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# Effect of Storage System and Packages Type on The Self life and Quality of okra

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**Abstract**

The main aim of this work was to study the effect of storage system (traditional, ventilated and cold) and package type on the quality of okra during storage. The results indicated that, the total accumulated weight loss increases with increasing the storage period. Storage system had a great effect on the losses, where, the traditional storage system recorded was 86.00 % compared with 84.37 and 68.68 % for the okra stored in the ventilated and cold systems. The okra stored without packages recorded the highest accumulated weight loss (86.00%) when stored at traditional storage system while the lowest accumulated weight losses (33.03%) for the okra stored in the clothes packages when stored in the cold storage. The highest value of moisture loss was recorded by the okra pods stored without packages, while the lowest value of moisture loss was recorded for the okra stored in without packages. The ash, protein, nitrogen and fat composition were increased with increasing storage period for different storge system and package types, while, the fiber composition was decreased with increasing storage period for the same conditions.

**Keywords**: okra storage – ventilated storage – cold storage –chemical composition

## Introduction

Okra (*Abelmoschus esculentus* L. Moench) is one of the most important vegetables produced in Egypt. However, production of the crop has been constrained by the short shelf life of its pods. Okra pods lose quality through blackening, shriveling and decaying within two days under room temperature conditions leading to heavy postharvest losses. To reduce these losses, traders disinfect fresh produce against decay-causing microorganisms using chlorine solution. However, chlorine has an unpleasant smell and is easily vaporized. Moreover, there is a growing consumer concern on the use of chemicals to manage infections **(Salunkhe and Desai, 1984)**. There has been a strong move towards the use of non-chemical methods, such as packaging and right storage temperature in managing postharvest pathogens **(Bauchmann and Earles, 2000)**.

Okra is highly perishable because of its high moisture content and respiratory activities **(Boonyaritthongchai *et al.*, 2013)**, then the okra is highly susceptible to water loss, color fading and decay, resulting in loss of commercial value and become squashy and not easy to consume fresh **(Huang and Jiang, 2012)**. The ridges of okra easily caused mechanical injuries and these pods become blacken on ridges and calyx disc after post-harvesting, resulting in value deletion and unsaleability in quality conscious markets **(Anonymous, 2004)**. Therefore, there is urgent need to develop suitable method to reduce the postharvest losses in okra and maintain high quality from harvesting to the entire supply chain.

Temperature management is the most effective tool for extending the shelf life of fresh horticultural produce. Exposure of okra pods to undesirable temperatures will result in bleaching, surface burning or scalding, shrivelling, excessive softening and desiccation **(Cantwell and Trevor, 2002)**. Temperature also influences the effect of ethylene, reduces oxygen, and elevates carbon dioxide levels; affect pathogen spore germination and growth rate. Low temperature will reduce the effects of pathogens on fresh produce. For instance, cooling commodities below 5°C immediately after harvest reduces the incidence of *Rhizopus* rot. However, extremely low storage temperatures can also affect the quality of certain vegetables. Okra is rapidly chill damaged when stored at temperatures less than 7°C for an extended period **(Perkin-Veazie and Collins, 1992)**. The symptoms of chilling injury include surface and internal discoloration (browning), pitting, water soaked areas, off-flavour development, and accelerated incidence of surface moulds and decay especially organisms not usually found growing on healthy tissue **(Ngure et al., 2009)**.

Storage temperature and humidity are most important as they influence the senescent phases of fresh vegetables by regulating the rate of all associated physiological and biochemical processes. Similar findings have been made with bell peppers stored in perforated packaging which had a lower decay incidence than in non-perforated packaging **(Ngure et al., 2009)**. It was also found that pods in perforated packaging had less off odour than those in non-perforated packaging. This finding is also similar to a study carried out on parsley where perforated packaging retained flavour and aroma better than in non-perforated packaging **(Heyes, 2004)**. In storage, ventilation is very important to avoid build-up of carbon dioxide and heat as non-perforation permits slow gas exchange combined with vapour and heat build-up leading to rapid deterioration.

Okra is a perishable commodity, susceptible to unsuitable environmental conditions, which cause high water losses, color fade and high decay percentages. To overcome these problems, sound storage system and suitable packages types should be used to prolong shelf life, reduce losses and keep the quality, therefore, the main aim of this investigation is to study the effect of storage system and type of packages on the quality and shelf life of okra.

## Materials and Methods

The main objective of the present study is to study the effect of storage conditions and package type on the quality of okra during storage. The experiment was carried out at Agricultural and Bio-Systems Engineering Department Faculty of Agriculture Moshtohor, Benha University, Egypt, during 2020 season.

