EFFECTIVENESS OF ALOE VERA COATING GEL ON SHELF LIFE OF GRAPES

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ABSTRACT

The goal of the current study was to determine how long grapes with aloe vera coverings suspended in water at concentrations of 0, 10, and 30% would last while stored in poly bags and open plates at varying temperatures between 0°C and 30°C in a refrigerator and incubator. The effectiveness of the Aloe Vera coating was evaluated using the data and the grapes' original shelf life. Aloe Vera-based coatings produced good gloss, and coating concentrations of 20% produced the best physicochemical and visual outcomes. The most efficient and suitable Aloe Vera coating concentration for extending the shelf life of grapes was discovered to be 20%. Additionally, it was discovered that using edible coating and packaging along with low temperature storage increases marketability by limiting moisture loss. In other words, employing an Aloe Vera gel coating can extend the shelf life of grapes and lessen fruit rotting brought on by fungus.

KEYWORDS:

Grapes, shelf life, Aloe Vera, coating, storage, safety of foods

INTRODUCTION

Grapes belonging to Family Vitaceae (Crisosto *et al.*, 1994; Davood *et al.*, 2013). Due to favorable climatic circumstances, grapes are mostly produced in Pakistan in the Baluchistan province's Quetta and Qalat divisions on an area of 8.4 thousand hectares with a yield of 72,800 metric tons. With a total area of 133 hectares and 1,359 tons of output, Khyber Pakhtunkhwa. FATA's area and production are 80 hectares with 1,097 tons of output, whereas KHYBER PAKHTUNKHWA's settled area is 53 hectares with 262 tons of production. Grapevines are produced on a 46-hectare area with a 241-ton annual production in the Malakand division (Anwar, 1999).

Grapes are non-climacteric, very perishable fruits having a short shelf life because they lose weight, rot, and lose nutrients as they age. Pre-harvest and post-harvest grape degradation can occur for a variety of reasons, including physical, physiological, or pathological ones. Grapes' physical degeneration occurs mostly as a result of rachis dehydration either before or after harvest (Crisosto *et al.,* 1994; Davood *et al.,* 2013). Another major physiological issue with mature table grape cultivars is the browning of grape skin (Valuerde *et al.,* 2005). Fungal infections are a major factor in grape deterioration because they reduce fruit output. Spray fungicides to prevent decay of grapes, but because of the health risks associated with their use, which have grown prohibitive, there is a need for natural alternatives. One such alternative is the application of plant essential oils, which is more successful at preventing table grape rot (Martinez-Romero *et al.,* 2007).

Aloe vera is a tropical and subtropical plant with medicinal qualities that has been used for centuries. The parenchymatous cells that make up the gel found in aloe vera leaves are colourless and mucilaginous. Aloe vera gel is increasingly being used in the culinary business as a source for drinks, beverages, and ice creams (Eshun and He, 2004). Aloe vera, a succulent plant with extremely short stems and no leaves, is a member of the Liliaceae family (Ni *et al.,* 2004). The gel juice has been used medically to treat skin conditions, constipation, radiation harm, gastrointestinal, kidney, and cardiovascular issues, as well as to lower blood triglyceride and cholesterol levels. Recent studies have revealed additional beneficial properties of aloe vera, including its ability to treat some diseases like AIDS, cancer, allergies, and diabetes by acting as an anti-inflammatory and antibiotic (Elsion and Hayes, 1985). In the cosmetics sector, aloe vera gel is also used for wound healing, the treatment of burns, and scarring (Aburjai and Natsheh, 2003).

Botrytis cinerea, the primary cause of grape fruit deterioration, has been reported to be resistant to the antifungal action of aloe vera gel (Jasso *et al.,* 2005). Due to their semi-permeable barrier to gases and water vapour, edible coatings modify the atmosphere around the fruit, and because of their environmental friendliness, their application presents a desirable alternative to film packaging. Since ancient times, they have been employed to delay dehydration, stifle respiration, improve textural quality to retain volatile taste compounds, and inhibit microbiological growth in order to preserve perishable food products (Debeaufort et al., 1998). Natural antimicrobial preservatives, antimicrobial films, and fungicide application can be lowered as a result of rising customer demand for food without chemical preservatives.

