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Original Article

The Effect of *Cordia Myxa* L. on Storage Quality of *Vitis Vinifera*

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ABSTRACT

Background: Fruits have a limited short life due to chemical changes and microbial damages. This study was conducted to determine the effect of *Cordia myxa* L. on storage quality of *Vitis vinifera*.

Methods: The grape fruits of *V. vinifera* L. were dipped with 1% and 2% of *C. myxa* L. extract (CME). The fruits were then packed in 250 g plastic containers and stored in a refrigerated incubator at ±4°C. The weight loss, acidity, total soluble solids (TSS), and damages were assessed in addition to sensory evaluation that was undertaken during 6 weeks storage period.

Results: A good response was demonstrated by treatment with CME, while dipping with 2% of CME was superior based on less weight loss that happened during storage (0.076), together with an increased acidity and TSS and the lowest percentage of microbial damages when compared to other treatments. A significant positive correlation coefficient (≤0.01) was seen between TSS and acidity and damaged fruits. The correlation was negative between acidity, damage, and TSS and weight. The sensory evaluation revealed a good quality for fruit dipped with 2% of CME.

Conclusion: The importance of immersing grape fruits with CME was demonstrated to extend the storage quality; while the fruits retained their nutritional and sensory values too.

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Introduction

Cordia myxa L. extract (CME) fruit belongs to one of the largest genera in the Boraginaceae family, locally known as Bumber. About three hundred species have been described globally, mostly in the warm region, and they are important because of their therapeutic properties and the possibility to grow in poor soil and adverse climatic conditions. These fruits have antioxidant properties and are considered nutritional goldmines; while most of them have high levels of various phytochemicals such as flavonoids, tannins, phenolic acids, terpenes, xanthones, and saponins which may account for their antioxidant potential (1, 2). Phytochemical screening of CME showed the presence of oil, glycosides, flavonoids, sterols, saponins, terpenoids, alkaloids, phenolic acids, coumarins, tannins, resins, gums, and mucilage. They are also rich in protein, fat, carbohydrates, ash, and essential minerals such as K, Na, Ca, Fe, and Zn. Sweeter fruits usually contain the maximum sucrose, glucose, and fructose along with a high total dietary fiber content that play an important role in reducing the risk of many diseases (3).

The CME is a valuable source of all kinds of secondary metabolites, which are applied as agrochemicals, bio-pesticides, colors, flavors, fragrances, and food additives. It is considered one of the medical plants that play a great role in treating many diseases as anti-diabetic, anti-inflammatory, antimicrobial, antiparasitic, and immunomodulator (4). The pharmacological studies showed that CME has anti-inflammatory, immunomodulatory, analgesic, antimicrobial, antiparasitic, cardiovascular, insecticidal, respiratory, gastrointestinal, and protective effects. It can also be used as a diuretic agent, an antihelminthic, demulcent, astringent, and expectorant agent in treatment of chest and urinary infections and in wound healing (5). This study aimed to highlight the importance of immersing grapes in CME extract and determining the quality of grapes throughout the storage period.

Materials and Methods

C. myxa powder was prepared and washed using tap water followed washing with by deionized water. It was later shade-dried and ground into fine powder using an electric grinder (Silver-Crest type blender, Germany). The prepared grape sample was soaked in three concentrations of the CME (0%, 1% and 2%) and was further kept in a plastic container and stored at ±4°C for six weeks starting from 5/10/2024. The percentage of weight loss was measured via the changes in fresh weight of fruits during storage according to the following equation 1:

A total of 5 g of soft fruit was mashed in 50 mL of distilled water and mixed by a blender for 5 minutes. Then it was filtered by a paper filtrate and 10 mL of the filtrate was neutralized with 0.1 N (NaOH) phenolphthalein indicator until reaching an equilibrium point (6). The results were calculated using the equation of *Total acidity (%)=(NaOH×0.1×0.064)/(weight sample)×100* that was calculated based on added citric acid (7) . Regarding percentage of total soluble solids of TSS, it was estimated according to the previous report (7) using a hand refractometer (2WAJ-China made) by placing a drop of grapes juice on the scale surface indicator and then correcting the reading at a temperature of 20°C by utilizing special tables as mentioned before (6). Regarding percentage of damaged fruits, the damaged fruits during storage were weighed and calculated applying the following equation 2:

The sensory evaluation was conducted by ten subjects; while the fruit samples were provided for them at the end of storage period (4 weeks). A questionnaire was distributed among them and was completed which included taste, flavor, color, and external appearance of fruits (Table 1). The experiment was carried out as a factorial experiment according to Complete Randomize Design (CRD), with 3 replicates, while two factors were included. The first factor consisted three concentrations of CME dipping (0%, 1% and 2%), and the second factor was the storage period. The results were statistically analyzed using the statistical program SPPS (Verion 20, Chicago, IL, USA). The mean was compared using the least significant difference (LSD) test at significancy level of ≤0.01 (8).