### 2.1. Materials

#### 2.1.1. Okra

The Okra was brought from the local market, at the beginning of the season, 2020.

#### 2.1.2. Storage conditions

The okra was stored using different systems as follows:-

- **Traditional system**

Okra was folded into different packages in room at ambient temperature.

- **Ventilated storage system**

Okra was folded into different packages in room was air at ambient temperature. Air blower (Model C.C.P. Parma – Flow Rate 110 L $h^{-1}$ – RPM 2800 – Power 300 W 220V 50Hz, Italy) for moving air in the system.

- **Cold system**

Okra was folded into different packages in refrigeration room. Refrigeration room used in this study has dimensions of 3.0 m length, 3.0 m in width and 3.0 m height. It made of prefabricated insulated panels of thickness of 60 mm. The panels insulation are covered with precoated stainless steel sheet on both sides. Cooling unit (Model Egypt Nile – Range temperature 0 – 40 °C – RPM 2800 – Power 2 hp 380V 50Hz, Italy) for control air temperature and mist system increasing relative humidity of air.

#### 2.2.3. Package types

The okra was stored at three different package types as follows: -

**- Perforated cardboard (Carton)**

1.0 kg okra was folded into a perforated cardboard (carton) package. The dimensions of perforated cardboard package are 30 cm long, 20 m wide and 20 cm high.

**- Plastic**

1.0 kg okra was folded into a plastic package. The volume of plastic package is 10 L.

**- Clothes**

1.0 kg okra was folded into a clothes package. The volume of clothes package is 10 L.

### 2.2. Methods

#### 2.2.1. Experimental design

The treatments were arranged in a split plot design in three replications. Table 1 shows the experimental design.

**Table 1.** The experimental design.

| Variables | Levels | Variables Levels |
|---|---|---|
| Storage systems | 3 | Traditional system<br>Ventilated system<br>Cold system |
| Package types | 4 | Control (without package)<br>Clothes<br>Paper<br>Plastic |

#### 2.2.2. Measurements

Temperature and relative humidity readings were recorded every hour at various locations in the storage systems. Temperature and relative humidity were recorded by using a HOBO Data Logger (Model HOBO U12 Temp/RH/Light-Range -20 to 70°C and 5 to 95% RH, USA). Okra samples were taken randomly from different systems every 3 days to determine the total weight losses.

Samples were taken every 3 days to determine the moisture loss. Okra samples were dried using drying oven at 105 °C until a constant weight was obtained. The moisture content was calculated as follows:

$$MC = \frac{M_{wet} - M_{dry}}{M_{wet}} \times 100$$

Where:

MC is the moisture content (% wb)

$M_{wet}$ is the wet mass (kg)

$M_{dry}$ is the dry mass (kg)

Total contents of macro elements were evaluated after being digested according to **Chapman and Partt (1961)**. Nitrogen was determined by Kjeldahl digestion apparatus **(Bremmer and Mulvaney, 1982)**. Potassium, calcium and magnesium were determined by Photofatometer (Model Jenway PFP7 – Range 0 - 160 mmol $L^{-1}$, USA) and phosphorus (P) was determined colorimetrically following the **Murphy and Riley (1962)** method. Protein, fat, fibers and ash content were determined according to the method of **AOAC (1990)**.

## 3. Results and Discussion

### 3.1. Storage conditions

Figures 1 and 2 show the average of temperature and relative humidity for the storage systems (cold, ventilated and traditional) under study. The average temperature ranged from 4.0 to 5.8, 30.0 to 33.2 and 18.4 to 34.8 °C for the cold storage, ventilated and traditional storage systems, respectively. It can be seen that the temperature in the traditional system fluctuated from 34 °C during the day time to less than 18 °C during the night time and relative humidity ranged from 26.1 to 99.8 %. The relative humidity values ranged from 25.3 to 61.1, 43.2 to 58.7 and 26.1 to 99.8 %, for the same pervious order during the storage period.

