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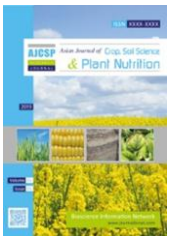

# Effects of different postharvest treatments on nutritional quality and shelf life of cucumber

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***ABSTRACT***

*Controlled atmosphere and modified atmosphere packaging technology used to slowdown the process of ripening and senescence during storage of many fresh fruits and vegetables. The present study was conducted at the laboratories of Department of Horticulture, Bangladesh Agricultural University, Mymensingh to study the effects of different postharvest treatments on nutrient quality and shelf life of an important vegetable named cucumber during the period of 3 August to10 September, 2008. The experimental treatments were control, fruit wrapped in aluminum foil, fruit held at 5˚C with or without plastic wrap, fruits held at 15˚C with or without plastic wrap, fruit wrapped in plastic bag and held at ambient condition. The single factor experiment was laid out in completely randomized design. Cucumber fruits when wrapped in plastic bags and held at 15˚C had the longest shelf life (12 days). Vitamin C content in cucumber fruit declined with storage duration. The vitamin C content in fresh cucumber was 8.68 mg/100g, which declined to 5.45 mg/100g at the 12th day of storage. This study finds out that cucumber fruits should be kept at 15˚C with plastic bag wrap for maximum time storage. Though cucumber is a perishable product, it can be stored up to 12 days at 15˚C with plastic bag wrap in a minimal cost.*

***Key Words:*** *Cucumber, Nutritional changes, Postharvest loss, Shelf life, Vitamin C and Storage.*

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## I. Introduction

Vegetables are enriched with different vitamins like A, C, niacin, riboflavin, and thiamine, and minerals such as calcium and iron. Vegetables help to uptake the essential nutrients from other foods by making them palatable, adding dietary fiber for digestion. They are essential for maintaining healthy life

(Robinson, 1990; Hanif et al., 2006). Now a day, in the third world countries malnutrition and under nutrition has become an alarming issue which effects negatively their economic and physical development (Blossner and Onis, 2005). It is clear that an increase in vegetable uptake is a strong weapon to combat with vitamin and mineral deficiencies. For improving food security with nutrition, vegetable production and availability must be increased. The area under vegetable cultivation, excluding potato and sweet potato is 0.41 million ha producing 4.07 million metric tons with an average yield of 9.98 t/ha (BBS, 2019). For a human body minimum requirement of fruit and vegetables 400 g/day/capita (FAO, 2003) but the present consumption of fruits and vegetables in Bangladesh is only 211 g/day (fruits, brinjal and potato) (Kaysar et al., 2016). According to Hossain (1992), to supply the minimum daily requirement of 200 gm vegetables for the population of Bangladesh, national production of vegetables should be over 120 million tons. Because of having highly perishable nature vegetables needs to reach the quickly to the consumers after harvest. Poor handling and marketing system cause both postharvest quantitative and qualitative losses. Quality of vegetables deteriorates gradually during storage, transport, wholesaling, and retailing, particularly when the conditions remain unfavorable, and at one stage produce becomes unfit for marketing or human consumption. Information related to the nutritional losses of important vegetables of Bangladesh is meager in the scientific literature.

The present study included an important vegetable of Bangladesh named cucumber (*Cucumis sativus* L.) under the family *Cucurbitaceae*. Cucumber is an important summer vegetable, which is grown in 9593 hectares of land with a total production of 65499 metric tons (BBS, 2019). Cucumber is mainly consumed fresh as a good source of vitamins and minerals. 100 g cucumber contains 96.3 g moisture, 0.4 g protein, 0.1 g fat, 0.3 g minerals, 0.4 g crude fiber, 2.5 g carbohydrate, 13 Kcal energy, 10 mg calcium, 25 mg phosphorus, 0.60 mg iron (Gopalan et al., 1989). It is also enriched with antioxidant, anti-inflammatory, and anti-cancer benefits (Mukherjee et al., 2013). Nutritional properties and storage quality of cucumber is merely investigated in Bangladesh. Promising storage techniques like modified atmosphere storage and low temperature would be investigated to examine the pattern of nutritional changes and shelf life of cucumber. Therefore, the present study is aimed at to determine the physico-chemical changes of cucumber during storage; and examine the efficacy of some promising postharvest treatments to prolong shelf life of cucumber.

