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EFFECT OF DIFFERENT STORAGE CONDITIONS AND PACKING MATERIALS ON PHYSICAL PROPERTIES AND SHELF LIFE OF LADYFINGER AND ROUND GOURD

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ABSTRACT

A study was conducted to investigate the effect of different storage conditions on physical properties and shelf life of Ladyfinger and Round gourd at Agriculture Lab, D.A.V. College, and Abohar during year 2015. The vegetables were wrapped in two different packing materials i.e. in paper and in polythene. They were stored at two different storage conditions i.e. at room temperature and in refrigerator. The samples were analyzed for volume, density, spoilage percentage and for shelf life of the vegetables. Results revealed that maximum shelf life of ladyfinger was 21 days with polythene packing in refrigerator and of round gourd was only six days under all conditions.

Keywords: ***Ladyfinger, Round gourd, storage conditions, packing materials, spoilage percentage, fruit volume, fruit density and shelf life.***

INTRODUCTION

Vegetables with increasing recognition of their value in the human diet, are gaining commercial importance. The nutritional value of vegetables as a source of minerals, vitamins, dietary fiber and fair amount of carbohydrates, protein and energy is known worldwide..The productivity of vegetables is maximum in Tamilnadu ranking first and then Karnataka while the production is maximum in Uttar Pradesh followed Bihar. There are different storage methods that adapted to increase shelf life of vegetables. Out of these methods i.e. drying, canning, curing and salting, freezing, common storage, which method is choose depends upon type of produce, quality desired and facilities available for storage In drying, moisture is removed by using an oven, a dehydrator or by warm heat of the Sun. In canning, the vegetables and fruits are heated with the help of pressure to kill micro-organisms that can cause spoilage. This action also deactivates enzymes in the produce that affects flavor, texture and color. The way to cure food is by adding organic acid like vinegar to increase acidity and limit microbial activity. A very common and desirable way to store fruits and vegetables is through freezing. Like other methods, freezing prevents micro-organisms from growing causing spoilage. The largest advantage of freezing is

that the nutritional value remains relatively good. The other method used for storage generated by our ancestors is called common storage. It involves storage in darkened, cold area. Now a days, protective edible coatings and waxes are applied to fruits and such as mineral oil, petroleum and paraffin that are regulated as food additive.

MATERIALS AND METHODS

The experiment was conducted at Agriculture Lab, D.A.V. College, Abohar during August, 2015. Four samples of ladyfinger and four samples of round gourd, each weighed near around 500gm were taken. They were named as L1, L2, L3, L4 and R1, R2, R3, R4 for Ladyfinger and Round gourd respectively for packing with paper and kept at room temperature, packing with polythene and kept at room temperature, packing with paper and kept at refrigerator, packing with polythene and kept at refrigerator respectively. The samples were analyzed for volume, density, spoilage percentage and for shelf life of the vegetables at an interval of two days.

Volume- The volume of the sample was measured by using water displacement method. In order to measurement of volume, the first container filled with water and then the sample is immersed in water. The amount of volume increased from initial level is equal to volume of that sample.

One millimetre (1ml) of water has volume of one cubic centimeter ($1cm^3$).

Volume of fruit = Final water level - Initial water level.

Density- Density of sample was measured if both the weight as well as volume is known. Density was measured by dividing the weight of the sample to the volume of that sample. Mathematically, it can be calculated by using following formula:

$$\text{Density} = \frac{\text{Weight of the sample}}{\text{Volume of the sample}}$$

Spoilage percentage- Spoilage is the process in which food deteriorates to the point in which it is not edible to humans or its quality of edibility becomes reduced. In vegetables, spoilage percentage was calculated by dividing the weight of spoiled vegetables to the total weight of the vegetables. The total spoilage percentage was calculated by following formula:

$$\text{Spoilage percentage} = \frac{\text{Weight of spoiled vegetables}}{\text{Total weight of vegetables}} \times 100$$

Shelf life of vegetables- Shelf life of vegetables is the period at that vegetables may be stored for consumption without deteriorate their quality. Shelf life is the recommended maximum time for which products or fresh produce can be stored without affecting their market value. The shelf of vegetables was in days.