Results

Figure 1a shows the changes in CME weight during the storage period. The lowest percentage of weight loss was 0.076 in the treatment of *V. vinifera* with 2% CME, while the treatment with 1% CME resulted in a weight loss of 0.3; whille the control treatment recorded the highest weight loss of 0.738. The statistical analysis at the level of significancy of ≤0.01 showed that the treatment of 2% CME was significantly superior over the rest of treatments. As indicated in Figure 1, weight loss of *V. vinifera* during storage period demonstrated a gross trend of deterioration, where the application of various concentrations of CME treatment was effective in stemming of weight loss when compared to the control group. The 2% CME illustrated the largest difference (0.076%) over the 1% CME treatment (0.3%) and the control (0.738%). Thus, 2% CME concentration was optimal in decreasing the weight loss in *V. vinifera*.

The percent of total acidity in *V. vinifera* against three treatments, which included control, 1%, and 2% of CME for a six-week storage period was displayed in Figure 1b.

$$weight\ loss(\%) = \frac{Sample\ weight\ before\ storage - Sample\ weight\ after\ storage}{Sample\ weight\ before\ storage} \times 100. \quad \text{Equation 1}$$

$$Damage\ fruits\ (\%) = \frac{weight\ of\ damaged\ fruits\ per\ package}{Total\ fruit\ weight\ per\ package} \times 100 \quad \text{Equation 2}$$

Table 1: Sensory evaluation for *V. vinifera* observed in samples of control and 1% and 2% *C. myxa* L. extract (CME) during storage period.

Concentration	1st day	1st week	2nd week	3rd week	4th week	5th week	6th week
Control	Excellent	Good	Good	Bad	Bad	Damaged	Damaged
1% CME	Excellent	Very good	Good	Good	Good	Good	Good
2% CME	Excellent	Excellent	Very good	Very good	Very good	Very good	Very good