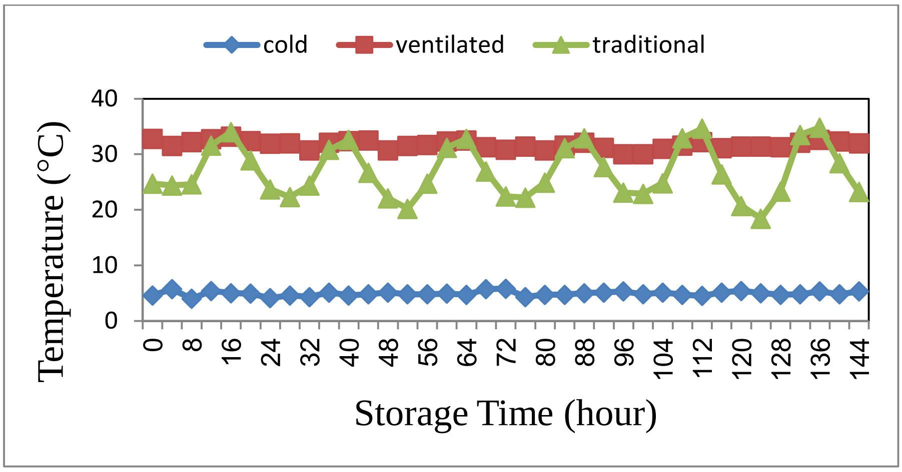


**Figure 1:** The average temperature for the storage systems.

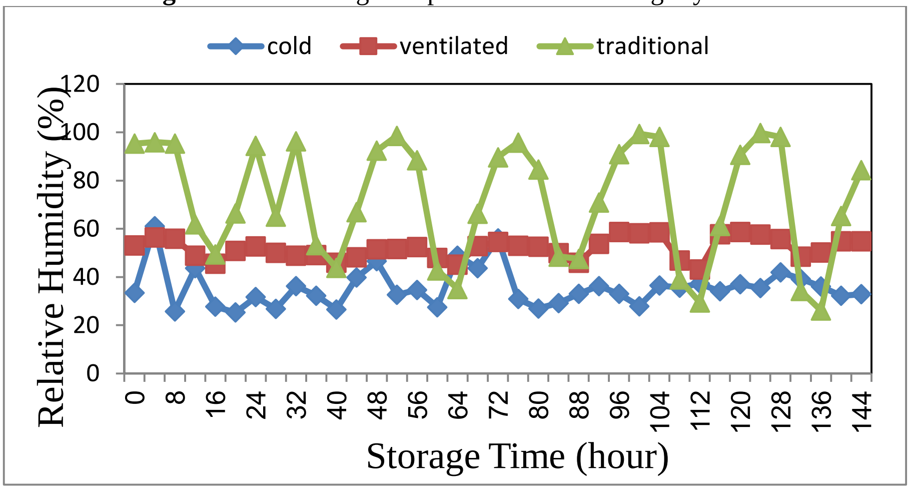


**Figure 2:** The average relative humidity for the storage systems.

### 3.2. Effect of storage conditions and packaging type on accumulated weight loss of okra pods.

Figures (3a, b and c) show the effect of different storage systems (cold, ventilated and traditional) and different packages (clothes, paper and plastic) on the accumulated weight loss of okra. The results indicated that the accumulated weight loss of okra pods increases with increasing storage period, where, it increased from 39.60 to 86.00, 10.67 to 58.17, 14.67 to 65.50 and 17.00 to 73.67 % for okra pods stored in without (control), clothes, paper and plastic packages, respectively under traditional storage system, when the storage period increased from 3 to 12 day, respectively. While, it increased from 37.41 to 84.37, 18.83 to 80.33, 13.33 to 63.17 and 22.83 to 83.17 % for okra pods stored in without (control), clothes, paper and plastic packages, respectively under ventilated storage system, when the storage period increased from 3 to 12 day, respectively. Also, it increased from 10.53 to 68.68, 2.93 to 33.03, 5.33 to 36.77 and 3.33 to 50.83 % for okra pods stored in without (control), clothes, paper and plastic packages, respectively under traditional storage system, when the storage period increased from 3 to 18 day, respectively. Generally, the higher storage temperature, the higher vapor pressure deficit, the higher weight losses of fruits. These results were in agreement with those obtained by **Khater and Bahnasawy (2016)**.

The results indicated that the highest value of accumulated weight loss in okra pods was 86.00 % was found for without packages (control) under traditional storage system, while, the lowest value of accumulated weight loss in okra pods was 33.03 % was found for clothes packages under cold storage system. These results were in agreement with those obtained by **Khater and Bahnasawy (2018)**.

