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Evaluation of Storage Pre-Treatment and their Effect on the Shelf Life of Fresh Coriander

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ABSTRACT

The present study deals with exploring the evaluation of storage pre-treatment and their effect on the shelf life of fresh Coriander. The impact of various plant extracts on the shelf life and quality of fresh coriander presents promising opportunities for extending its storage duration while maintaining its freshness and nutritional value. Through the exploration of natural compounds found in plants, such as essential oils, polyphenols, and flavonoids, researchers have identified several strategies to inhibit microbial growth and oxidative deterioration in coriander. Coriander have a short shelf life due to climacteric nature. The current work was conducted to extend the shelf life of fresh coriander with moringa, jaman and marwa plants extracts coatings. After that about nine sets were prepared. In each sets the relevant extracts were sprayed on the coriander daily one time for five days. The results revealed that the weight loss of coriander after 5th day was minimum by Marwa ethanolic extract. Moreover, the trend of weight loss in coriander was: Marwa ethanolic extract < Jaman ethanolic extract < Jaman aqueous extract < Moringa aqueous extract < Shopping bag wrapping < Marwa aqueous extract < Distilled water < Tissue paper wrapping < Moringa ethanolic extract. In conclusion, the utilization of plant extracts represents a promising approach to enhance the shelf life and quality of fresh coriander, offering sustainable and natural alternatives to synthetic preservatives. Continued research in this area holds the potential to unlock new strategies for preserving fresh herbs and improving food security.

Keywords: Coriander, Moringa aqueous, Jaman aqueous extract, Marwa aqueous extract.

INTRODUCTION

The herb coriander (*Coriandrum sativum*), sometimes referred to as cilantro, is an annual member of the Apiaceae family. While the entire plant is edible, the portions that are most frequently used in cooking are the dried seeds and the fresh leaves (Wei, Liu, Zhao, Zhao, Xue & Lan 2019). Leaves include a modest quantity of nutritional minerals and are especially rich in vitamins A, C, and K when measured in a 100-gram reference amount. The fresh leaves are used as a garnish for soups, salads, guacamole, and chutneys and salads (Spence 2023). Coriander leaves are usually added to dishes right before serving or used raw since heat taints their flavor. Coriander leaves are used extensively and roasted until their flavor is lost in cuisines from Central Asia and India (Kumar, Balasubramanian, Govindaraj &

Krishnaveni 2014).

Coriander oils, extract, and seeds may all have hypoglycemic effects. In fact, because coriander lowers blood sugar so much, persons with low blood sugar or those taking diabetes medication should use it with caution. A number of antioxidants included in coriander help guard against the harm that free radicals can do to cells. It appears that coriander extract functions as a diuretic, assisting your body in eliminating excessive water and salt (Sharma et al. 2022).

Coriander was lost 7.3% of the time throughout agricultural operations including harvesting, gathering, threshing, winnowing, drying, packing, and storage. In order to preserve its freshness and scent for subsequent use, post-harvest operations should be properly carried out (Anitha & Hore 2018). Enhancing coriander's quality

and shelf life is one way to make the herb better and last longer. Plant extracts can be used to do this by adding them to packing materials or by misting fresh coriander with plant extracts. This may result in less post-harvest losses, more economic value for farmers and food producers and better fresh coriander quality for consumers (Teshome, Forsido, Rupasinghe & Olika Keyata 2022).

Natural plant extracts can be used to improve the quality and shelf life of fresh coriander, which is a practical and scientific application that can also support and encourage the use of natural and eco-friendly alternatives to synthetic chemicals and improve tomato quality and nutritional value for consumers.

