Effects of plant natural substances as an edible coating on physio-chemical properties changes in tomato (*Solanum lycopersicum* L.) fruits during room temperature storage

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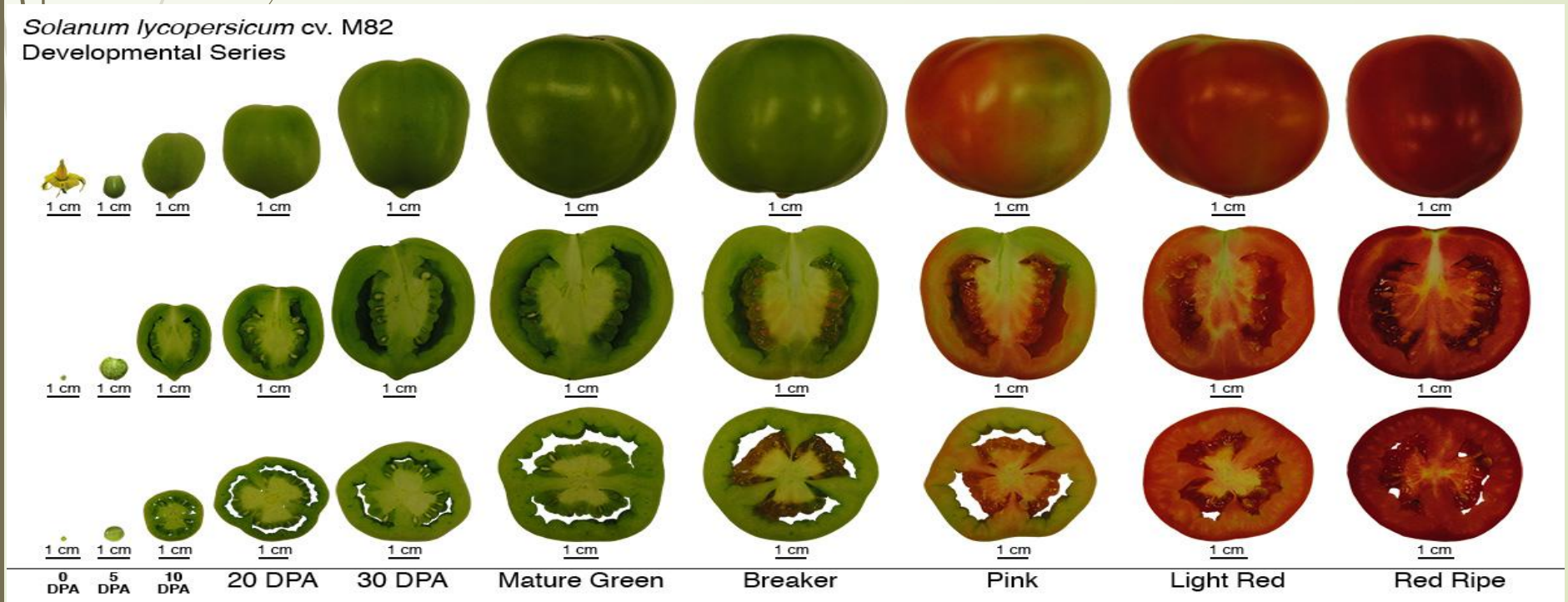
1. Introduction