Fruit preservation is crucial to preventing fruit deterioration, as between 25 and 80 percent of freshly harvested fruits are lost to rot (Quezada-Gallo *et al.,* 1998). A cutting-edge edible covering for organic fruit storage is aloe vera gel. Aloe vera gel coating has been shown to increase shelf life by preventing fruits and vegetables from losing quality after harvest. There are edible surface coatings for vegetables and fruits made of natural preservatives, such as waxes, however these coatings frequently include chemicals like polyethylene, carnauba, and candelilla (Alleynev *et al.*, 200).

Water, amino acids, vitamins, lipids, sterols, tannins, and enzymes make up the aloe gel (Salunkhe *et al.*, 1991). It has antibacterial, antiviral, and antifungal characteristics; it also contains phenol, saponin, and anthraquinones components. Against gramme positive and gramme negative infections, aloe vera has demonstrated antibacterial properties (Adetunji, 2008). Food oxidation and spoiling are caused by the fungi Aspergillus, Fusarium, and Penicillium (Atterholt *et al.*, 1998). The current study was conducted to ascertain the impact of an Aloe Vera coating gel on the shelf life of grapes, taking into account the fruit's relevance to both the economy and diet.

MATERIALS AND METHODS

Study area

The present study was conducted in the Food Science and technology Section, ARI, Peshawar. From the chemical store, chlorine was taken to pre-treat and clean grapes. After coating, grapes were stored in a BOD automated incubator and a refrigerator. The incubator has a temperature range of 50 C to 500 C and a sensitivity range of up to 0.50 C. The refrigerator has a temperature range of 40 to 180 C. The Aloe Vera and water were thoroughly combined using a magnetic stirrer. For pH estimation, a digital pocket pH test meter was employed.

Sample

Fresh healthy grapes were purchased from the fruit market, Peshawar.

Grapes surface preparation

The main goal of surface preparation was to make a sound, clean substrate that was suited for strong bonding by eliminating all contaminants that would impair proper coating adhesion. To blanch the grapes, they were washed with chlorine.

Aloe Vera coating preparation

The Main Market is where the aloe vera was purchased. The pH was kept at 4 by adding ascorbic acid (1.9–2.0g, L-1) and citric acid (4.5–4.6g, L-1) after the aloe vera had been cooked at 700C for stabilization. To stop the solution from oxidizing, it was stored in the dark.

Coating application

Following a thorough cleaning, the grapes were separated into 16 groups (100gm 1gm) and air dried. These groups corresponded to 4 coating treatments (0% control), 10%, 20%, and 30%. The grapes were then dipped in the gel for 5 minutes and allowed to dry for 30 minutes before being air dried again. Four of the eight groups were stored in poly bags and four were kept on open plates in a refrigerator set to 40 C. The remaining 8 groups were kept in an incubator at 300 C, 4 of which were packed in polyethylene, and 4 of which were kept on open plates. Physical measurements were made three times per week.

Assessment of grape quality

A 4-person panel visually inspected groups of each treatment to rate the rachis look, the frequency of cracked and broken berries, deterioration, browning, and acceptability. The visual qualities were graded in broad daylight. So, at the conclusion of storage, the quality of the grapes was evaluated by looking at the fruit, the frequency of cracked, brown, and shattered berries, berry colour, and weight loss.

pH Assessment

Berry extraction was used to make fruit juice, which was then filtered through cheesecloth to measure the pH. Using a digital pocket pH meter, pH was measured. On the first day and following each of the various sampling days, the readings were taken in duplicate.