## II. Materials and Methods

The postharvest quality changes of cucumber as influenced by different types of storage conditions was conducted at the laboratories of the Departments of Horticulture and Bio-Chemistry, Bangladesh Agricultural University, Mymensingh during the period of 3 August to 10 September, 2008. The temperature of the storage room was recorded daily with a thermometer. The average minimum and maximum temperature of storage room during the period of investigation were 28 and 32°C, respectively. The materials used for the present experiment were freshly harvested cucumber fruits variety 'Hybrid' (known as 'Supply'). The fruits were collected from the growers of Norshingdi District.

### Experimental design

The single-factor experiment was laid out in completely randomized design with three replications of 9 fruits in each replication. There were 27 fruits per treatment and total fruits required were 189. The fruits were of uniform shape, size, and free of any visible defects, disease symptoms and insect infestations.

The single-factor experiment consisted of the following treatments.
$T_1$ = Control (Unwrapped fruits held at ambient condition)
$T_2$ = Fruits covered with aluminum foil and held at ambient condition
$T_3$ = Fruits wrapped in plastic bag (LDPE) and held at 5˚C
$T_4$ = Unwrapped fruits held at 5˚C
$T_5$ = Fruits wrapped in plastic bag (LDPE) and held at 15˚C
$T_6$ = Unwrapped fruits held at 15˚C
$T_7$ = Fruits wrapped in a plastic bag and held at ambient condition

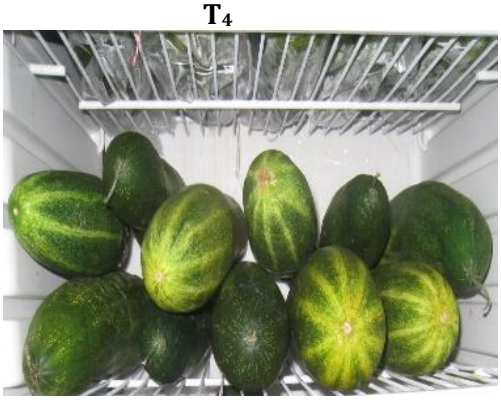
$T_1$

$T_2$

$T_3$

$T_4$

$T_5$



$T_6$

$T_7$

[$T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15°C, $T_4$: Fruits stored at 15°C without plastic wrap, $T_5$: Fruits stored at 5°C with plastic wrap, $T_6$: Fruits stored at 5°C without plastic wrap and $T_7$: Fruits stored in plastic bags at room temperature.]

**Plate 01. Different storage condition of cucumber**

**Application of postharvest treatments**

The postharvest treatments used in the present study were randomly assigned to the selected cucumber fruits. The procedures of applying the postharvest treatments were as follows.

**Control:** Eighty-one (81) cucumber fruits were randomly selected from lot and placed on the brown paper placed on wooden laboratory table. The fruits were then randomly divided into 3 groups for three different treatments, namely no-wrapping, wrapping with plastic bags and wrapping with aluminum foil.

**Storage at 15˚C temperature:** Fifty-four (54) experimental fruits were randomly divided into 2 groups for two different treatments, namely no-wrapping and wrapping with plastic bags. Then the wrapped and unwrapped fruits were held at 15˚C in a refrigerated incubator (FOC 225E, VELP SCIENTIFICA).

**Storage at 5˚C temperature**: Similarly, fifty-four (54) experimental fruits were randomly divided into 2 groups for two different treatments, namely no-wrapping and wrapping with plastic bags. Then the wrapped and unwrapped fruits were held at 5˚C in a refrigerated incubator (FOC 225E, VELP SCIENTIFICA).

**Parameters studied**

Parameters studied were colour, firmness, shrinkage, weight loss, moisture content, dry matter content, vitamin C and shelf life. The experimental fruits were washed in running water to remove dirt, and subsequently air-dried before applying the treatments. Among 9 fruits in each replication of each treatment, 4 fruits were used for destructive sampling at 2-day interval to investigate several parameters including moisture content, dry matter content, vitamin C. The remaining 5 fruits were used to investigate colour, firmness, total weight loss, and shelf life. The methods of studying the above parameter are described below.