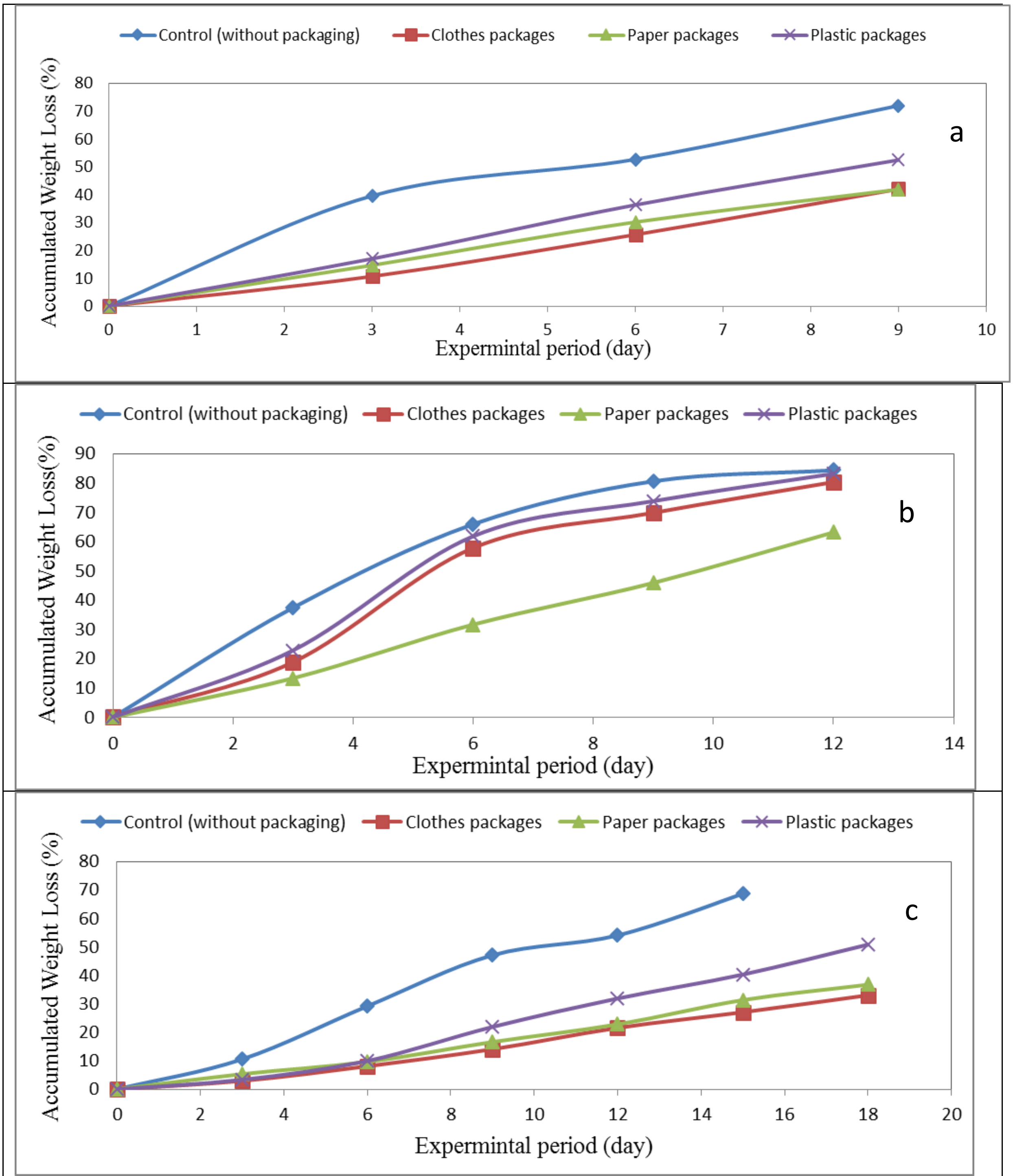


Figure (3): The effect of storage temperature and packages on the accumulated weight loss of green beans pods.
a: Traditional system b: Ventilated system c: Cold system

Regression analysis was carried out to find a relation between the accumulated weight loss and both storage systems and packages type. Equation (2) shows the most appropriate form for the relationship between the accumulated weight loss and packages type at different storage systems. The constants of these equations and coefficient of determination are listed in Table (2).

$$WL = a + bT$$

Where:-

WL is the accumulated weight loss of okra (%)

T is the storage period (day)

**Table 2.** The constants a, b, c and coefficient of determination for accumulated weight loss at the different storage systems and the different packages type.