Assessment of weight loss

Weights of individual groups were recorded on the first day and after the different sampling dates. Weight losses were expressed by the following relationship:

Weight loss(g/100g) = {(WWf)/W} X 100 Where W - initial weight Wf – final weight

Color analysis

A color examination of the grapes was conducted to ascertain the effects of treatment and storage duration on colour change. First, a DSLR camera was used to take a picture while it was fluorescently lit. The image was then examined using image analysis software (such as Adobe® Photoshop TM) to calculate the luminance (L*) value, parameter "a*" defined along the red-green axis, and parameter "b*" defined along the yellow-blue axis. The net colour difference (ΔE) was calculated using the relation:

ΔE= "√(L*L*)2 + (a*a*)2 + (b*b*)2}

RESULTS AND DISCUSSION

Qualitative Features of Fruit Gloss Coated Grapes

Any new coating recipe must satisfy the demand for high gloss in order to be of economic worth. The packaging group stored in incubation at 300 C was unmarketable with a significant incidence of decay and hastened quality deterioration, according to visualization of all groups of grapes after 21 days of storage. The anticipated shelf life sampling schedule was therefore halted at this time. The visual characteristics of the remaining 12 groups, however, were deemed to be satisfactory and were kept for further research. After 21 days of storage at 300 C in an incubator, the unpackaged groups lost a significant amount of moisture before completely losing it after 35 days.

Grapes' shine diminished after 7–14 days of storage at 250–300 C under commercial storage conditions (Valuerde *et al.*, 2005). As storage time extended, disparities in fruit gloss and coatings under various settings also diminished significantly. These findings are most likely the result of variations in temperature and humidity, which undoubtedly had an impact on the crystalline structure and light reflectivity of the fruit surface.

In contrast to the findings earlier reported by Valverde et al. 2005 who studied a novel edible coating based on Aloe vera gel to maintain the quality and safety of Crimson Seedless table grapes during cold storage and subsequent shelf life, Aloe vera-based coatings also provided good gloss, and coating with 20% concentration gave the best visual and physicochemical results. Aloe vera gel regulated respiratory exchange and stopped moisture loss. With control grapes, losses of more than 50% were found after 21 days of cold storage + 4 days at 20°C, whereas it greatly decreased firmness losses during cold storage and subsequent shelf life.

Surprisingly, coatings with 30% aloe vera concentration did not give grapes a higher gloss than coatings with 20% aloe vera concentration. This could be because coating formulations tend to be translucent, which could be enhanced by adding more lipids, making the coating appear less glossy.

Grapes weight loss

Grapes covered with different coating concentrations lost weight in a noticeable way. The effect of coating concentration on coated grape weight loss is depicted in the figure. With time, the uncoated grapes lost more weight than the coated ones.

By the conclusion of the 35th day, the grapes that were held at 40 C in poly bags without coating had significantly lost weight. After 21 days, the grapes that were kept at 300 C in an incubator with poly packaging began to brown and degrade as a result of microbial invasions. They were removed from the experiment as a result.

The contrary was true for grapes stored at 300 C, when openly stored grapes displayed more life than grapes in poly packing. The grapes held at 40 C without packaging exhibited more moisture content loss than those with poly packaging.

Effectiveness also depends on how things are stored. The coating with a 20% concentration had the least moisture loss across all concentrations, packaging conditions, and temperature variations, it was determined after examining all coating concentrations with moisture loss. The openly stored grapes in the incubator at 300 C lost the most moisture for the entire storage time, while the wrapped grapes at 40 C lost the least moisture under all circumstances. Therefore, a coating concentration of 20% was the most effective treatment for creating a moisture barrier for longterm preservation. These findings imply that using edible coating and packaging along with low temperature storage increases marketability by minimizing moisture loss.

Grapes pH

Graphs depicting the pH of the grape juice during storage indicate that it gradually increased. The groups that had packaging and were kept in incubators at 300 C exhibited acidic behaviour from the 14th to the 21st day. This resulted from the grapes' browning, decomposition, and microbial attack brought on by packaging and high temperature. The final pH for uncoated grapes at 300°C and in an unpackaged state was 6.96, which was caused by the fact that they completely lost all of their moisture over the course of storage. Grapes that were packaged and stored at 40 C produced the lowest pH. Except for the 20% coating, there was not much of a variation in the pH of the various coating concentrations. No discernible distinction could be seen between the two treatments (10.0% and 30.0%). It was discovered that coated grapes had higher value at the end of storage; this was because aloe vera coatings on the fruit's surface caused a semi-permeability that may have altered the internal atmosphere, or endogenous O2 and CO2 concentrations in the fruit, and therefore delayed ripening.