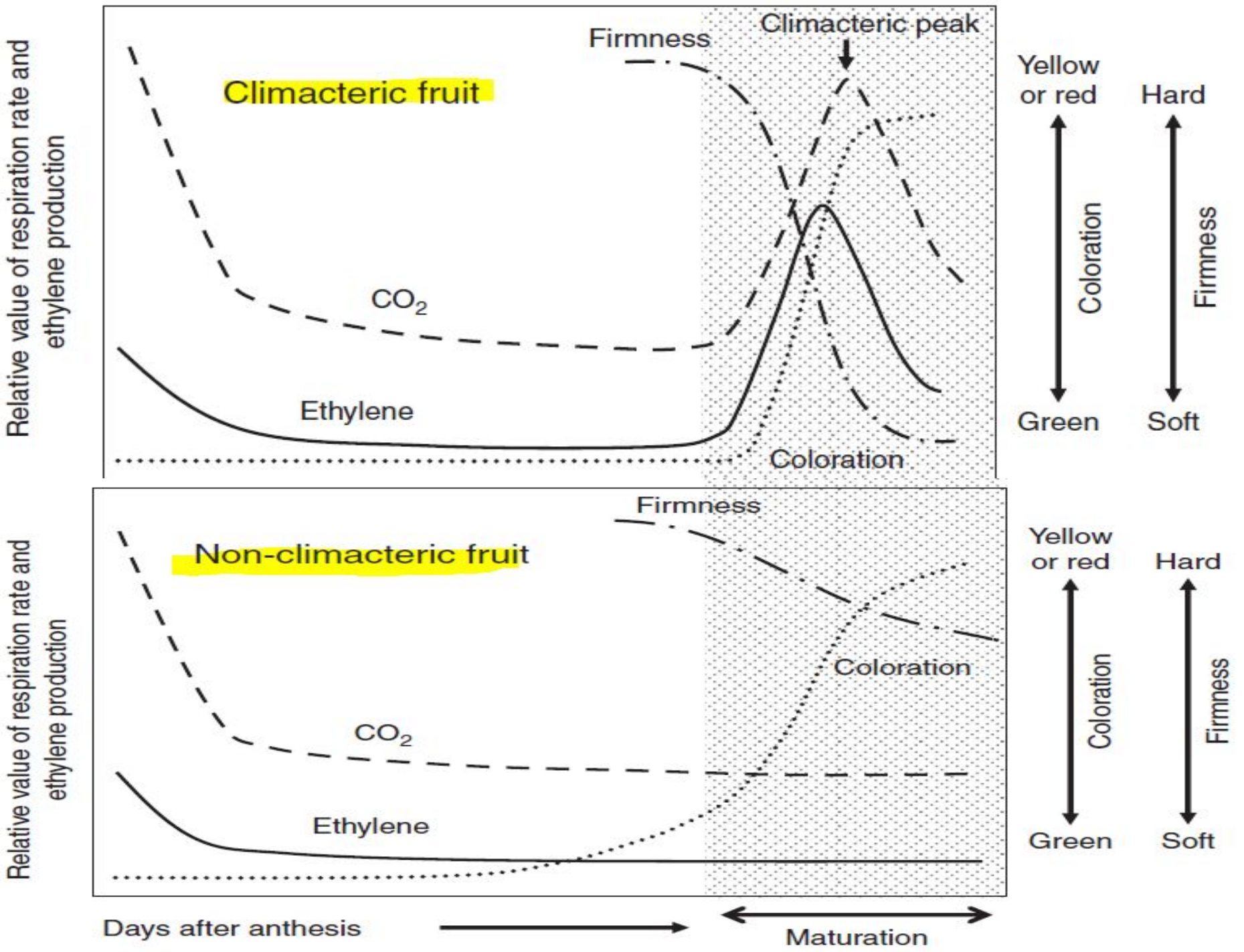
- **Tomato (*Solanum lycopersicum* L.) is ranked in the top three crops cultivated in palestine with annual yield of 220 thousand tons cultivated in around 17 thousand dunums (FAOstat, 2017).**

- **Tomatoes classified as a climacteric fruits and have a short shelf-life usually 5 - 7 days.**

What is a climacteric fruit ?

- it is a fruit harvested at full maturity and can be ripened off the parent plant.
- The respiration rate and ethylene formation though minimal at maturity, raise dramatically to a climacteric peak, at the onset of ripening, after which it declines




Climacteric fruit
Firmness
Climacteric peak
CO_2
Ethylene
Coloration
Relative value of respiration rate and ethylene production
Yellow or red
Green
Coloration
Hard
Soft
Firmness
Non-climacteric fruit
Firmness
Coloration
CO_2
Ethylene
Relative value of respiration rate and ethylene production
Yellow or red
Green
Coloration
Hard
Soft
Firmness
Days after anthesis
Maturation

Post-harvest losses

- Losses in quantity and quality occur between harvest and consumption.
- losses occur due to immaturity, over-ripening, mechanical damage, and decay .
- These losses can be attributed to poor harvesting method, rough handling, improper packaging and poor transport conditions..