Additional compounds with therapeutic qualities found in *Moringa oleifera* leaf extract include tannins, saponins, flavonoids, terpenoids, and glycosides. It has been demonstrated that these substances function as potent antibacterial, antioxidant, and anti-carcinogenic agents. Based on nutritional research, moringa was shown to have 28.50% carbs, 25.02% proteins, 10.42% fat, 11.83% dietary fiber, 1.108 mg β -carotene, 326.4 μ g/100 g of vitamin B1, and 15.2 mg/100 g of vitamin C. Another usage for moringa leaf extract is as a food preservative. By lessening oxidation, it extends the meat's shelf life. Antioxidants such as quercetin and chlorogenic acid are abundant in *Moringa oleifera* (Vergara-Jimenez, Almatrafi, & Fernandez 2017).

Most moringa trees are grown in semiarid, tropical, and subtropical climates, which in the US correspond to USDA hardiness zones 9 and 10. Although it may grow in a variety of soil types, it is most happy in sandy or loamy, well-drained, neutral to slightly acidic (pH 6.3 to 7.0) soil. (Ebabhi & Adebayo 2022).

Syzygium cumini, often known as black jamun, is a rich source of anthocyanin, which is sensitive to temperature, light, and oxygen. Additionally, the fruit contains compounds that are good for your health yet are unstable under regular circumstances. As a result, the encapsulating technique can enhance the compounds' stability as well as the food microcapsule's release of the active ingredient. Microencapsulation offers a pH, light, and temperature barrier. Microcapsules with agricultural produce extract can be used in the food sector to fortify food items, increasing their nutritional content during processing (Sharma, Dash, Badwaik & Bhagya Raj 2023).

Marjoram has a long history of being utilized as a

medicinal herb. Beyond its use as a diuretic, both marjoram itself and marjoram oil have been employed in treating a variety of ailments including cancer, colds, coughs, cramps, depression, ear infections, gastrointestinal issues, headaches, paralysis, arthritis, chest congestion, and muscle aches. (Generalić Mekinić, Skroza, Ljubenković, Katalinić & Šimat 2019).

MATERIAL AND METHODS

Sample collection

Fresh coriander was collected from the Township Market, Lahore. Moreover, the fresh leaves of coriander, moringa, jaman and marwa were collected from the nursery nearby Minhaj University Lahore. The sample were collected 1st June 2023, temperature was 36°C at daytime.

Preparation of aqueous extract

For the preparation of plant leaf extract, about 10 g of selected plants (marwa, moringa and jaman) leaves were taken in 100 mL of distilled water and heated at 60 °C for 15 minutes. After that, the extracts were cooled down and filtered. The resultant extracts of each selected plants were 10%. Furthermore, the filtrates were stored at 4°C for further used.

Preparation of ethanolic extract

To make extract from Marwa, Jaman, and Moringa leaves at 60 °C, 5 g of each chosen plant was boiled in 150 mL of ethanol. Additionally, it were filtered, and the filtrate was stored for later use at 4 °C. After that, for five days, each extract was sprayed daily on the healthy coriander that was purchased (Figure 1).

Experiments

Fresh coriander were initially thoroughly washed with tap water and air dried. After that about nine sets were prepared. Set 1: Control (Sprayed with tap water). Set 2: ethanolic leaf extract of moringa leaves, Set 3: ethanolic leaf extract of marwa leaves, Set 4: ethanolic leaf extract of jaman leaves, Set 5: aqueous extract of moringa leaf, Set 6: aqueous extract of marwa leaves, Set 7: aqueous extract of jaman leaves, Set 8: wrapping with tissue paper and Set 9: wrapping with polythene bags. Each set of treatments were replicated thrice and was completely randomized design. In each sets the relevant extracts were sprayed on the coriander daily one time for five days.

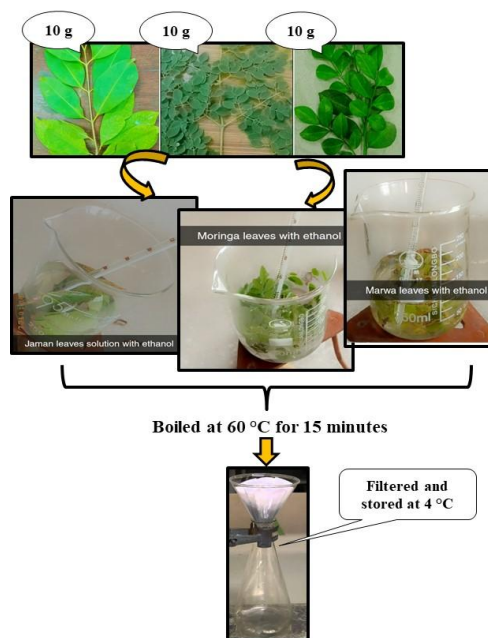


Figure 1. Preparation of plant extracts.

