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Effect of some Treatments on Chemical Composition and Quality Properties of Saidy Date Fruit (*Phoenix dactylifera L.)* During Storage

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Abstract

This study was conducted out to improve the quality and the shelf-life of Saidy date variety during storage period for 12 months at room temperature using packing under vacuum, drying and irradiation (1KGy) treatments. Results showed that packing under vacuum is more effective for controlling the insect infestation (3.85%) followed by the irradiated (11.12%), dried (12.11%). While, the control sample recorded 17.24%, at the end of storage time (12 months). The moisture content of the control date sample decreased from 15.23 to 9.29% at the end of storage while it was decreased from 15.23 to 9.67%, from 15.15 to 8.92% and from 15.80 to 9.67% for the packed under vacuum, dried and irradiated samples, respectively. Data showed that, during the storage periods (12-months), the protein contents reduced from 2.52 to 1.97%, from 2.52 to 2.02%, from 2.57 to 2.15% and from 2.45 to 2.09% for the control, packed under vacuum, dried and irradiated samples, respectively. Data revealed that total bacterial counts immediately decreased after irradiation and drying to a greater extent, compared to the reduction in molds and yeasts. Beside, the microbial flora in all treatments remained at low count until the end of storage period. The irradiated sample had the lowest microbial counts, followed by the packed under vacuum and dried samples. The organoleptic evaluations show that the panelist could not discriminate between the non-irradiated and irradiated date fruits. Furthermore, all treatments have no detectable adverse effect on the preference rating of the fruits. The irradiated samples were occupied the first rank in overall acceptability of sensory evaluation followed by the dried and packed under vacuum samples. These results suggest that packing under vacuum, drying and irradiation treatments of Saidy date fruit could be used as alternative methods for improving the fruit quality, as well as prolonging its marketable period at room temperature for 12 months or more.

Key words: *Saidy, Storage, Packing under vacuum, Drying, Irradiation, 12 months, Room temperature, Chemical composition, Physical characters, Microbial counts.*

Introduction

Date palm (*Phoenix dactylifera* L.) is one of the most important plants of the arid desert area of the Middle East, Southern Asia and Northern Africa for over 5000 years (Selim *et al*., 2012). The world production of dates increased considerably during the last 30 years. The Arab countries produce about 74.5% of global date production. Egypt considered as the first country of the top ten date producers in world (1,501,799 tons), followed by Iran (1,083,720 tons) and Saudi Arabia (1,065,032 tons) (FAO, 2015).

Storage of dates at high temperature and high humidity renders them susceptible to insect infestation and microbiological harmful causing extensive losses in storage dates (Azelmat *et al*., 2006). Methyl bromide is the main fumigant used for the treatment of stored products still available. Due to its adverse effect on human health and environment, it has been identified as an ozone-depleting substance by the Montreal Protocol (UNEP, 1992). Its restricted use and anticipated phasing out by around 2010 (Patil *et al*., 2004) highlights the urgency for an alternative treatment (Ahmed, 2001). Currently, dates are preserved by many other methods. The other methods of preservation are too expensive and would need careful consideration (Navarro *et al*., 2000).

The vacuum packaging of natural dates is the most adapted to better protection of the product against yeast and mold proliferation and against dehydration (Achour *et al*., 2003). Michalczyk *et al*. (2009) and Borchani *et al*. (2011) reported that drying is much more effective in preserving valuable food compounds than traditional methods.

Irradiation is one of the safest and most economical ways of food preservation. Gamma radiation treatment has been approved by international bodies; FAO, IAEA and WHO in 1981, and most of the products irradiated with gamma rays at doses ranging from 1 to 10 kGy. Losses of nutritional value are minimal as the irradiation treatment does not increase the temperature of the food than in canning, drying, pasteurization or sterilization (Joshi *et al*., 2011).

The quality and extending the shelf life of fresh dates can be improved by using some treatments. Besides, this can contribute to improve economical status of this food material, thereby increasing the income and foreign exchange of the country (Ud Din *et al*., 2011). Therefore, the aim of this study is to investigate the effects of packing in vacuum, drying and irradiation treatments on the chemical composition, quality properties and the shelf life of Saidy date fruits during storage for twelve months at room temperature.