Plastic boxes and rough handling

Similar transportation conditions

post-harvest implementations:

- The increasing demand for fresh fruits and vegetables forces the food industry to develop new and better methods for maintaining food quality and extending shelf life .

- **Plastic boxes and careful handling**

- **Precooling**

- **cold transportation**

Coating technique

- A growing interest in natural edible coatings increased due to many factors such as health and environmental concerns of synthetic ones .

- the purpose is to extend the shelf life of the food products and provide a barrier against hazards.

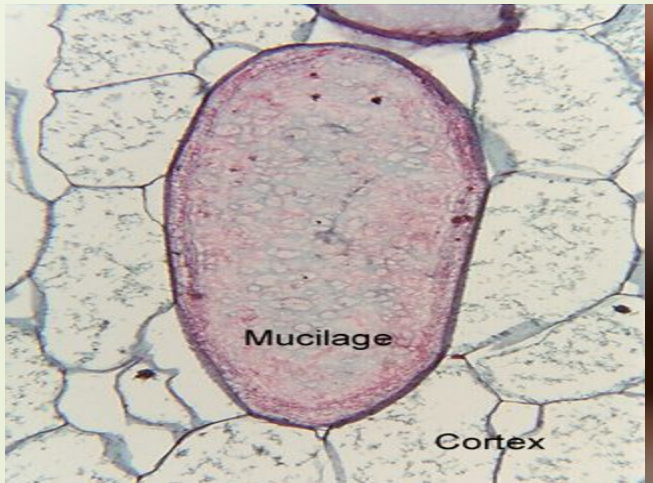
- They can retard moisture losses and the loss of volatile compound , reduce the respiration rate , and delay change in texture properties .

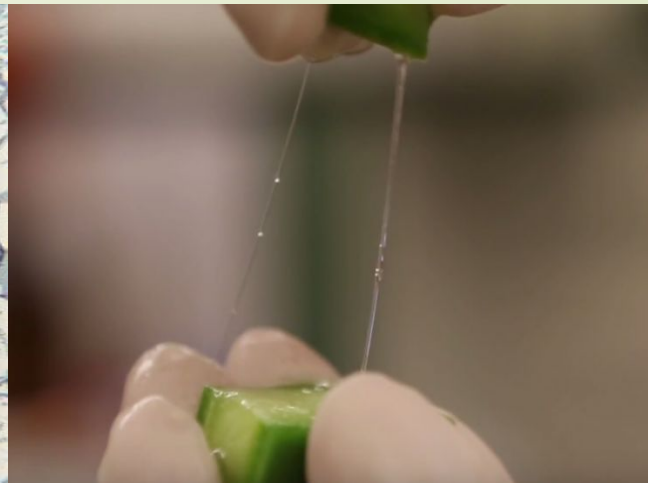
a cactus-mucilage edible coating (*Opuntia ficus* indica)

Edible film and coating , which can be divided into protein polysaccharide lipids and composites are defined as thin layer of edible material formed on a food surface as a coating or placed (pre-formed) between food component .

Cactus mucilage may find applications in food, cosmetics, pharmaceutical and other industries.

The complex polysaccharide is part of dietary fibre and has the capacity to absorb large amounts of water, dissolving and dispersing itself and forming viscous or gelatinous colloids





2 . Research question and identified problems.

Due to these characteristics of tomato fruits and its sensitive storage ability this research was done to make an Assessment of cactus mucilage as a potential coating film to increase its shelf life .

3. objectives

1. The aim of present work is a preliminary study and assessing the potential suitability of using cactus (*opuntia ficus-indica*) mucilage as an edible coating to extend the shelf-life of tomatoes.