Collection of data

Physiochemical analysis of coriander

A) Weight loss

After seven days of storage, the difference between the coriander's original and final weights was determined in triplicate to represent the entire weight loss that occurred during that time (AOAC, 1994).

B) Sensory analysis

Sample was assessed using a hedonic scale by a panel of five judges based on organoleptic features such as coriander texture, color/appearance, flavor, and taste during various storage times (Raghav and Saini, 2018).

C) Percent decay

The following formula was used to determine the samples' percentage decay:

$$\text{Percent decay (\%)} = 100 - (A - B) / A$$

Where A represents total weight of sample and B represents decayed sample

Statistical analysis

Data was analyzed by using the least significant difference (LSD) by using Statistix 8.1.

RESULTS

Physiochemical analysis of coriander

Weight loss

A) Distilled water

It was found that the foliar spray of distilled water on fresh coriander for five days significantly ($P \leq$

0.05) declined the weight of coriander by 14 to 89% as compared to the weight that was taken at the first day of fresh coriander when bought from the market. Moreover, it was noted that the foliar spray was applied on tissue paper fresh coriander for five days that was significantly ($P \leq 0.05$) reduced the weight of coriander by 11 to 91% as compared to the weight that was taken at the first day of fresh coriander when bought from the market as shown in Table 1.

Shopping bag wrapping

It was shown that the foliar spray was applied on shopping bag wrapping fresh coriander for five days significantly ($P \leq 0.05$) decreased the weight of coriander by 14 to 81% as compared to the weight that was taken at the first day of fresh coriander when bought from the market (Table 1).

B) Moringa aqueous extract

Fresh coriander was shown to benefit from the foliar spray application of Moringa aqueous extract for five days significantly ($P \leq 0.05$) decreased the weight of coriander by 2 to 77% as compared to the weight that was taken at the first day of fresh coriander when bought from the market (Table 1).

C) Moringa ethanolic extract

It was noted that the foliar spray of Moringa ethanolic extract on fresh coriander for five days significantly ($P \leq 0.05$) reduced the weight of coriander by -26 to -100% as compared to the

weight that was taken at the first day of fresh coriander when bought from the market (Table 1).

D) Jaman aqueous extract

It was demonstrated that using fresh coriander with a foliar spray of Jaman aqueous extract for five days significantly ($P \leq 0.05$) increased the weight of coriander by -18 to 71% as compared to the weight that was taken at the first day of fresh coriander when bought from the market (Table 1).

E) Jaman ethanolic extract

It was observed that the foliar spray of Jaman ethanolic extract on fresh coriander for five days significantly ($P \leq 0.05$) increased the weight of coriander by -18 to 57% as compared to the weight that was taken at the first day of fresh coriander when bought from the market (Table 1).

F) Marwa aqueous extract

On fresh coriander, it was observed that the foliar spray of Marwa aqueous extract for five days significantly ($P \leq 0.05$) increased the weight of coriander by 32 to 88% as compared to the weight that was taken at the first day of fresh coriander when bought from the market (Table 1).

I) Marwa ethanolic extract

It was shown that the foliar spray of Marwa ethanolic extract on fresh coriander for five days significantly ($P \leq 0.05$) increased the weight of coriander by 27 to -14% as compared to the weight that was taken at the first day of fresh coriander when bought from the market (Table 1).