| Storage system | Packages Type | Constants a | Constants b | $R^2$ |
|---|---|---|---|---|
| Traditional | Control | 9.18 | 6.81 | 0.95 |
| | Clothes | 0.99 | 4.92 | 0.99 |
| | Paper | 1.19 | 5.27 | 0.99 |
| | Plastic | 0.67 | 6.09 | 0.98 |
| Ventilated | Control | 11.28 | 7.06 | 0.94 |
| | Clothes | 3.03 | 7.06 | 0.95 |
| | Paper | -0.97 | 5.29 | 0.99 |
| | Plastic | 4.87 | 7.24 | 0.94 |
| Cold | Control | -0.75 | 4.82 | 0.98 |
| | Clothes | -1.52 | 1.81 | 0.98 |
| | Paper | -0.50 | 1.89 | 0.99 |
| | Plastic | -3.06 | 2.75 | 0.96 |

**3.3. Effect of storage conditions and packaging type on moisture loss of okra pods**.

Figures (4a, b and c) show the effect of different storage systems (cold, ventilated and traditional) and different packages (clothes, paper and plastic) on the moisture loss of okra. The results indicated that the moisture loss of okra pods decreases with increasing storage period, where, it decreased from 86.00 to 14.00, 58.17 to 16.17, 65.50 to 14.67 and 73.67 to 21.20 % for okra pods stored in without (control), clothes, paper and plastic packages, respectively under traditional storage system, when the storage period increased from 3 to 12 day, respectively.

In the ventilated system, the moisture content decreased from 84.37 to 3.77, 80.33 to 10.50, 63.17 to 17.27 and 83.17 to 9.33 % for okra pods stored in without (control), clothes, paper and plastic packages, respectively when the storage period increased from 3 to 12 day, respectively. Also, it decreased from 68.68 to 14.61, 33.03 to 5.97, 36.77 to 5.43 and 50.83 to 10.53 % for okra pods stored in without (control), clothes, paper and plastic packages, respectively under traditional storage system, when the storage period increased from 3 to 18 day, respectively.

Concerning the effect of package type, under the cold storage system, the highest value of moisture loss (14.61 %) was recorded by the okra pods stored for without packages (control) while the lowest value of moisture loss (5.43 %) was recorded for the garlic stored in paper packages. At the ventilated storage system, the highest value of moisture loss (17.27 %) was recorded for the garlic stored in paper packages while the lowest value of moisture loss (3.77 %) was recorded by the okra pods stored for without packages (control). At the traditional storage system, the highest value of moisture loss (23.60 %) was recorded for the garlic stored in paper packages while the lowest value of moisture loss (14.00 %) was recorded by the okra pods stored for without packages (control).