2. Determining the best methods of cactus mucilage extraction. Two methods of mucilage extraction were tested (drying the blade at 45 ºC for 7 days and fresh extraction with water (2:1, v:v) (cactus : water)

3. The work investigated the effect of the coatings on quality changes during storage at room temperature, including; fruit fresh weight loss, texture, color changes, Brix (total soluble solids)

4. Project Description and Methodology

- 210 Mature-green tomatoes (cv: Izmir) at early pink stage was harvested from the greenhouse of the farm of Faculty of agriculture and veterinary and brought immediately to the laboratory for further experiments .

- The fruits was selected according to their size (medium) & color, without blemishes (defect-free) and/or fungal infection.

The experimental design

- **The experimental design was a complete randomized design(CRD) with three replications for each treatment.**
- **For fruit wt losses parameters , 10 fruits per treatments were used as 3 replicates .**

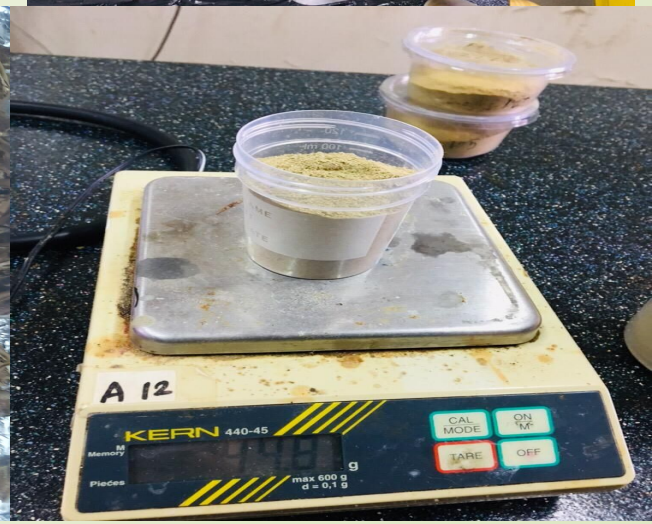
- fruits were washed by immersing them in distilled water & air dried for 25 min then
- coated by immersing them for two times for 3 minutes each in cactus mucilage prepared and extracted with 2 different methods



Coating solution preparation

- Cactus stems thorns was removed . washed then it was cubed (2*2 cm). Two methods of preparation was tested.

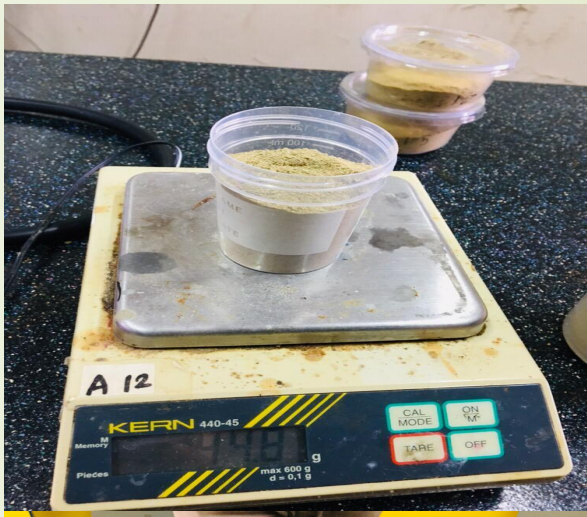
1. **Dry cactus method**
   - Cubed cactus stems was dried at 45 ºC for 7 days,
   - then grinded using a food processor machine.



Dry cactus solution preparation :

- powder was dissolved with water(7g powder /100ml water)

- then it was filtered to remove solids .



2. Fresh extract preparation

- Cubed cactus extract were extracted by using a fruit juicer .

- Then the cactus diluted with water (2:1-v:v)(cactus : water)

Post harvest treatments

- Fruits were washed with distilled water and air dried .
- tomato fruits were dipped two times for 3 min each in cactus mucilage extracts .
- After air drying at room temperature, fruits were stored at ambient temperature (25–30 C).
- The control consisted of tomatoes immersed in water for the same period of dipping in mucilage .