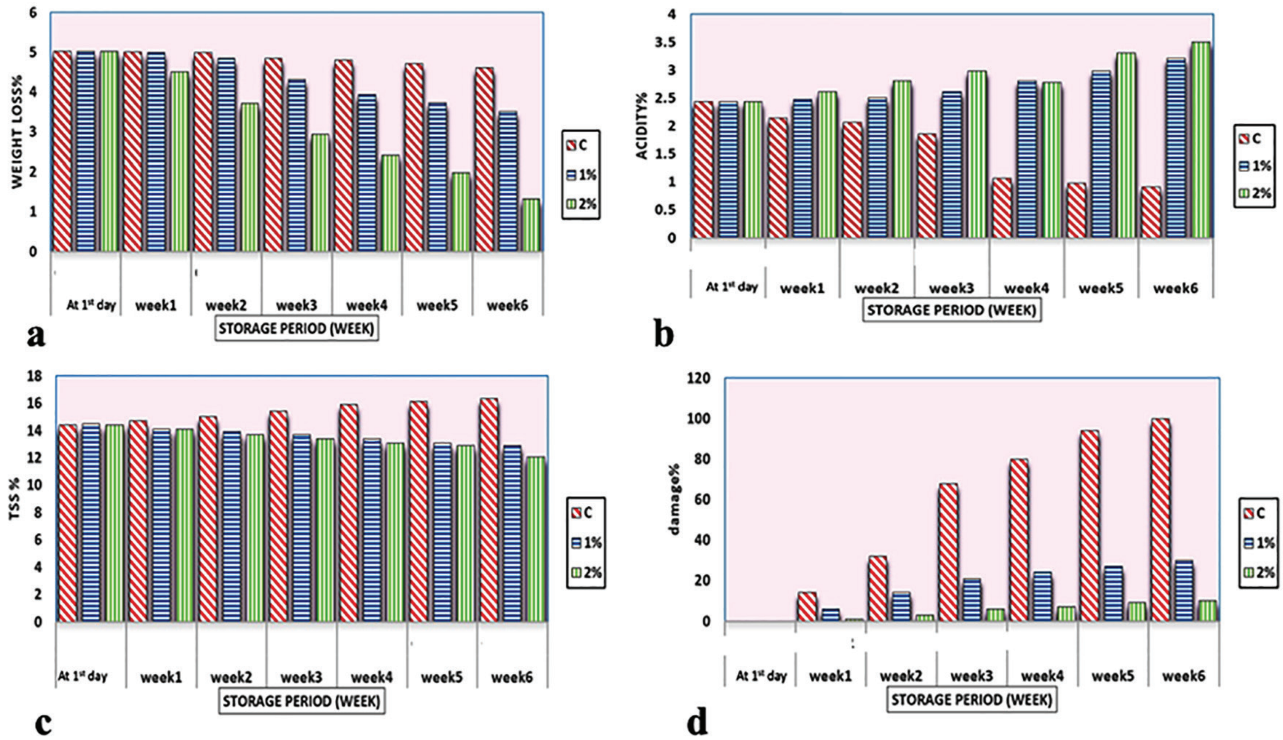

Figure 1: Changes in (a) weight loss, (b) total acidity, (c) TSS and (d) percentage of microbial damage for V. vinifera during the storage period.

On the first day of storage, total acidity was almost identical in all groups. Despite an increase in storage period, a high acidity rate was visible in both the 1% and 2% treatments of CME as compared to the control group. In the sixth week, the acidity that was recorded from the 2% CME treatment was the highest, followed by the 1% CME treatment, while the least was recorded in the control group. The observed trend depicts that 1% and 2% treatments of CME could preserve the acidity during the storage period.

Figure 1c shows the TSS% variations in *V. vinifera* during the six weeks storage period in the control group and under treatments of 1% and 2% of CME, respectively. All fruits treated with any chemicals maintained a lower TSS when compared to their respective controls, while out of the two treatments, 2% CME grapes consistently remained at the minimum value throughout the storage period. The statistical analysis showed significant reduction of grape damage between samples that were treated with 1% and 2% of CME when compared to the control group. The grapes that were dipped in 2% CME kept a high weight and less percentage of damage especially for microbial damage as showen in Figure 1d.

As Figure 2 shows, a highly positive significant correlation (p≤0.01) is observed between the acidity and the fruit damages and also a positive correlation between TSS (0.73) and the weight loss, and the fruit damages (0.74, 1.0, respectively). There was a significant positive correlation between the damages and the weight loss (0.25). On the other hand, the correlation was significantly negative between the acidity whth the damages, TSS and the weight loss in a ratio ranging from -81 to -65.

The Table 1 and Figure 3a and 3b show the fruits dipped in CME at the first day and the end of storage period, respectively. The results of sensory evaluation revealed that the grape fruit in the control sample was quichly damaged, while the fruit immersed in 1% and 2% of CME had good sensory evaluations. In the first week, the 1% CME was very good, 2% was excellent, and the control sample was satisfactory. In the second week, the control samples showed a progressive damage to the sensory qualities; while the fruits in 1% CME were good and in the 2% CME were very good. In the fifth week, the sensory