Materials and Methods

Materials

Saidy date fruit was obtained from El-Tahan Date Packing Factory, Kharja oasis, The New-Valley governorate, Egypt during the 2014 season.

Treatments

Packing under vacuum

Date fruits were packaging in polyethylene bags (½ Kg) and scaled using under vacuum packing machine model M2 Pack 603.

Drying

Date fruits washed by tab water and then heated in the oven at 65°C for 3 h. After heat treatment, the fruits were cold on the air and packaged in polyethylene packages (¼ Kg) for storage for 12 months at 25±5ºC and evaluation.

Irradiation

Date fruits irradiation was carried out in the National Center for Radiation Research and Technology (NCRRT), Cairo, Egypt using Co60 facility "Indian Gamma cell" type Ge-4000A. The applied dose was 1KGy delivered at a dose rate of 2.08KGy per hour at the time of experimentation.

Physical analysis

Date fruit properties: Saidy date fruits were evaluated for: fruits number per kg, mean weights of fruit, flesh, pit and calyx, flesh/pit ratio, percent of flesh and pits, percent of fruit infestation, fruit dimensions (length and width at maximum circumference).

Total soluble solids (TSS): The TSS was estimated by the method described by Abdel-Hafiz *et al*. (1980).

pH value: The pH value was measured by using a Systronic 324-combination glass electrode pH meter at 25°C.

Color: Color was determined as the optical density (OD) of the diluted and centrifuged extract of fruit flesh (5% TSS) and the absorbance was measured at 400nm using Perkin Elmer Lambda, UV/VIS Spectrophotometer (Abd-Ellah, 2009).

Chemical analysis

The moisture content was determined by drying the samples at 70°C. Sugars **(**reducing and total), crude fiber, crude protein, crude fat and ash were determined according to AOAC (2000) methods.

Acidity was determined as malic acid by titration, according to Dalaly and Al-Hakiem (1987). The mineral content of date fruits flesh was estimated according to AOAC (2000) methods. Potassium and sodium were determined using Flame photometric (410). Calcium, manganese, magnesium, copper, iron and zinc were determined using Perkin-Elmer Atomic Absorption Spectrophotometer 2380. Phosphorus was determined by Spectrophotometer Philips PV 8650.

Total phenolic compounds of date fruits were determined using Folin- ciocalteu reagent according to Velioglu *et al*. (1998). Total phenolic contents (mg/100g) were expressed as gallic acid equivalent (Asami *et al*., 2003).

Antioxidant capacity: Free radical scavenging activity of date fruits extract was determined using the 1, 1-diphenyl-2-picrylhydrazyl (DPPH) method (Ao *et al*., 2008).

$$\text{DPPH radical scavenging \%} = \frac{\text{OD control} - \text{OD sample}}{\text{OD control}} \times 100$$

The calorific value was calculated using the Alwater Factor (Joint FAO/WHO, 1973).

Microbial evaluation

The total bacterial counts were determined using the plate counts technique on a nutrient agar medium according to procedures by A.P.H.A (1976) and Difco (1984). The plates were incubated at 37°C for 48 h. Yeast and mold counts were determined using the plate counts technique on potato dextrose agar (PDA) according to procedures by A.P.H.A (1976) and Difco (1984). The plates were kept between 3 and 5 days depending on the type of fungi at 25-28 ºC.

Sensory evaluation: Saidy date fruits and its treatments were sensory evaluated. The quality attributes, including color, texture, taste, appearance and overall acceptability were evaluated by a trained panel according to Molander (1960).

Statistical analysis: Data were statistically analyzed using the analysis of variance (ANOVA) and the differences among the means were determined for significance at 5% level

by using the MSTAT computer program (MSTAT -C 1989).

Results and Discussions

Physical characteristics of date fruit

Saidy date fruits at Tamr stage were evaluated for their fruits number (86/ Kg), average weight of fruit (11.62g) and pit (1.48g), percentage of flesh (86.28%), total soluble solids (88.38%) and insect infestation percentage (3.48%)(Table 1). Data of physical measurements are in the same ranges reported by other researchers (Ramadan, 1990 and 1995, Abd-Ellah, 2009 and Selim *et al.,* 2012). Variation in the physical properties of the same date variety grown in different regions can be attributed to several factors such as soil, fertilization and other environmental conditions (Ramadan, 1995 and Selim *et al*., 2012).