Parameters studied

- The following parameters was recorded at the day of harvesting (Zero day) and later on at each 3-4 days interval till the fruit decaying :
  - Fruit Brix
  - Fruit Firmness
  - Fruit weight loss as a percentage of initial fresh weight.
  - Fruit skin colour

- Data collection dates

Dates	Days after treatments	
D0	zero day	8/4/2019
D1	4 day	11/4/2019
D2	8 day	15/4/2019
D3	12 day	18/4/2019
D4	16 day	22/4/2019
D5	20 day	25/4/2019

- Firmness using penetrometer
- model Lutron FR-5120
- penetration head size was 6 mm

- **Fruit skin colour using colorimeter**
- **model <u>KONICA MINOLTA</u>**

- The Hunter L (color lightness), a (position on the green-red axis).

- Fruit weight loss as a percentage of initial fresh weight

- the weight of the same fruit was recorded each time

- %wtl = {(wti -wtf)/wtl}

Total soluble solid (Brix) using refractometer model Milwaukee MA871

Results & discussion

1. Fruit Firmness

- **Cactus coating application was found to significantly enhance the fruit firmness during the coarse time of the experiment compared to uncoated fruits, while at D 5 no significant effects was recorded**

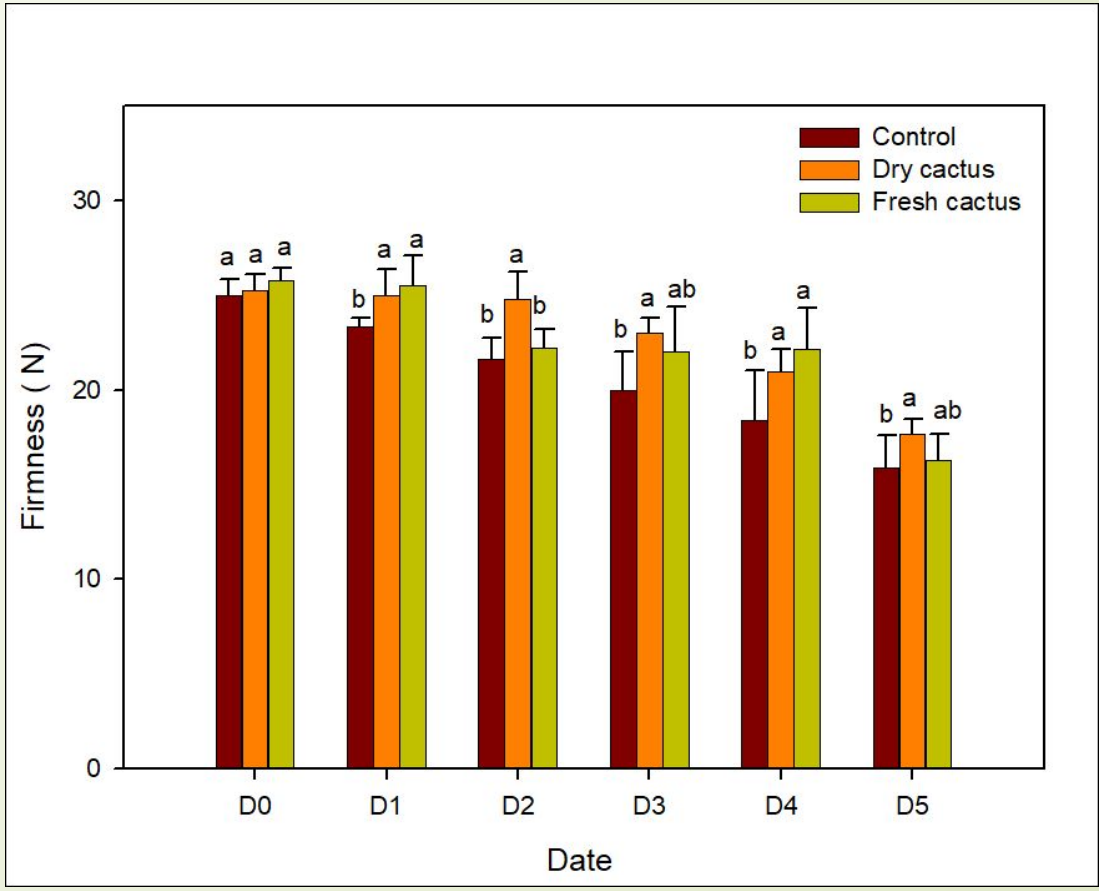


Fig 1. the effects of different cactus coating treatments on tomato fruits firmness after different storage time at room temp

- The data were statistically analyzed using the analysis of variance and Duncan's multiple range test was used for the mean separation at 5% level of probability, using SAS software version 8.0

Fruit Firmness at D5 (22 days storage at room temperature

Fruit Firmness at D5 (22 days storage at room temperature

Tomatoes fruit cross section

Results & discussion
2. Fruit Brix

- Cactus coating application was found to significantly reduced the fruit Brix, during the coarse time of the experiment compared to uncoated fruits, while no significant effects was recorded between the 2 types of extraction

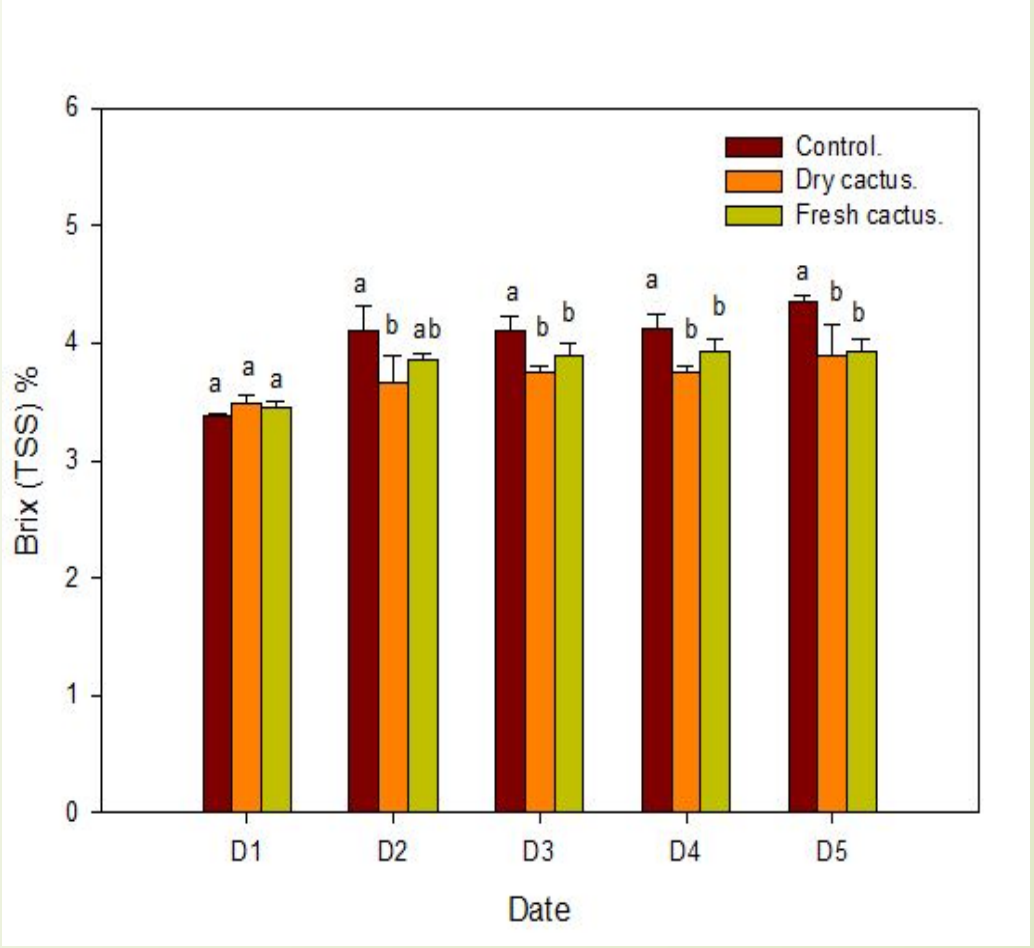


Fig 2. the effects of different cactus coating treatments on tomato fruits sugar after different storage time at room temp