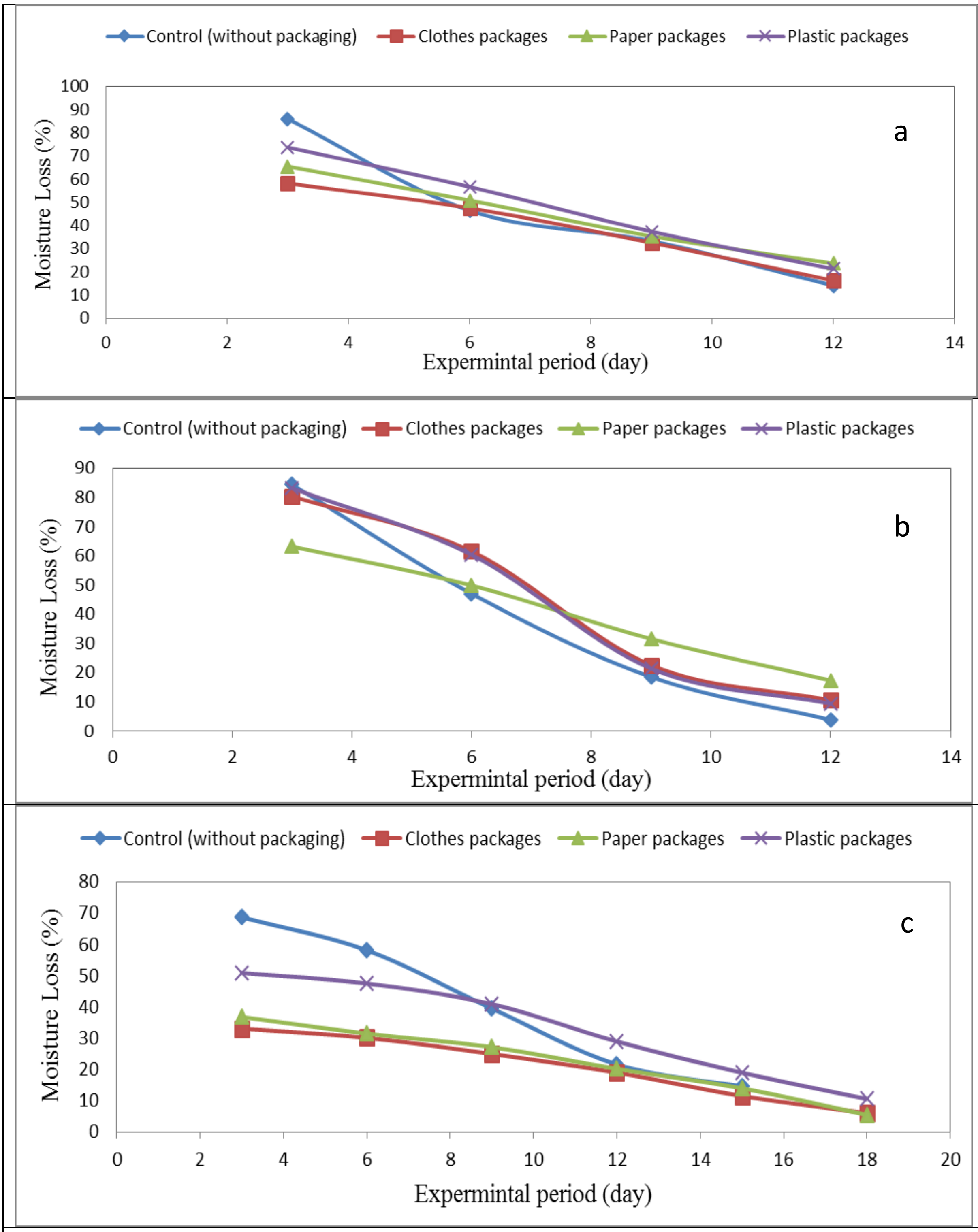


Figure (4): The effect of storage temperature and packages on the accumulated weight loss of green beans pods.
a: Traditional system b: Ventilated system c: Cold system

Regression analysis was carried out to find a relation between the moisture loss and both storage systems and packages type. Equation (3) shows the most appropriate form for the relationship between the moisture loss and packages type at different storage systems. The constants of these equations and coefficient of determination are listed in Table (3).

$$ML = a + \mathrm{b}T$$

Where:-

ML is the accumulated weight loss of okra (%)

**Table 3.** The constants a, b, c and coefficient of determination for moisture loss at the different storage systems and the different packages type.

| Storage system | Packages Type | Constants | | $R^2$ |
|---|---|---|---|---|
| | | a | b | |
| Traditional | Control | 102.22 | -7.64 | 0.94 |
| | Clothes | 73.86 | -4.77 | 0.99 |
| | Paper | 79.12 | -4.71 | 0.99 |
| | Plastic | 91.40 | -5.89 | 0.99 |
| Ventilated | Control | 105.97 | -9.01 | 0.97 |
| | Clothes | 105.83 | -8.28 | 0.96 |
| | Paper | 79.45 | -5.20 | 0.99 |
| | Plastic | 108.67 | -8.68 | 0.97 |
| Cold | Control | 77.37 | -3.84 | 0.92 |
| | Clothes | 38.08 | -1.49 | 0.99 |
| | Paper | 40.77 | -1.55 | 0.98 |
| | Plastic | 59.27 | -2.27 | 0.97 |

### 3.4. Effect of storage system and packaging type on the chemical composition of okra before and after storage

Table 5 shows the effect of storage system and package type on the chemical composition of garlic before and after storage. The results indicate that the ash was increased from 11.96 to 23.31, 11.96 to 20.52, 11.96 to 21.60 and 11.96 to 21.60 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the traditional storage system at the end of period storage. In the ventilated storage, the ash was increased from 11.96 to 22.95, 11.96 to 20.66, 11.96 to 21.93 and 11.96 to 21.46 % for okra stored in without package (control) clothes, paper and plastic packages, respectively, at the end of period storage. While, it was increased from 11.96 to 21.77, 11.96 to 20.89, 11.96 to 20.13 and 11.96 to 21.76 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the cold storage system at the end of period storage.

