	0.006	0.031
CD at 5 %	0.237	0.266	0.175	0.147	0.362	0.329	0.017	0.090

P₁S₁ : Control (Tap water) stored at 3 °C temperature, P₁S₂ : Control (Tap water) stored at 6 °C temperature, P₂S₁ : Hexanal 2mM stored at 3 °C temperature, P₂S₂ : Hexanal 2mM stored at 6 °C temperature, P₃S₁ : Hexanal 4mM stored at 3 °C temperature, P₃S₂ : Hexanal 4mM stored at 6 °C temperature, P₄S₁ : Salicylic acid 2mM stored at 3 °C temperature, P₄S₂ : Salicylic acid 2mM stored at 6 °C temperature, P₅S₁ : Salicylic acid 4mM stored at 3 °C temperature, P₅S₂ : Salicylic acid 4mM stored at 6 °C temperature.

ammonia lyase (PAL) activity and superoxide dismutase (SOD) activity, promoting accumulation of key phenolic compounds associated with delayed ripening (Azizah *et al.*, 2014). Similar trends of higher phenolic retention under controlled ripening have been observed in strawberry (Ali *et al.*, 2021). High phenolic retention corresponds well with the higher firmness, lower decay, and stable acidity reported earlier for these fruits.

Conclusion

Hexanal and salicylic acid treated fruits with low storage temperature significantly delayed ripening and preserved the overall physiochemical quality of strawberry fruits. Hexanal performed well over salicylic acid to preserve postharvest quality of strawberry fruits. However, salicylic acid also strengthens fruit quality, compared to control. Hexanal 4mM and storage temperature of 6°C consistently maintained superior physico-chemical and nutraceutical quality throughout storage. Low storage temperature of 3°C imposed chilling injury to the fruits. Overall, the combined postharvest dip application of hexanal @ 4mM and optimal storage temperature could be a promising strategy for enhancing fruit storability, reducing postharvest losses, and delivering higher-quality strawberry fruits to consumers.

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DECLARATIONS

Author contribution statement: Conceptualization: M.M. and A.S.; Methodology: A.S.; Software and validation: V.S., P.S. and M.M.; Formal analysis and investigation: P.V.K.Y. and M.M.; Resources: M.M.; Data curation: A.S.; Writing-original draft preparation: A.S.; Writing-review and editing: P.S. and V.S.; Visualization: P.V.K.R.; Supervision: P.V.K.R.; Project administration: M.M.; Funding acquisition: M.M. All authors have read and agreed to the published version of the manuscript.

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