**Colour:** Days required to reach different stages of color during storage were determined objectively using a numerical rating scale of 1-4, where 1 = green, 2 = slightly green, 3 = slightly yellow, and 4 = yellow.

**Firmness:** Days required to reach different stages of firmness during storage were determined using numerical rating scale of 1-3 (1 = hard, 2 = sprung, and 3 = soft) was used to define the levels of firmness.

**Shrinkage:** The shrinkage of the fruits at different days was determined using eye estimation and the numerical rating scale of 1-4 (1 = no shrinkage, 2 = slight shrinkage, 3 = moderate shrinkage, and 4 = complete shrinkage).

**Weight loss:** Cucumber fruits (four) of each replication of each treatment was weighed using weighing balance every day. Weight losses of fruits as influenced by different postharvest treatments were estimated using the following formula:

$$\text{Percent weight loss (WL)} = \frac{IW - FW}{IW} \times 100$$

Where,

WL = Percent total weight loss,
IW = Initial weight of fruits (g),
FW = Final weight of fruits (g).

**Moisture content:** About twenty grams of weight by Triple Beam Balance was measured and taken in a Petri dish from treatment out of each replication. The Petri dish was placed in an electric oven at 70 ± 2˚C for 72 hours until the constant weight attained. It was then cooled and weighed. The percent moisture content of fruit was calculated using the following formula:

$$\text{Moisture content (\%)} = \frac{IW - FW}{IW} \times 100$$

Where,

IW = Initial weight of pulp (g),
FW = Final weight of oven dried pulp (g)

**Dry matter content:** Percent dry matter content of cucumber was estimated from the data obtained during moisture estimation using the following formula:

Percent dry matter = (100 - percent moisture content).

**Vitamin C content:**
Vitamin C content of mango was determined by a 2,6-dichlorophenol indophenol visual titration method (Plummer,1971).

**Shelf life**
Shelf life of cucumber was calculated by counting the days required to reach shrinkage score 3 (moderate shrinkage) and firmness score 3 (soft), and ones the fruits were appeared to be unfit for marketing and consumption.

**Statistical analysis**
Collected data on various parameters were statistically analyzed using MSTAT Statistical Package. The means for all the treatments were calculated and analysis of variances (ANOVA) for all the parameters was compared by least significant difference (LSD) test at the 1% and 5% levels of probability (Gomez and Gomez, 1984).

## III. Results and Discussion

**Changes in the physical characters of cucumber during storage**
**Colour changes**
The colour change of cucumber is an important factor in storage (Omoba and Oyekwere, 2016). The colour usually changes into yellow from green. From the 6th day of storage, the colour was changed significantly (Plate 02). Fruits stored in ambient condition with or without plastic wrap and wrap with aluminum foil paper turned totally yellow at 10th days of storage. The storage in 15˚C with or without plastic bags was shown less change in colour at 12th day of storage (Table 01). If green vegetables stored for a long time, will undergo eroding of chlorophyll (Moalemiyan and Ramaswamy, 2012). This eroding shortens vegetables shelf life and negatively affects the quality (Fukasawa et al., 2010) Storage in high $CO_2$ and/or low $O_2$ results in reduced loss of chlorophyll as well as reduced loss of chlorophyll as well as reduced accumulation of other pigments including anthocyanin, lycopene, xanthophyll and carotenoids (Barth et al., 1993; Barth and Hong, 1996; Salunkhe and Wu, 1973; Wang et al., 1971; Zhuange et al., 1994).

**Table 01. Effect of temperature on colour changes of cucumber during storage**

| Treatments | Colour changes | | | | | |
|---|---|---|---|---|---|---|
| | Days after storage | | | | | |
| | 2 | 4 | 6 | 8 | 10 | 12 |
| **$T_1$** | 1.60 | 1.93 | 2.53 | 3.07 | 4.00 | 4.00 |
| **$T_2$** | 1.53 | 2.00 | 2.67 | 3.40 | 3.93 | 4.00 |
| **$T_3$** | 1.47 | 1.80 | 2.07 | 2.33 | 2.60 | 3.07 |
| **$T_4$** | 1.40 | 1.60 | 2.20 | 2.47 | 2.80 | 3.13 |
| **$T_5$** | 1.60 | 1.73 | 1.87 | 2.13 | 2.87 | 4.00 |
| **$T_6$** | 1.87 | 1.87 | 2.07 | 2.40 | 2.87 | 4.00 |
| **$T_7$** | 1.27 | 1.60 | 2.27 | 2.67 | 4.00 | 4.00 |
| **LSD at 5%** | 0.51 | 0.41 | 0.39 | 0.55 | 0.54 | 0.31 |
| **LSD at 1%** | 0.72 | 0.58 | 0.54 | 0.77 | 0.75 | 0.43 |
| **Level of significance** | NS | NS | ** | ** | ** | ** |