Results & discussion

3. fruit wt loss

- Dry extraction - Cactus coating application was found to significantly reduce the fruit wt loss % during the coarse time of the experiment compared to uncoated fruits

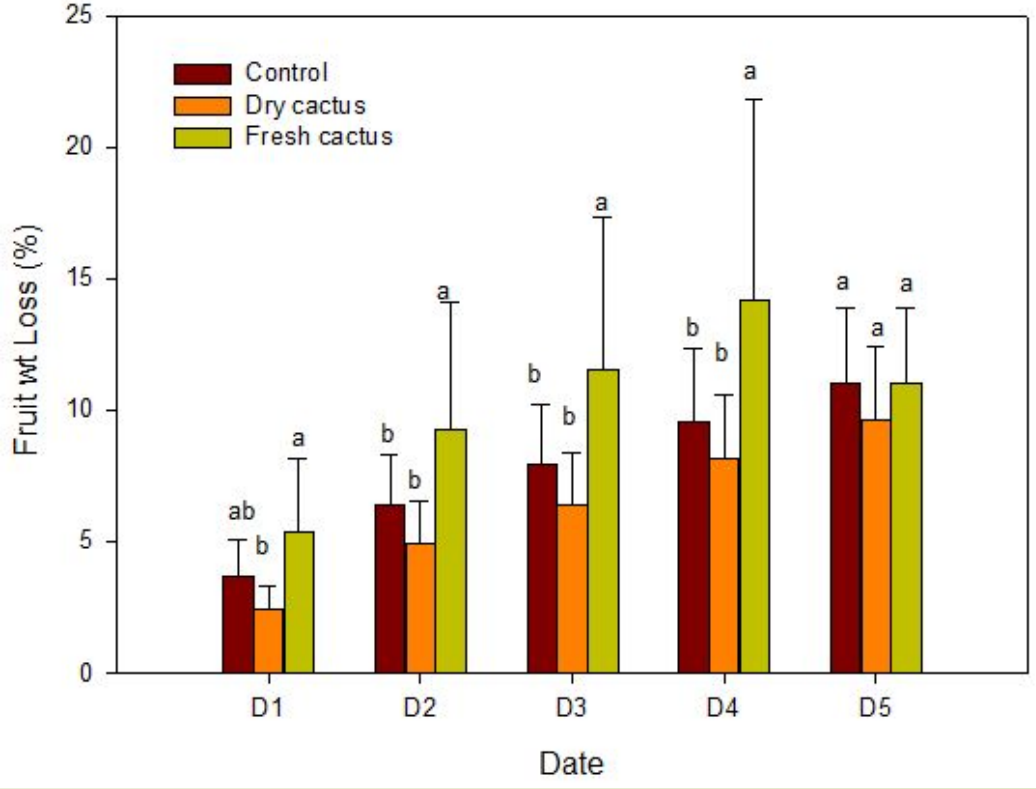


Fig 3. the effects of different cactus coating treatments on tomato fruits fruit wt loss after different storage time at room temp

Results & discussion

4. Fruit skin color

- **a scale**:

Red vs. green where a positive number indicates red and a negative number indicates green.