RESULTS AND DISCUSSION

Volume-Ladyfinger

Table 1 represents that volume of ladyfinger decreases with advancement in storage period. Under room temperature and packaging with paper, volume of fruits decreased from 7.14cc at 0 day of storage to 3.00cc after 12 days of storage while in packaging with polythene volume decreased from 6.67cc at 0 day of storage to 5.33cc after 12 days of storage. Under refrigerated conditions and packaging with paper, volume of fruits decreased from 7.14cc at 0 day of storage to 3.33cc after 12 days of storage while in packaging with polythene volume decreased from 7.14cc at 0 day of storage to 4.67cc after 15 days of storage. Results concluded that volume loss was maximum at room temperature i.e. 4.14 cc by wrapping with paper after 12 days of storage and minimum i.e. 1.33 cc by wrapping with polythene at room temperature.

Table 1.Effect of different storage conditions on volume of ladyfinger

Days of storage Vegetable sample	0	3	6	9	12	15
L1	7.14	6.67	4.67	4.00	3.00	-
L2	6.67	6.33	6.33	6.00	5.33	-
L3	7.14	5.33	5.33	4.67	3.33	-
L4	7.14	6.67	6.00	5.33	4.67	4.00

Round Gourd

Table 2.Effect of different storage conditions on volume of round gourd

Days of storage Vegetable sample	0	3	6
R1	25	20	Spoiled
R2	25	24	Spoiled
R3	25	20	Spoiled
R4	25	22	Spoiled

Table 2 represents that volume of round gourd decreases with advancement in storage period. Under room temperature and when packed with paper, volume of fruits decreased from 25cc at 0 day of storage to 20cc after 3 days of storage while in packaging with polythene volume decreased from 25cc at 0 day of storage to 24cc after 3 days of storage. Under refrigerated conditions and packaging with paper, volume of fruits decreased from 25cc at 0 day of storage to 20 cc after 3 days of storage while in packaging with polythene volume decreased from 25cc

at 0 day of storage to 22 cc after 3 days of storage. Results concluded that volume loss was maximum i.e. 5cc when wrapped with paper under both storage conditions while volume loss was minimum i.e. 1gm/cc under room temperature by wrapping with polythene. Bahnasawy and Khater (2014) observed similar observations on volume on cucumber fruit. He concluded that volume change was maximum i.e. 0.35gm/cc at room temperature and minimum i.e. only 0.15gm/cc at 5°C. Similarly, Genanew *et al* (2013) observed that the volume loss in tomato was least i.e. 25.6% in fruits packed with polythene and maximum loss was in fruit i.e. 55.3% under control.

Density-Ladyfinger

Table 3.Effect of different storage conditions on density of ladyfinger

Days of storage Vegetable sample	0	3	6	9	12	15
L1	68.45	60.02	54.91	31.58	21.43	-
L2	74.18	74.98	76.48	78.05	79.82	-
L3	70.84	66.21	59.07	57.11	48.86	-
L4	68.16	72.88	80.83	90.75	82.01	79.42

Table 3 represents that density of ladyfinger decreased with increase in storage time with wrapping in paper and increased with increase in storage period with wrapping in polythene at both temperatures. At room temperature, density decreased from 68.45gm/cc to 21.43gm/cc after 12 days with newspaper packing and it was increased from74.18gm/cc to 79.82gm/cc after 12 days. Under refrigerated conditions, density decreased from 70.84gm/cc to 48.86gm/cc after 12 days when wrapped in paper and increased from 68.16gm/cc to 79.42gm/cc after 15 days when packed in polythene. Results concluded that loss was maximum at room temperature in paper packing i.e. 47.02gm/cc and increase maximum in refrigerator with polythene packaging i.e. 8.26gm/cc.

Round Gourd

Table 4.Effect of different storage conditions on density of round gourd

Days of storage Vegetable sample	0	3	6
R1	20.40	22.15	Spoiled
R2	21.03	21.73	Spoiled
R3	19.95	21.61	Spoiled
R4	20.87	23.64	Spoiled

Table 4 shows that density of round gourd increased with increase in storage period. At room temperature, it increased from 20.40gm/cc to 22.15gm/cc and 21.03gm/cc to 21.73 respectively in paper and polythene packaging while in refrigerator, it increased from 19.95gm/cc to 21.61gm/cc and 20.87gm/cc to 23.64gm/cc respectively in paper and polythene packaging after 3 days of storage. Hazbavi *et al* (2015) observed similar observations on density on date palm. Results concluded that there was no significant change in density of fruit after 3 months of storage and gradual increase after 6 months of storage. Jha et al (2012) conducted similar study. He concluded that density of apple declined after 28 days of storage i.e. from 1.01 to 0.97kg/m^3.