Length

A) Distilled water

It was found that the foliar spray of distilled water on fresh coriander for five days significantly ($P \leq 0.05$) declined the length of coriander by 33 to 7% as compared to the length that was taken at the first day of fresh coriander when bought from the market (Table 1).

B) Tissue paper

It was noted that the foliar spray was applied on tissue paper fresh coriander for five days significantly ($P \leq 0.05$) increased the length of coriander by 1 fold as compared to the length that was taken at the first day of fresh coriander when bought from the market (Table 1).

C) Shopping bag wrapping

It was shown that shopping bag wrapping fresh coriander for five days significantly ($P \leq 0.05$)

increased the length of coriander by 1 fold as compared to the length that was taken at the first day of fresh coriander when bought from the market as shown in Table 1.

D) Moringa aqueous extract

On fresh coriander, it was found that the foliar spray of Moringa aqueous extract for five days significantly ($P \leq 0.05$) decreased the length of coriander by 11% as compared to the length that was taken at the first day of fresh coriander when bought from the market (Table 1).

E) Moringa ethanolic extract

It was noted that the foliar spray of Moringa ethanolic extract on fresh coriander for five days significantly ($P \leq 0.05$) reduced the length of coriander by 25% as compared to the length that was taken at the first day of fresh coriander when bought from the market as shown in Table 1.

F) Jaman aqueous extract

It was demonstrated that five days of foliar spraying fresh coriander with Jaman aqueous extract, it was significantly ($P \leq 0.05$) reduced the length of coriander by 25 to 33% as compared to the length that was taken at the first day of fresh coriander when bought from the market (Table 1).

G) Jaman ethanolic extract

It was observed that the foliar spray of Jaman ethanolic extract on fresh coriander for five days significantly ($P \leq 0.05$) increased the length of coriander by 6 folds as compared to the length that was taken at the first day of fresh coriander when bought from the market (Table 1).

H) Marwa aqueous extract

On fresh coriander, it was observed that the foliar spray of Marwa aqueous extract for five days significantly ($P \leq 0.05$) increased the length of coriander by 5 folds as compared to the length that was taken at the first day of fresh coriander when bought from the market (Table 1).

I) Marwa ethanolic extract

It was found that the foliar spray of Marwa ethanolic extract on fresh coriander for five days insignificantly ($P \leq 0.05$) decreased the length of coriander by 7% as compared to the length that was taken at the first day of fresh coriander when bought from the market (Table 1).

Morphological alterations in coriander

It was found that with various foliar sprays of different

extracts were when applied on the fresh coriander exhibited tremendous morphological alterations like wilting, changing color from light green to dark green and dark brown. Loss of turbidity was also observed

Figure 1.

Table 1. Effect of foliar spray with different solutions on the weight and length of fresh coriander. Alphabets a, b, c etc. in superscript are Least Significant Difference (LSD) of three replicates.

Treatments	Weight					Length				
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 1	Day 2	Day 3	Day 4	Day 5
Control	0.37 ^a	0.32 ^b	0.16 ^c	0.06 ^d	0.0 ^e	1.11 ^a	0.74 ^b	1.01 ^a	1.04 ^a	1.11 ^a
Tissue paper rapping	1.3 ^a	1.19 ^b	0.45 ^c	0.29 ^d	0.11 ^e	0.30 ^c	0.48 ^b	0.48 ^a	0.63 ^a	0.59 ^a
Shopping bag rapping	1.5 ^a	1.29 ^b	0.70 ^c	0.46 ^d	0.28 ^e	1.48 ^b	1.85 ^a	1.11 ^c	1.85 ^a	1.85 ^a
Moringa aqueous extract	0.81 ^a	0.84 ^a	0.56 ^b	0.45 ^c	0.19	0.67 ^b	0.74 ^b	0.89 ^a	0.59 ^c	0.59 ^c
Moringa Ethanolic extract	0.11 ^c	0.14 ^b	0.21 ^a	0.16 ^b	0.22 ^a	0.59 ^b	0.74 ^a	0.59 ^b	0.44 ^c	0.44 ^c
Jaman Aqueous extract	1.19 ^b	1.41 ^a	0.98 ^c	0.77 ^d	0.34 ^e	0.89 ^a	0.81 ^a	0.59 ^b	0.67 ^b	0.67 ^b
Jaman Ethanolic extract	0.89 ^{ab}	1.05 ^a	0.77 ^b	0.63 ^c	0.38 ^d	0.37 ^e	0.44 ^d	0.52 ^c	0.59 ^b	0.67 ^a
Marwa Aqueous extract	1.63 ^a	1.10 ^b	0.56 ^c	0.45 ^d	0.19 ^e	0.67 ^c	0.81 ^b	0.96 ^a	0.96 ^a	0.96 ^a
Marwa Ethanolic extract	0.09 ^{ab}	0.05 ^b	0.05 ^c	0.04 ^d	0.03 ^e	0.06 ^a	0.05 ^a	0.06 ^{ab}	0.05 ^{ab}	0.04 ^{ab}