[$T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15˚C, $T_4$: Fruits stored at 15˚C without plastic wrap, $T_5$: Fruits stored at 5˚C with plastic wrap, $T_6$: Fruits stored at 5˚C without plastic wrap, and $T_7$: Fruits stored in plastic bags at room temperature. Colour score (1= green, 2= light green, 3= light yellow, and 4= yellow). ** Significant at 1% level and NS: Non-Significant]

**Firmness changes**
Firmness is an important factor that affects the quality and consumers acceptability of fresh fruits. Softening of fruits occurs due to weakening in the cell structure, the cell wall composition and the intracellular materials (Shiekh et al., 2013). There was no significant effect of treatments on firmness of the cucumber during storage. As the firmness of the cucumber changed sequentially there was less temperature effect. Firmness at 6th days of storage was reached at 2 in room condition of storage. At the 12th day of storage almost every fruit became soft but the storage at 15˚C with or without wrap

scored 2.73 and 2.93, respectively. The control treatment i.e. without wrapping at room temperature became soft at 10th days of storage (Table 02).

**Plate 02. Changes in colour of cucumber fruit under control condition. The fruit was photographed at the 6th day of storage**

**Table 02. Effect of temperature on firmness changes of cucumber during storage**

| Treatments | Firmness changes | | | | | |
|---|---|---|---|---|---|---|
| | Days after storage | | | | | |
| | 2 | 4 | 6 | 8 | 10 | 12 |
| $T_1$ | 1.33 | 1.80 | 2.07 | 2.67 | 2.80 | 3.00 |
| $T_2$ | 1.07 | 1.40 | 2.00 | 2.40 | 2.60 | 3.00 |
| $T_3$ | 1.47 | 1.60 | 1.93 | 2.33 | 2.40 | 2.73 |
| $T_4$ | 1.33 | 1.53 | 2.07 | 2.47 | 2.40 | 2.93 |
| $T_5$ | 1.20 | 1.67 | 1.67 | 2.07 | 2.07 | 3.00 |
| $T_6$ | 1.33 | 2.00 | 2.20 | 2.47 | 2.60 | 3.00 |
| $T_7$ | 1.53 | 1.60 | 1.67 | 2.27 | 2.60 | 3.00 |
| **LSD at 5%** | 0.38 | 0.52 | 0.41 | 0.48 | 0.45 | 0.21 |
| **LSD at 1%** | 0.52 | 0.73 | 0.57 | 0.66 | 0.62 | 0.30 |
| **Level of significance** | NS | NS | NS | NS | NS | NS |

[$T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15˚C, $T_4$: Fruits stored at 15˚C without plastic wrap, $T_5$: Fruits stored at 5˚C with plastic wrap, $T_6$: Fruits stored at 5˚C without plastic wrap, and $T_7$: Fruits stored in plastic bags at room temperature]