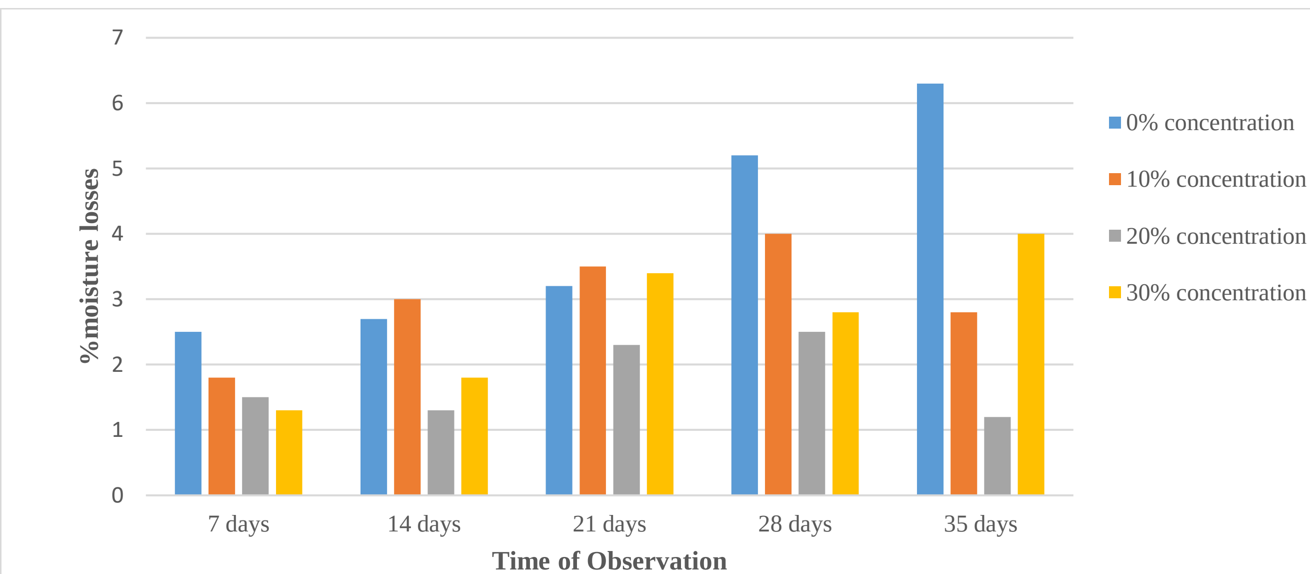

Figure 1: Association between moisture % losses and time of storage of packaged grapes at 4° C