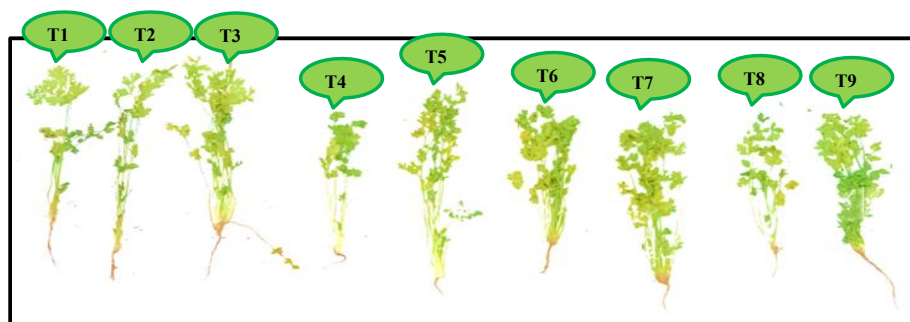


Figure 1. Morphological alterations in coriander after 5th day.

T1: Distilled water	T2: Tissue paper wrapping	T3: Shopping bag wrapping	T4: Moringa aqueous extract	T5: Moringa ethanolic extract	T6: Jaman aqueous extract	T7: Jaman ethanolic extract	T8: Marwa aqueous extract	T9: Marwa ethanolic extract
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Sensory analysis

The observations taken by five panel judges reported tremendous findings of coriander tastes treated with different aqueous and ethanolic extracts (Table 2).

Table 2. Sensory analysis of coriander by using hedonic scale at different aqueous and ethanolic extracts.

Treatments	Distilled water	Tissue paper wrapping	Shopping bag wrapping	Moringa aqueous extract	Moringa ethanolic extract	Jaman aqueous extract	Jaman ethanolic extract	Marwa aqueous extract	Marwa ethanolic extract
9= like extremely	-	-	-	-	-	-	-	-	+
8 = like very much	-	-	-	-	-	-	+	-	-
7= like moderately	-	-	-	-	-	-	-	-	-
6= like slightly	-	-	-	+	-	-	-	-	-
5= neither like nor dislike	-	-	-	-	-	-	-	-	-
4= dislike slightly	-	-	-	-	-	-	-	-	-
3= dislike moderately	-	-	+	-	-	+	-	-	-
2= dislike very much	+	+	-	-	-	-	-	+	-
1=dislike extremely	-	-	-	-	+	-	-	-	-

Comparative analysis by weight loss

The results revealed that the weight loss of coriander after 5th day was minimum by Marwa ethanolic extract. Moreover, the trend of weight loss in coriander was: Marwa ethanolic extract < Jaman ethanolic extract < Jaman aqueous extract < Moringa aqueous extract < Shopping bag wrapping < Marwa aqueous extract < Distilled water < Tissue paper wrapping < Moringa ethanolic extract (Figure 2).