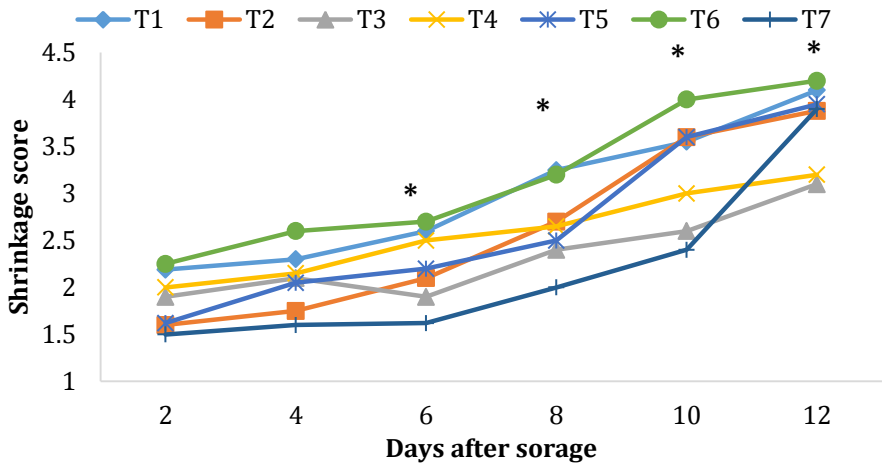



**Figure 01. Effect of temperature in firmness changes and shrinkage at different days after storage.**

[$T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15˚C, $T_4$: Fruits stored at 15˚C without plastic wrap, $T_5$: Fruits stored at 5˚C with plastic wrap, $T_6$: Fruits stored at 5˚C without plastic wrap, and $T_7$: Fruits stored in plastic bags at room temperature, * represent LSD at 5% level of significance.]

## Shrinkage

As vegetables are so much perishable it started shrinkage immediately after harvest. At the second days of storage the fruits without wrapping in room temperature started shrinkage. Shrinkage had a significant effect on the storage of cucumber at different temperature. The cucumber stored at 5˚C without wrapping was shown chilling injury after 8th day. After 6th days of storage shrinkage was

occurred significantly (Plate 02). At 12th day of storage in 15˚C with or without plastic wrap the cucumbers were not shown totally shrinkage. It was moderately shrinkage (3) whereas, other treatments were shown fully shrinkage (Figure 01).

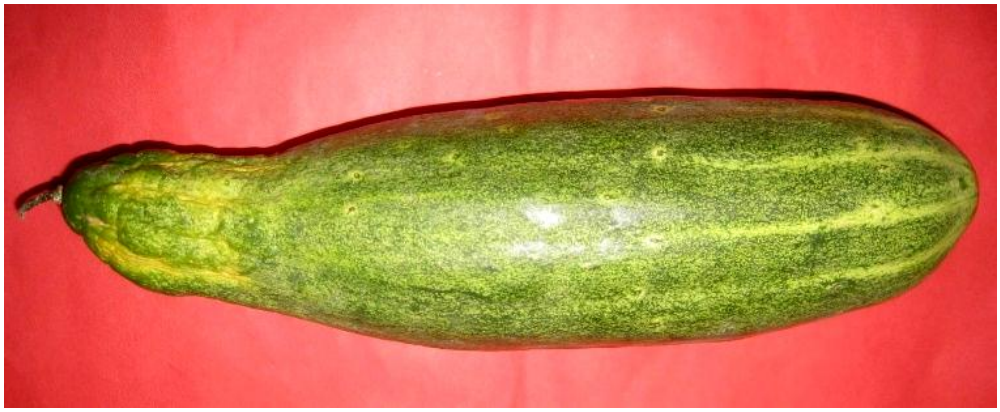


**Plate 02. Shrinkage of cucumber fruit under ambient condition. The fruit was photographed at the 6th day of storage.**

**Weight loss**

Storage of cucumber at different temperature had greater effect on total weight loss. At 6th day of storage the weight loss was highest in the $T_1$ which was stored in room temperature without plastic wrap. Weight loss percentage was significantly increased in case of every treatment. The lowest weight loss was observed in the $T_5$ which was stored in 5˚C with plastic wrap. Second lowest weight loss was occurred at stored in 15˚C with plastic bags (Table 03). Again, the weights of fruits stored at 15˚C temperature with or without plastic wrapping were measured at 12th day of storage. In case of others it was not possible because of spoilage of the fruits. Loss of weight in fresh vegetables is mainly due to the loss of water because of transpiration and respiration process (Zhu et al., 2008).