**Table 5.** The effect of storage system and package type on the chemical composition of garlic before and after storage.

| Storage System | Package Type | Chemical Composition, % | | | | |
|---|---|---|---|---|---|---|
| | | Ash | Protein | Nitrogen | Fiber | Fat |
| Before storage | | 11.96 | 6.66 | 1.27 | 18.78 | 9.34 |
| Traditional | Control | 23.31 | 13.05 | 2.49 | 13.11 | 6.78 |
| | Clothes | 20.52 | 10.98 | 2.09 | 11.61 | 5.17 |
| | Paper | 21.60 | 12.17 | 2.32 | 12.54 | 6.34 |
| | Plastic | 21.20 | 11.33 | 2.19 | 12.30 | 5.13 |
| Ventilated | Control | 22.95 | 11.27 | 2.15 | 15.24 | 6.39 |
| | Clothes | 20.66 | 10.82 | 2.06 | 14.18 | 5.50 |
| | Paper | 21.93 | 9.26 | 1.76 | 14.60 | 5.50 |
| | Plastic | 21.46 | 9.16 | 1.74 | 12.63 | 6.05 |
| Cooled | Control | 21.77 | 11.01 | 2.09 | 16.17 | 5.65 |
| | Clothes | 20.89 | 11.21 | 2.14 | 15.19 | 5.02 |
| | Paper | 21.13 | 9.26 | 1.76 | 15.46 | 5.50 |
| | Plastic | 21.76 | 10.47 | 1.99 | 14.35 | 4.37 |

The results also indicate that, the protein was increased from 6.67 to 13.05, 6.67 to 10.98, 6.67 to 12.17 and 6.67 to 11.33 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the traditional storage system at the end of period storage. In the ventilated storage, the protein was increased from 6.67 to 11.27, 6.67 to 10.82, 6.67 to 9.26 and 6.67 to 9.16 % for okra stored in without package (control) clothes, paper and plastic packages, respectively, at the end of period storage. While, it was increased from 6.67 to 11.01, 6.67 to 11.21, 6.67 to 9.26 and 6.67 to 10.47 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the cold storage system at the end of period storage.

The result revealed that the nitrogen (N) was increased from 1.27 to 2.49, 1.27 to 2.09, 1.27 to 2.32 and 1.27 to 2.19 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the traditional storage system at the end of period storage. In the ventilated storage, the nitrogen (N) was increased from 1.27 to 2.15, 1.27 to 2.06, 1.27 to 1.76 and 1.27 to 1.74 % for okra stored in without package (control) clothes, paper and plastic packages, respectively, at the end of period storage. While, it was increased from 1.27 to 2.09, 1.27 to 2.14, 1.27 to 1.76 and 1.27 to 1.99 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the cold storage system at the end of period storage.

The fiber was decreased from 18.78 to 13.11, 18.78 to 11.61, 18.78 to 12.54 and 18.78 to 12.30 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the traditional storage system at the end of period storage. In the ventilated storage, the fiber was decreased from 18.78 to 15.24, 18.78 to 14.18, 18.78 to 14.60 and 18.78 to 12.63 % for okra stored in without package (control) clothes, paper and plastic packages, respectively, at the end of period storage. While, it was decreased from 18.78 to 16.17, 18.78 to 15.19, 18.78 to 15.46 and 18.78 to 14.35 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the cold storage system at the end of period storage.

The fat was increased from 9.34 to 6.78, 9.34 to 5.17, 9.34 to 6.34 and 9.34 to 5.13 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the traditional storage system at the end of period storage. In the ventilated storage, the fat was increased from 9.34 to 6.39, 9.34 to 5.50, 9.34 to 5.50 and 9.34 to 6.05 % for okra stored in without package (control) clothes, paper and plastic packages, respectively, at the end of period storage. While, it was increased from 9.34 to 5.65, 9.34 to 5.02, 9.34 to 5.50 and 9.34 to 4.37 % for okra stored in without package (control) clothes, paper and plastic packages, respectively under the cold storage system at the end of period storage.

## Conclusions

An experimental study was carried out successively to study the effect of storage system and package type on the quality of okra during storage. The obtained results can be summarized as follows:

- The highest value of accumulated weight loss (86.00%) was recorded by the okra pods stored without packages (control) for the okra stored in the traditional system, while the lowest value of accumulated weight loss (33.3%) was recorded for the okra stored in clothes package for the cold systems.
- The highest value of moisture loss was recorded by the okra pods stored without packages, while the lowest value of moisture loss was recorded for the okra stored in without packages.
- The ash, protein, nitrogen and fat composition were increased with increasing storage period for different storge system and package types.
- The fiber composition was decreased with increasing storage period for different storge system and package types.

## References


**Anonymous, 2004.** Annual report of punjab horticultural postharvest technology centre. P. A. U, Ludhiana.

**AOAC (Official Methods of Analysis), 1990.** Association of official analytical chemists. 5th Edt., 1990 Pub. by the Association of Official Analytical Chemists, Suite 400.