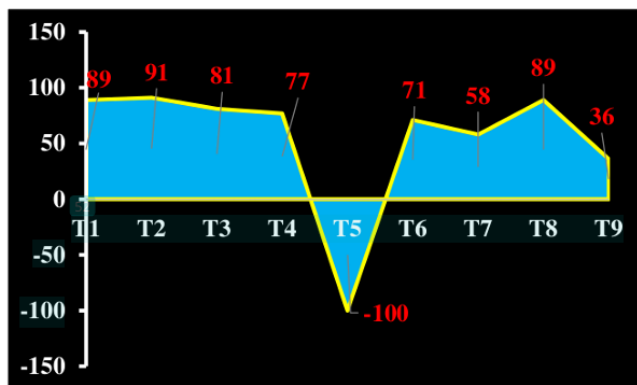


Figure 2. Comparative analysis by weight loss.

DISCUSSION

The plant *Syzygium cumini*, commonly referred to as jamun, is abundant in bioactive substances such as flavonoids and polyphenols that have antibacterial qualities against a range of diseases. These properties could potentially inhibit microbial growth and delay spoilage in fresh coriander. A study by Sarkar et al. (2014) examined the ability of *S. cumini* extracts to fight

foodborne bacteria with antimicrobial activity. The antioxidant capacity of *S. cumini* extracts may contribute to the preservation of fresh coriander by scavenging free radicals and reducing oxidative stress, which can lead to deterioration in quality. A study by Sharma et al. (2012) examined *S. cumini*'s fruit and leaf content as well as each part's antioxidant activity. Research could explore the application of *S. cumini* extracts through different preservation techniques such as dipping, coating, or packaging to assess their efficacy in increasing the shelf life of fresh coriander. Optimization of extraction methods and concentration levels could also enhance their effectiveness.

While specific studies on the use of *S. cumini* extracts for preserving coriander may be scarce, the antimicrobial and antioxidant properties of this plant suggest its potential utility in food preservation. Further research, including experiments tailored to coriander, could provide valuable insights into the feasibility and effectiveness of using *S. cumini* extracts for this purpose. *Origanum majorana* (Marwa) extracts have been studied for their antimicrobial activity against a range of foodborne pathogens. These antimicrobial properties could help reduced the growth of spoilage microorganisms in fresh coriander, thereby extending its shelf life. Research by Sartoratto et al. (2004) examined how well *O. majorana* essential oil inhibited a variety of bacteria and fungi. Marjoram extracts contain phenolic compounds and other antioxidants that can scavenge free radicals and inhibit oxidative reactions, thus preserving the freshness and quality of coriander during

storage. Research has indicated that *O. majorana* extracts has antioxidant properties. For example, research by Baranauskiene et al. (2013) examined marjoram essential oil's antioxidant qualities and their use in food preservation. Exploration of various applications and methods like dipping, spraying, or incorporating marjoram extracts into packaging materials, could provide insights into the most effective way to utilize *O. majorana* extracts for preserving fresh coriander. Optimizing concentration levels and application techniques is crucial to maximizing the efficacy of marjoram extracts in extending shelf life while maintaining quality.

The antibacterial qualities of moringa oleifera extracts against a variety of microorganisms have been studied. These antimicrobial effects could potentially reduced the growth of spoilage microorganisms in fresh coriander, thereby extending its shelf life. For example, a study by Fahey et al. (2019) examined the antibacterial efficacy of leaf extract from *Moringa oleifera* against a range of fungi and bacteria. *M. oleifera* is rich in antioxidants such as phenolic compounds, flavonoids, and vitamins, which can scavenge free radicals and inhibit oxidative reactions. These antioxidant properties could help preserve the freshness and quality of coriander during storage. A study by Ghasemzadeh et al While specific studies on the use of *M. oleifera* extracts for preserving coriander may be limited, the antimicrobial and antioxidant properties of Moringa suggest its potential as a natural preservative for fresh herbs. Further research tailored to coriander preservation could provide valuable data on the feasibility and effectiveness of using *M. oleifera* extracts for this purpose.

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