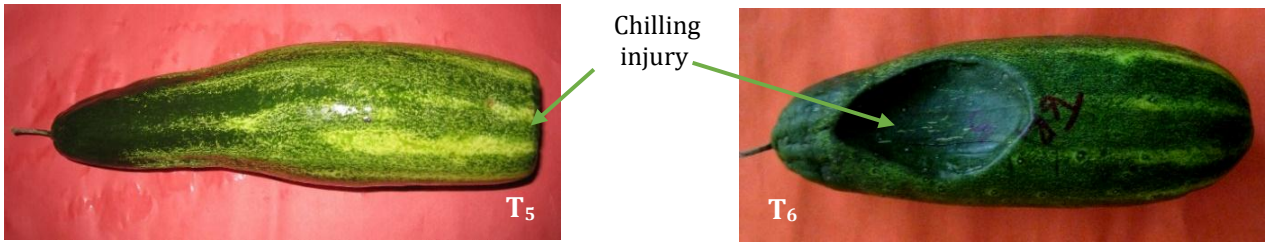



**Plate 03. Chilling injury of cucumber at 6th days of storage in $T_5$: Fruits stored at 5˚C with plastic wrap and $T_6$: Fruits stored at 5˚C without plastic wrap**

**Table 03. Effect of temperature on weight loss of cucumber during storage**

| Treatments | Weight loss | | | | | |
|---|---|---|---|---|---|---|
| | Days after storage | | | | | |
| | 2 | 4 | 6 | 8 | 10 | 12 |
| $T_1$ | 4.45 | 7.70 | 10.11 | 13.02 | 20.83 | - |
| $T_2$ | 2.39 | 4.63 | 7.80 | 9.76 | 16.73 | - |
| $T_3$ | 2.20 | 6.58 | 7.11 | 8.44 | 9.27 | 10.65 |
| $T_4$ | 5.12 | 8.54 | 9.28 | 11.58 | 12.60 | 13.98 |
| $T_5$ | 1.23 | 1.61 | 2.41 | 2.94 | 4.02 | - |
| $T_6$ | 2.45 | 3.72 | 6.49 | 8.60 | 10.59 | - |
| $T_7$ | 1.95 | 5.05 | 6.84 | 11.43 | 18.89 | - |
| **LSD at 5%** | 1.21 | 1.63 | 2.01 | 2.03 | 3.46 | 12.53 |
| **LSD at 1%** | 1.68 | 2.26 | 2.79 | 2.81 | 4.80 | 17.39 |
| **Level of significance** | ** | ** | ** | ** | ** | - |

[** Significant at 1% level and ns: not-significant; $T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15˚C, $T_4$: Fruits stored at 15˚C without plastic wrap, $T_5$: Fruits stored at 5˚C with plastic wrap, $T_6$: Fruits stored at 5˚C without plastic wrap, and $T_7$: Fruits stored in plastic bags at room temperature]

**Moisture content of cucumber**

There was very little significant effect of changes in moisture content percentage of cucumber fruits under different storage condition. Moisture content of the cucumber fruits decreased with the time. At the 3rd day of storage moisture content was highest (98.00%) in without wrapped cucumber at 15˚C. At the 9th day after storage the moisture content percentage of the cucumber was highest again in the $T_4$ (95.66%). At 9th day after storage the moisture content percentage was lowest in plastic wrapped cucumber stored in room temperature (94.15%) (Table 04). The reduction in moisture contents with the advancement of storage period was in agreement with the research findings of Joshi and Roy (1988).

**Dry matter content**

Different storage condition had significant effect on the dry matter content of the cucumber fruit. The highest dry matter content after 9th day of storage was found in the wrapped cucumber stored at room temperature (5.85%). The dry matter content after 9th day of storage was lowest in the cucumber fruits which stored at the temperature of 15˚C without plastic wrap (4.34%). Dry matter content in different treatments was increased day by day (Figure 02).

**Table 04. Effect of temperature on moisture content % of cucumber during storage**

| Treatments | Moisture content % | | | |
|---|---|---|---|---|
| | Days after storage | | | |
| | 3 | 6 | 9 | 12 |
| $T_1$ | 97.51 | 97.35 | 95.10 | - |
| $T_2$ | 97.45 | 95.78 | 95.44 | - |
| $T_3$ | 97.30 | 96.36 | 95.40 | 93.83 |
| $T_4$ | 98.00 | 95.70 | 95.66 | 94.75 |
| $T_5$ | 97.57 | 96.70 | 95.29 | - |
| $T_6$ | 97.39 | 96.62 | 94.61 | - |
| $T_7$ | 97.38 | 96.87 | 94.15 | - |
| LSD at 5% | 1.155 | 1.256 | 1.427 | 1.142 |
| LSD at 1% | 1.603 | 1.765 | 1.981 | 1.585 |
| Level of significance | NS | NS | NS | * |

[$T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15˚C, $T_4$: Fruits stored at 15˚C without plastic wrap, $T_5$: Fruits stored at 5˚C with plastic wrap, $T_6$: Fruits stored at 5˚C without plastic wrap, and $T_7$: Fruits stored in plastic bags at room temperature, ** Significant at 1% level, *Significant at 5% level and NS: Non-significant.]