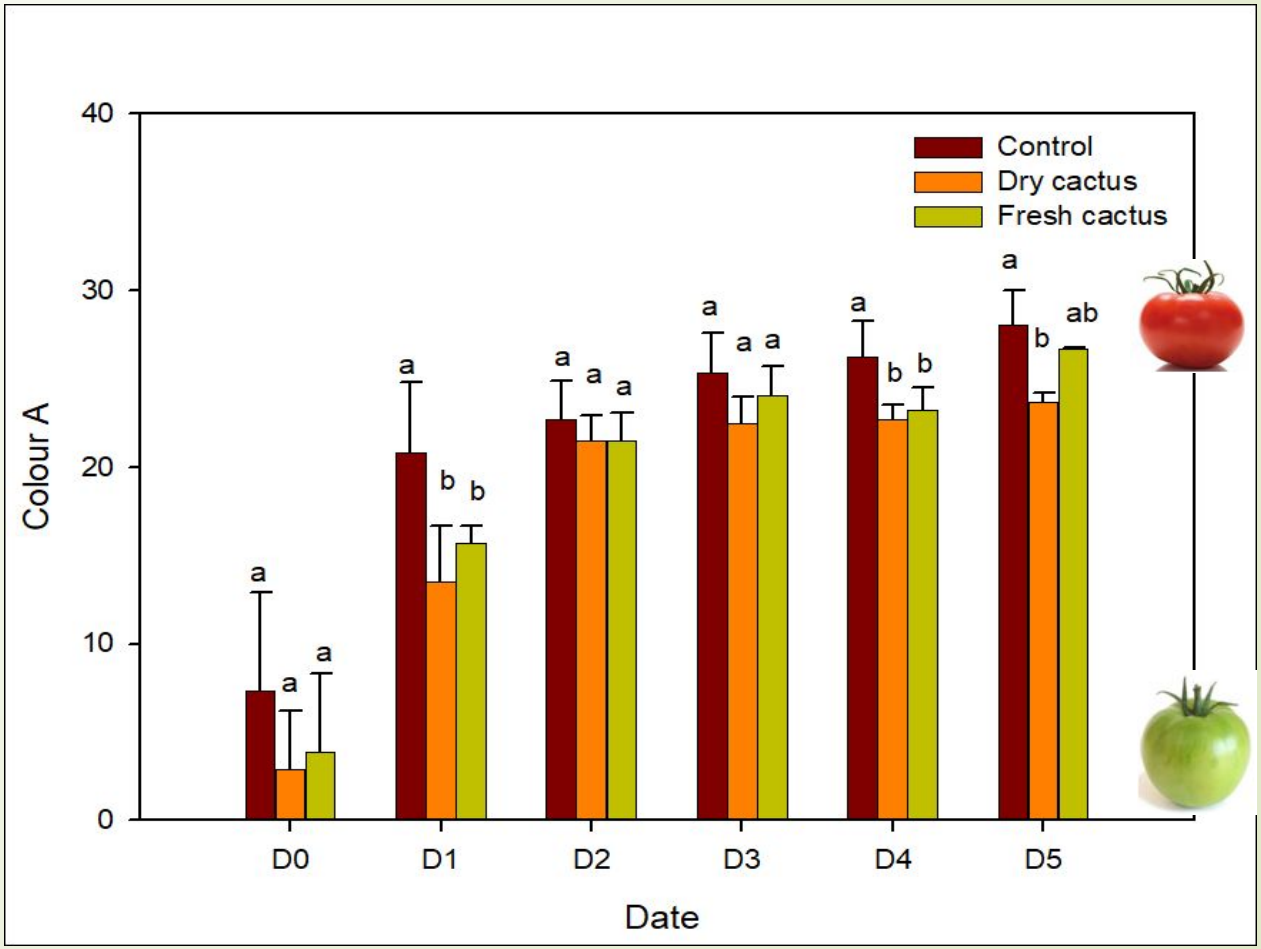


Fig 4. The effects of different cactus coating treatments on tomato fruits skin color change after different storage time at room temp .

Recommendation

- cactus dry preparation methods is found to enhance the storage ability and shelf life of tomato fruits ub to 20 days with a significant enhanced firmness and acceptable color and fruit losses.

- we recommend to make further testing on the dry cactus adding more control agent of fruits ripening to get longer shelf life .

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