Spoilage percentage-Ladyfinger

Table 5.Effect of different storage conditions on spoilage percentage (%age) of ladyfinger

Days of storage Vegetable sample	0	3	6	9	12	15	18
L1	0.00	1.81	21.06	39.32	40.75	100	-
L2	0.00	0.00	0.00	2.01	14.63	100	
L3	0.00	0.00	0.00	14.43	60.48	100	-
L4	0.00	0.00	0.00	0.00	0.00	65.52	100

Table 5 represents the spoilage percentage during storage in ladyfinger. At room temperature, maximum spoilage i.e. 100% observed after 15 days in paper packing and after 15 days in polythene packaging. However, in refrigerator, maximum spoilage i.e. 100% observed after 15 days in paper packing and after 18 days in polythene packaging.

Round Gourd

Table 6.Effect of different storage conditions on spoilage percentage (%age) of round gourd

Days of storage Vegetable sample	0	3	6
R1	0.00	69.82	100
R2	0.00	4.49	100
R3	0.00	11.68	100
R4	0.00	12.94	100

Table 6 represents the spoilage percentage in round gourd. Both in room and in refrigerated conditions, maximum spoilage i.e. 100% was observed after 6 days both in paper packaging as well as in polythene packaging. Hameed *et al* (2013) reported similar observation on spoilage on green chillies. He reported that after one week of storage,

the fruits stored at 10°C showed minimum spoilage percentage i.e. 8.91% and maximum spoilage percentage at 0 °C i.e. 54%. Similarly, the maximum spoilage percentage was observed in okra kept in perforated packages i.e. 88% and in non perforated packaged i.e. 85% at 8.5°C and minimum spoilage percentage was observed in non perforated polythene bags at 13°C i.e. 22% by Ngure *et al (*2009).

Shelf life of vegetables-Ladyfinger

Table 7 represents that shelf life of ladyfinger was minimum i.e. 15 days under both pickings at room temperature and in paper packaging in refrigerator whereas it was maximum i.e. 21 days in polythene packing in refrigerator.

Table 7.Effect of storage conditions on shelf life of Ladyfinger

Vegetable sample	Shelf life in days
L1	15
L2	15
L3	15
L4	21

Round Gourd

Table 8.Effect of storage conditions on shelf life of Round gourd

Vegetable sample	Shelf life in days
R1	06
R2	06
R3	06
R4	06

Table 8 represents that round gourd have shelf life of only 6 days under all conditions of storage i.e. under both packaging materials at room temperature and in refrigerator. Abong *et al* (2011) reported similar observations on shelf life of crisps from potato. He concluded that shelf life was maximum for aluminium foil pack at 25°C while shelf life was minimum at 35°C. Similarly, Sahoo and Kulkarni (1999) observed effect of temperature and packaging material on shelf life of French beans. He concluded that the maximum shelf life was observed with perforated polythene bags and kept at cold storage i.e. 30 days and minimum under control at room temperature i.e. 9 days.

CONCLUSIONS

Results concluded that in ladyfinger, volume loss was maximum at room temperature i.e. 4.14 cc by wrapping with paper after 12 days of storage and minimum i.e. 1.33 cc by wrapping with polythene at room temperature. In round gourd, it was maximum i.e. 5cc by wrapping with paper under both paper as well as polythene packaging while volume loss was minimum i.e. 1gm/cc under room temperature by wrapping with polythene. Results concluded that in ladyfinger, density loss was maximum at room temperature in paper packing i.e. 47.02gm/cc and density increase was increase maximum in refrigerator with polythene packaging i.e. 8.26gm/cc. In round gourd, loss was maximum in polythene and kept in refrigerator i.e. 23.64gm/cc and minimum in refrigerator with paper packaging i.e. 21.61gm/cc. Results concluded that in ladyfinger, 100% spoilage was reported simultaneously in paper and polythene wrapping at room temperature and paper packing in refrigerator after 15 days. In round gourd, it was reported simultaneously under all conditions of storage after 6 days. Results concluded that maximum shelf life of ladyfinger was 21 days when wrapped in polythene in refrigerator. Maximum shelf life of round gourd was only 6 days under all storage conditions.

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