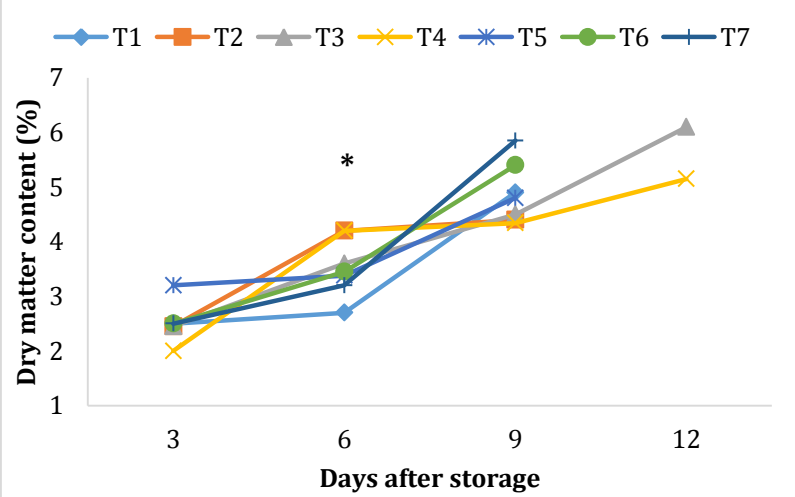



**Figure 02. Effect of temperature in dry matter percentage of cucumber at different days after storage.**

[* represents 5% level of significance; $T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15˚C, $T_4$: Fruits stored at 15˚C without plastic wrap, $T_5$: Fruits stored at 5˚C with plastic wrap, $T_6$: Fruits stored at 5˚C without plastic wrap, and $T_7$: Fruits stored in plastic bags at room temperature]


**Plate 04. Photographic representation of cucumber after 6th days of storage at different temperature condition.**
[$T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15˚C, $T_4$: Fruits stored at 15˚C without plastic wrap, $T_5$: Fruits stored at 5˚C with plastic wrap, $T_6$: Fruits stored at 5˚C without plastic wrap, and $T_7$: Fruits stored in plastic bags at room temperature]

**Changes in the chemical characters of cucumber during storage**
**Vitamin C content**
Vitamin C content of cucumber was highly influenced by temperature. There was a decreasing trend in relation to vitamin C content of cucumber fruit during storage (Figure 03). The initial vitamin C content of the cucumber was 8.68 mg/100g. In the 3rd days after storage highest vitamin C content was found in the $T_4$ and the lowest one was $T_6$. The lowest vitamin C content (4.11 mg/100g) was found in cucumber which held at 5˚C without plastic wrap at 9th day after storage. Vitamin C content was highest in storage cucumber at 15˚C with plastic wrap in 9th day after storage. Results indicated that the fresh cucumbers contained higher levels of vitamin C as compared to stale cucumber. The fresh and mature-hard mangoes contained higher levels of vitamin C as compared to ripe mangoes (Mondal et al., 1998; Gofur et al., 1994). The decrease in vitamin C with time is possibly due to the oxidative degradation of the compounds.