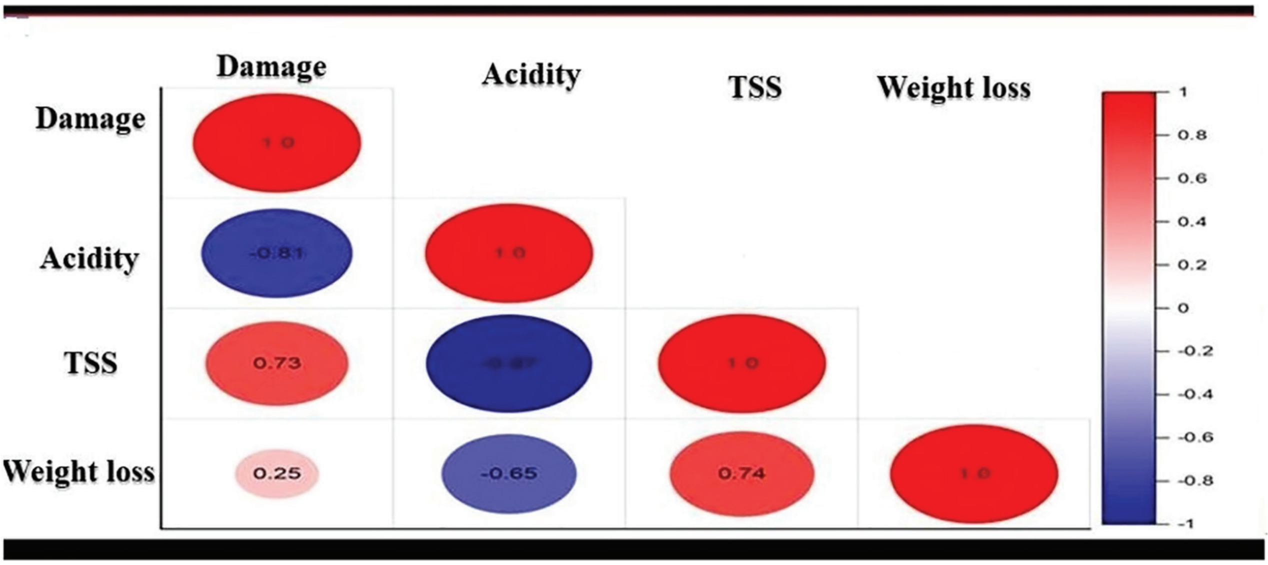

Figure 2: Coefficient correlation between studied characteristics for weight loss, TSS, acidity and damage.

Figure 3: *V. vinifera* quality during the storage period for control (Con) sample and 1% and 2% *C. myxa* L. extract (CME) at the 1st day and 6th week.

evaluation of the 1% and 2% CME samples was good and very good, respectively, but the control sample was completely damaged. The sensory evaluation in the end of storage period for fruits in 1% CME was satisfactory and in 2% CME was very good.

Discussion

The weight loss in fruits treated with CME showed less percentage of weight loss due to the formation of an insulating layer on the surface of the fruits, which could reduce the water evaporation and consequently the rate of respiration of the fruits by maintaining water content inside and not losing the weigh. The excellent performance of 2% CME can potentially be due to its ability to create barrier layers on the fruit surface that reduced water loss and respiration rate and could better maintain water contents (9, 10). CME can provide an insulative layer, which acts to shield the defenders from internal humidity, temperature fluctuations, and some of the major known factors that can affect weight loss during the storage. This is in line with a former research that focused on edible coatings as important components in keeping postharvest quality and shelf life (11).

The higher acidity in treated samples points to the stability of organic acids that maintain the fruit quality. Other works in literature have demonstrated that the coating or specific solution treatments can retard the metabolic rate and maintain the organic acid contents in the fruit (12, 13). The reduction of TSS in treated fruits indicates an inhibition in metabolic activity and growth of microorganisms brought about by CME coatings. Regarding the preservative role of TSS in fruits, the above results strongly supported the hypothesis that CME coating can reduce the rate of respiration and enzymatic activities which are responsible for the breakdown of sugars within fruits. This would also support the fact that 2% CME treatment retains more quality when compared to 1% CME treatment. The abovementioned findings are in agreement with those a previous study that reported natural coatings play a role in maintaining the quality of fruits through delayed physiological and biochemical changes (14).

The inhibition growth of bacteria and fungi in the CME treated samples can potentially decease gas permeability and prevent the enzyme attack generated by the pathogens responsible for the breakdown of cell wall components. This observation supports earlier works on the importance of natural active antimicrobial agents in the postharvest preservation of fruits (15). The most economically famous postharvest disease of grapes is grey mold caused by fungus *Botrytis cinerea* that can survive under low temperature of -0.5°C. If fruits are not properly treated after harvest or during storage, an infection can occur and result in creation of infection nests as white surface mycelia. Other pathogenes like *Aspergillus spp.* and *Rhizopus stolonifer* can cause microbial infection of *Alternarea spp.* and *Penicillium expansum* during a prolonged storage period (16-22).

The fruits dipped in 2% CME during storage period were shown to retain their shape based on their water content and not being dried. In addition, the color remained as a bright green color, possibly due to a low respiratory rate, low evaporation of water and maintaining a balanced atmosphere (10). CME acts as a semi-permeable barrier coating and thus prevents fruit discoloration and delay ripening and aging (10). In control samples and in 1% concentration of CME, the color of the fruits gradually changed during storage into brown color at the end of the storage period that may be due to the presence of active enzymes such as polyphenol, which acts to oxidize polyphenols into quinone and then pass through a series of reactions and leads to the appearance of brown color based on the presence of melanin pigment (11).

Conclusion

Immersing grape in CME to maintain the storage quality is important as grape retain the nutritional and sensory values in addition to maintaining a long-life of storage. Further studies can be conducted on the mechanism of CME coatings and their scalability for commercial applications. Therefore, more researches should be conducted to improve the storage of fruits and other food products by using CME and to extend the shelf life of storage and to protect it from damage and developing new products with nutritional value and health benefits.

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Finding

No fund receive for this study.

Authors' Contribution

Hamza designed the study and significantly contributed with Sara to gathering the samples. Muntaha contributed data analysis. Ahmed prepared the first version of the manuscript. Sayed Hadi reviewed the article and Zainab participated in writing and editing of the final version.

Conflict of Intrest

None declared.

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