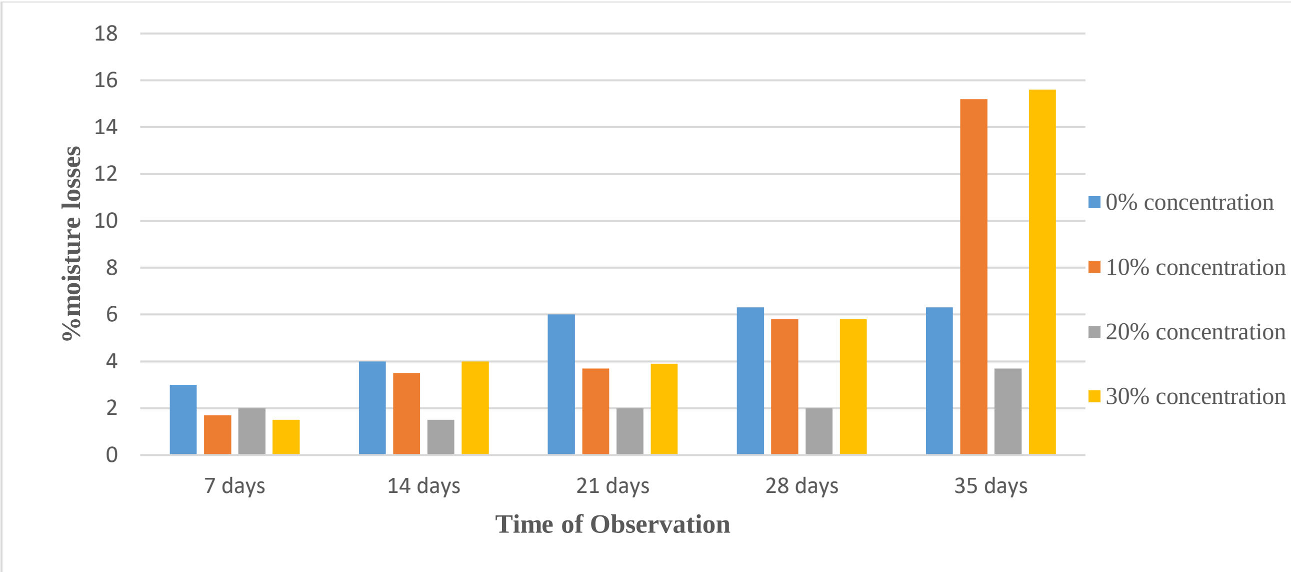

Figure 2: Association between moisture % losses and time of storage of unpackaged grapes at 4° C

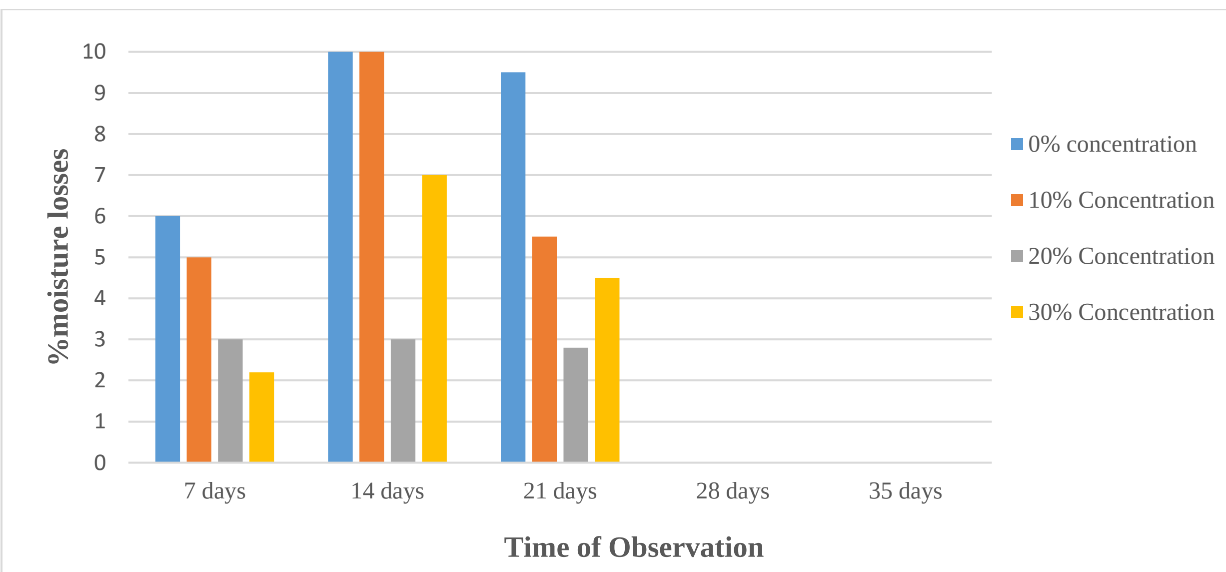

Figure 3: Association between moisture % losses and time of storage of packaged grapes at 30° C