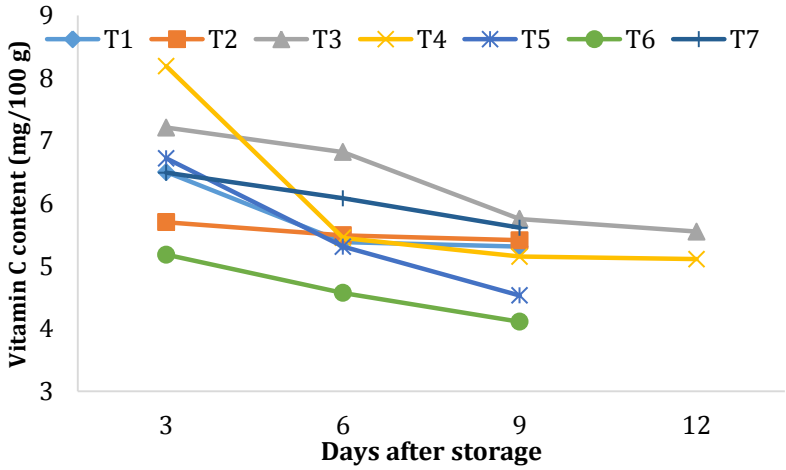



**Figure 03. Effect of temperature in vitamin C content of cucumber at different days after storage.**
[$T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15˚C, $T_4$: Fruits stored at 15˚C without plastic wrap, $T_5$: Fruits stored at 5˚C with plastic wrap, $T_6$: Fruits stored at 5˚C without plastic wrap, and $T_7$: Fruits stored in plastic bags at room temperature]

**Shelf life**
The shelf life of cucumber was significantly affected by the different storage temperature. It was found that the fruits stored at the 15˚C with and without plastic wrap had a higher storability than the other treatments. The fruits which were stored in ambient conditions spoil rapidly. The shelf life of the fruits

which stored in the 5˚C with or without plastic wrap was injured in chilling temperature. The shelf of the cucumber in different storage temperature is graphically represented in Figure 04.

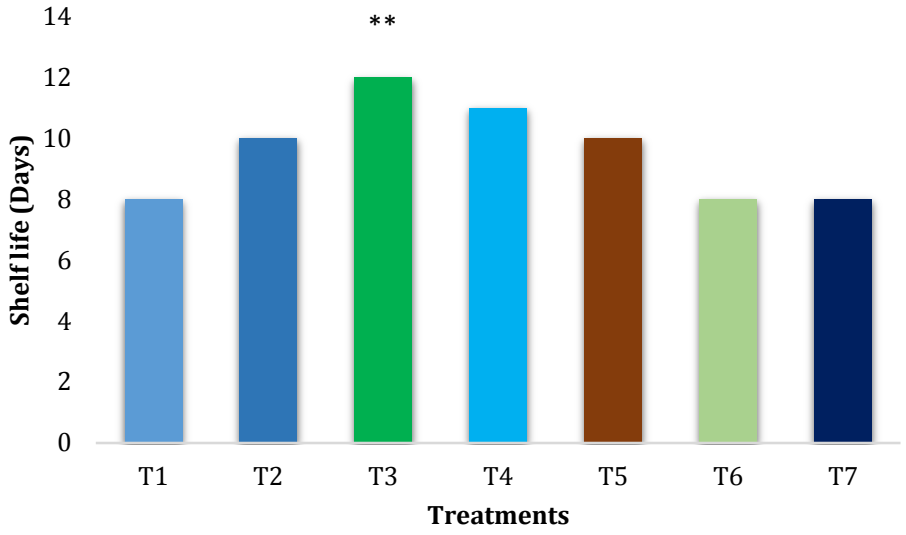



**Figure 04. Effect of temperature in shelf life of cucumber fruits at different days after storage.**
[** represent LSD at 1% level of significance $T_1$: Fruits stored in ambient condition (control), $T_2$: Fruits stored at room temperature with foil wrap, $T_3$: Fruits stored in plastic bags at 15˚C, $T_4$: Fruits stored at 15˚C without plastic wrap, $T_5$: Fruits stored at 5˚C with plastic wrap, $T_6$: Fruits stored at 5˚C without plastic wrap, and $T_7$: Fruits stored in plastic bags at room temperature]

## IV. Conclusion

From this experiment, it was observed that cucumber could be stored better at 15˚C with or without plastic wraps. Both extreme low and ambient conditions were found to be unsuitable for cucumber storage. Low temperature (5˚C) results in chilling injuries, and high temperature (28-32˚C) results in fruit shrinkage. Vitamin C content of cucumber was significantly influenced by storage temperatures. There was a decreasing trend in relation to vitamin C content of cucumber fruit during storage. Vitamin C content of fresh cucumber was 8.68 mg/100 g, which was reduced to 5.45 mg/100 g after 12 days of storage.

## Conflict of interest

The authors declare that they have no conflict of interest.

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