**Bauchmann J. and Earles R., 2000.** Postharvest handling of fruits and vegetables. Appropriate Technology Transfer for Rural Areas (ATTRA). ATTRA Horticulture Technical Note. p. 19 (http://www.attra.ncat.org).

**Boonyaritthongchai, P., Srilaong V., Wongs-Aree C. and Techavuthiporn C., 2013.** Effect of methyl jasmonate on reducing chilling injury symptom and maintaining postharvest quality of okra (*Hisbiscus esculentus* L.). Vii International Postharvest Symposium. 1012: 1119-1124.

**Bremmer, J.M. and Mulvaney, C.S., 1982.** Nitrogen-total. In: Page, A.L., Miller, R.H., Keeney, D.R. (Eds.), Methods of Soil Analysis, Part 2. Chemical and Microbiological Properties, second ed., Agronomy series No. 9 ASA, SSSA, Madison, WI, pp. 595–624.

**Cantwell M. and Trevor S., 2002.** Recommendations for maintaining postharvest Quality. Department of Vegetable Crops, University of California, Davis, CA 95616. www.Santacruzwebdesign.com

**Chapman, H.D. and Partt, F.P., 1961.** Methods of analysis of soils, plant and water. Cal. Univ., 150-200.

**Heyes J., 2004.** Parsley. New Zealand institute for crop and food research, Palmerston North. www.ba.ars.usda.gov/hb66/102/parsley.pdf

**Huang, H. and Jiang Y., 2012.** Effect of plant growth regulators on banana fruit and broccoli during storage. Sci. Hort. 145: 62–67.

**Khater E.G. and Bahnasawy A.H., 2018.** Effect of Storage temperature and Packages Type on The Self life and Quality of Green Beans. The 4th International Conference on Biotechnology Applications in Agriculture (ICBAA), Benha University, Moshtohor and Hurghada, 4-7 April 2018, Egypt, 663 -670.

**Khater, E.G. and Bahnasawy A.H., 2016.** Watermelon fruits properties as affected by storage conditions. Misr Journal of Agricultural Engineering 33, 101 – 122.

**Murphy, J. and Riley, J.P., 1962.** A modified single solution method for determination of phosphate in natural waters. Anal. Chem. Acta 27, 31–36.

**Ngure, J.W., Aguyoh J.N. and Gaoquiong L., 2009.** Interactive effects of packaging and storage temperatures on the shelf-life of okra. Journal of Agricultural and Biological Science, 4(3): 44-49.

**Perkins-Veazie, P.M. and Collins J.K., 1992.** Cultivar, packaging and storage temperature difference in storage temperature differences in postharvest shelf life of okra. Hort. Technology. 2: 350-352.

**Salunkhe D.K. and Desai B.B., 1984.** Post-harvest biotechnology of fruits. Vol. 1. CRC. Press Inc., Boca Raton. Florida.

**تأثير ظروف التخزين ونوع العبوات على العمر التخزينى وجودة البامية**

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يهدف هذا البحث الى دراسة تأثير ظروف التخزين ونوع العبوات على جودة البامية أثناء التخزين. وقد تم تقدير الفاقد الكلى فى الوزن والمحتوى الرطوبى اثناء التخزين. وكذلك تم تقدير التركيب الكيميائى قبل وبعد التخزين. وقد اظهرت النتائج ان الفاقد التركمى فى الوزن لقرون البامية زاد بطول فترة التخزين وكان لنظام التخزين تأثير واضح على الفاقد فى الوزن حيث كان اعلها النظام التلقيدى (86.00%) مقارنة بالانظمة الاخرى كانت 84.37 و68.68 % لنظامى التخزين المهوى والمبرد على الترتيب. كان للعبوات تأثير على الفاقد فى الوزن التراكمى حيث كانت اقلها للعبوات القماش (33.03%) للتخزين المبرد واعلاها بدون العبوات (86.00%) للتخزين التقليدى. كانت اعلى قيمة للفقد فى المحتوى الرطوبى لقرون البامية المخزنة بدون عبوات فى النظام التقليدى واقلها لقرون البامية المخزنة بدون عبوات فى النظام المبرد. زاد كلا من محتوى الرماد والبروتين والنيتروجين والدهن بعد فترة التخزين لقرون البامية عن المحتوى قبل التخزين لمختلف نظم التخزين مختلف العبوات، بينما قل محتوى الفيبر لقرون البامية بعد التخزين لنفس الظروف.

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