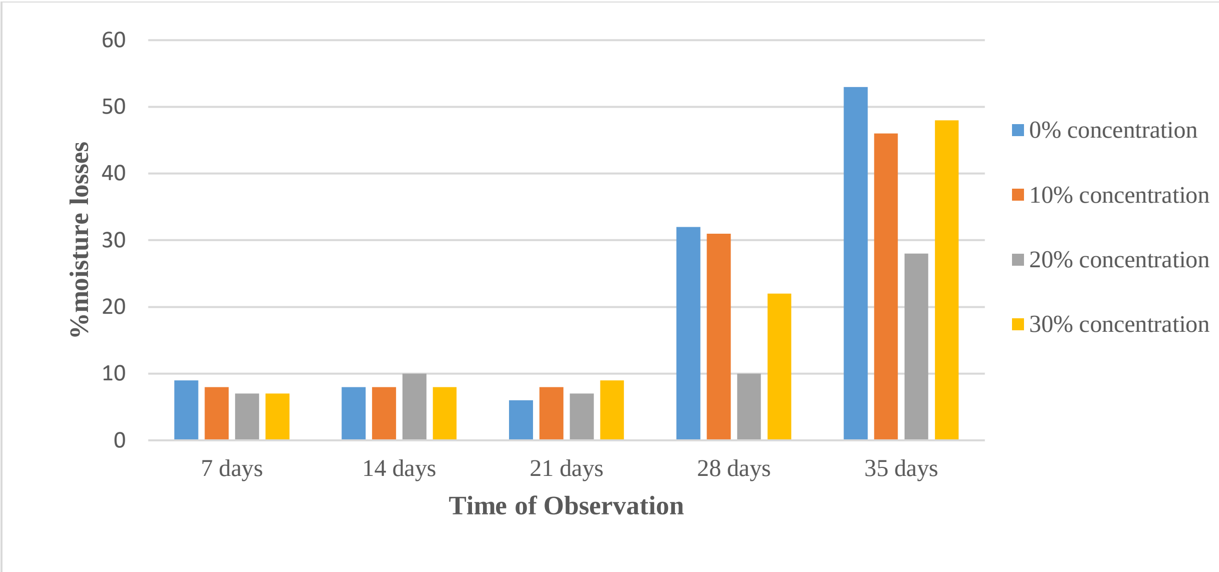

Figure 4: Association between moisture % losses and time of storage of packaged grapes at 30° C

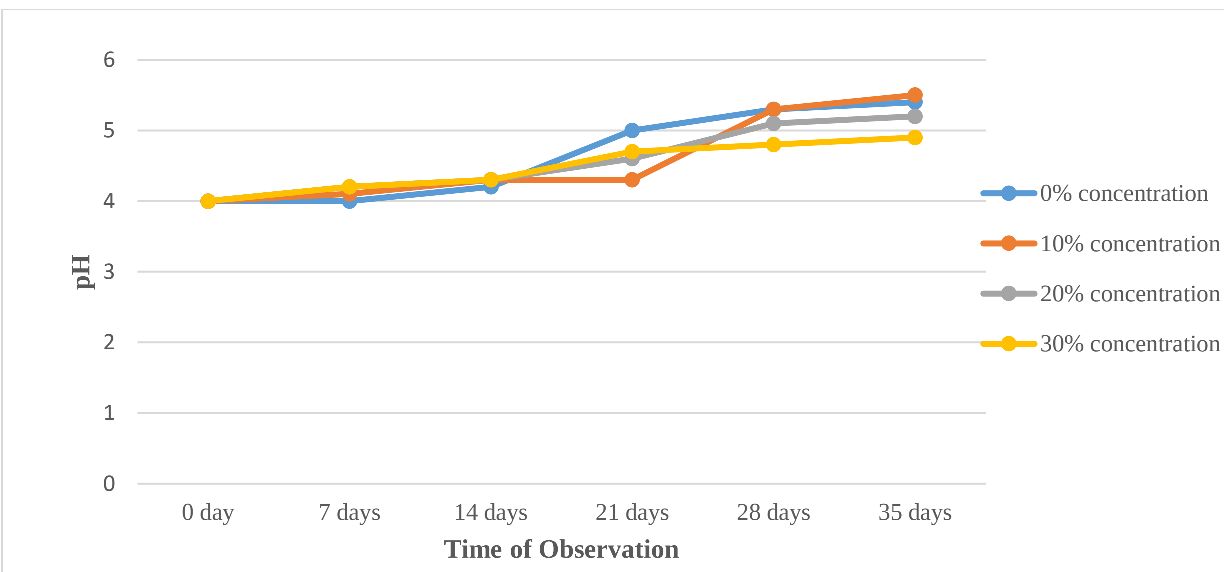

Figure 5: Association between pH and time of storage of packaged grapes at 4° C

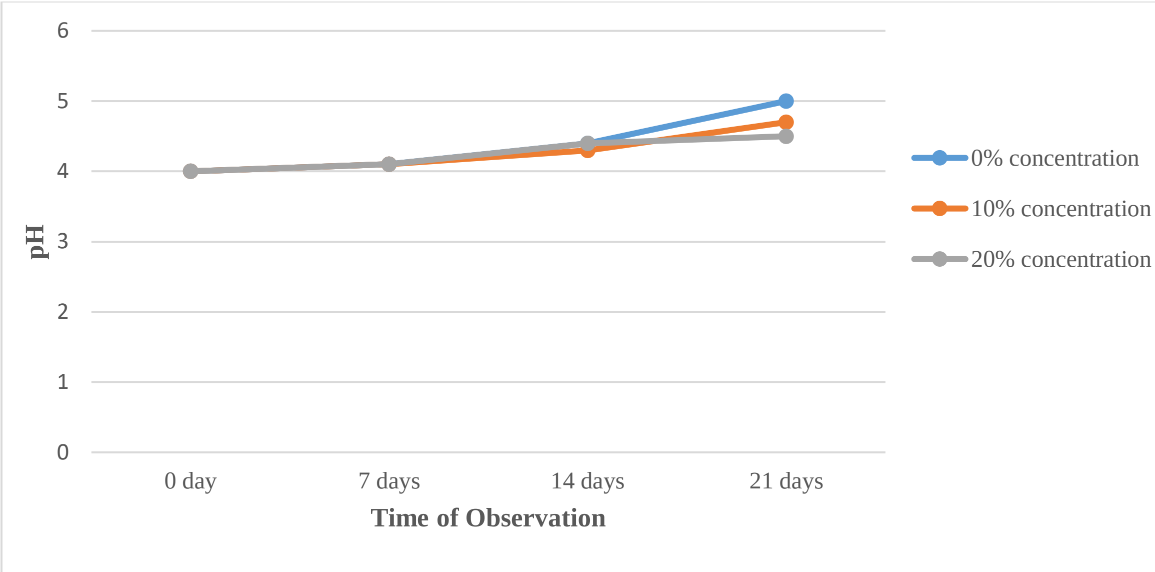

Figure 6: Association between pH and time of storage of unpackaged grapes at 4° C

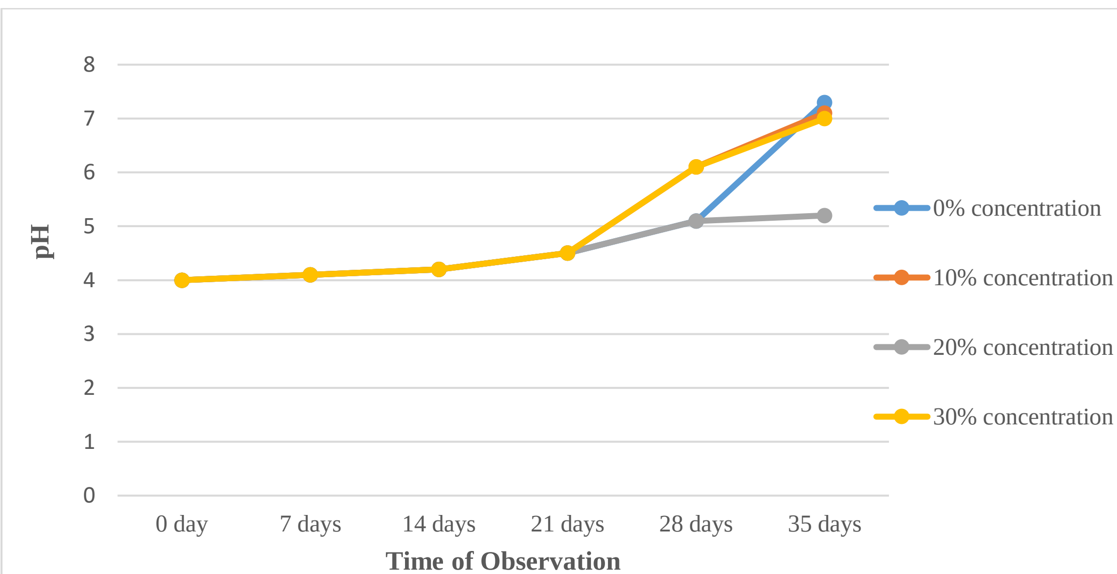

Figure 7: Association between pH and time of storage of packaged grapes at 30° C

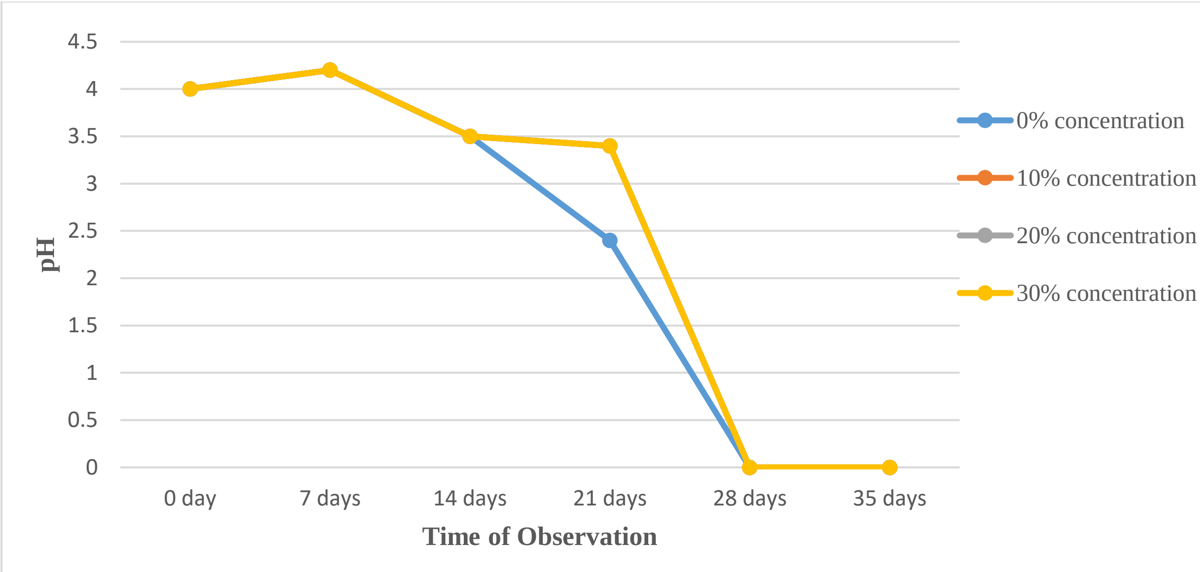

Figure 8: Association between pH and time of storage of unpackaged grapes at 30° C

CONCLUSIONS

Aloe Vera gel was applied to grapes and suspended in water at concentrations of 0, 10, 20, and 30%. The grapes were then stored in poly bags and open plates at varying temperatures between 0°C and 300°C in the refrigerator and incubator. Grape weights were initially measured and divided into 16 groups of 100 1gm. The readings were taken after the grapes had been preserved for 35 days. During the storage period, fruit gloss, decomposition, rachis browning, weight loss, and pH were assessed. Weight loss, fruit gloss, colour, and pH all changed depending on coating concentrations, temperature, and packaging. With higher coating concentrations, the weight losses of coated grapes have decreased. On the other hand, a 30% coating concentration resulted in more weight loss. The least amount of moisture was lost at a 20% coating concentration across all measured parameters. The grapes' decrease of moisture content caused weight loss over time. Less moisture was lost from the coated grapes because the coating created a barrier on the surface. It's possible that moisture escaped from the grapes due to a lack of coating integrity and uniformity. Normally, rachis browning, enzymatic changes, and water loss cause grapes to turn brown with time. It was proposed that edible coating would assist preserve firmness by locking in moisture. These coatings are better suited for extending shelf life because to their greater 20% coating concentration. The sample was kept in storage using open plates and poly packing at various temperatures. It was determined that poly packing can extend shelf life by 1-2 weeks under 300C storage settings and up to 2-3 weeks at the same temperature under open conditions. The poly wrapping turned the grapes dark, acidic, and enhanced microbial activity in an incubator at 300C. Grapes placed in plastic bags and kept in a refrigerator at 40°C had a shelf-life extension of 35 days, whereas those kept in open plates beneath the refrigerator had a 3– 4-week shelf life.

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