Table 1. Physical characteristics of Saidy date fruits:

characteristics	
Fruits number/ Kg	86
Fruits weight	11.62g
Flesh weight	10.02g
Pit weight	1.48g
Calyx weight	0.12g
Flesh/pits ratio	6.77
Flesh	86.28%
Pit	12.77%
Calyx	0.95%
Insect infestation	3.48%
TSS	88.38%
pH value	6.72
Color (at 400nm as OD)	0.449

Chemical composition

The results in Table 2 show the proximate analysis of Saidy date fruits at Tamr stage**.**

The moisture, sugars (total and reducing), crude fiber, crude protein, ash and crude fat contents were 15.23, (77.93 and 74.10), 2.52, 2.52, 2.17 and 1.49%, respectively. This data are in agreement with that reported by Ben Lambiote(1983), Youssef *et al*. (1989), Abd-Ellateaf (1991), Ramadan (1995), Al-Hooti *et al*. (1995), Nezam El-Din (1995), Youssef *et al.* (1998), Assous (1999), Khalil *et al*. (2002), Elleuch *et al.* (2008), Abd-Ellah (2009), Hasnaoui *et al*. (2010) and Borchani et al. (2010). Besides, the results are in the same line with that recorded by Ramadan (1990), Khalil (1995), Al-Farsi *et al*. (2005a), Ismail *et al.* (2006) and Selim *et al*. (2012).

The reducing sugars represented 95.08% of the total sugars at Tamr stage; this could be due to the effect of the invertase activity on the non-reducing sugars during ripening. Results in the Table (2) illustrated that the calorific value of Saidy date fruits was (335.21 Cal. /100g). These results are in the same trend with those recorded by Hussein *et al.* (1979), El-Shamery (1988) and Ramadan (1990 and 1995). Due to the notion that sugars were the predominat constituent of dates, there is a mutual relationship between calorific value and sugar content. This worth noting makes date to be a preferable main food-stuff for the mob especially during the holy fasting month (Ramadan) and those attaining hard works (Ramadan, 1995).

Table 2. Chemical composition of Saidy date fruits (% dry weight basis):**

Components	%
Moisture*	15.23
Total solids	84.77
Total sugars	77.93
Reducing sugars	74.10
Non-reducing sugars	3.83
Crude fiber	2.52
Crude protein	2.52
Ash	2.17
Crude fat	1.49
Calorific value (Cal/100g)	335.21
Total phenolic content (mg/100g)	297.37
Antioxidant activity*	25.57

* On fresh weight basis
** Means of triplicates

Date in Table 2 recorded that Saidy date flesh contained total phenolic content 297.37 mg as gallic acid/100 g on dry basis. This result is in accordance with those reported by Al-Farsi *et al.* (2005b), Benmeddour *et al.* (2006) and Saleh *et al*. (2011). Louaileche *et al*. (2015) found that the total phenolic contents of eight date varieties ranged from 169.18 to 381.76 mg GAE/100g dwb. The results also showed that antioxidant activity of Saidy date fruits was 25.57% (on fresh weight basis).

Minerals content

Results of the average values of the macro-elements and micro-elements of Saidy date fruits are shown in Table (3).

Potassium was the predominat element present of Saidy date fruits (545.88 mg/100g) followed by calcium (76.15 mg/100g) and phosphorus (70.50 mg)/100 g dry basis (Table 3). The data are in the same line with those reported by Morton and Miami (1987), El-Shamery and El-Dien (1988), Ramadan (1990 and 1995), Al-Hooti *et al*. (1997), Youssef *et al*. (1998), Fadhl *et al.* (1999), Sahari *et al.* (2007) and El-Sohaimy and Hafez (2010). The same data revealed that Saidy date flesh contained 57.70 mg magnesium and 38.41 mg sodium /100 g dry matter which are in accordance with that reported by Ahmed *et al*. (1995); Al-Hooti *et al*. (1995), Fadhl *et al.* (1999), Hassan (2000) and Sahari *et al*. (2007).

Table 3. Minerals content of the Saidy date fruits:

Element		mg/100g (dwb)
Macro elements	Potassium (K)	545.88
	Calcium (Ca)	76.15
	Phosphorus (P)	70.50
	Magnesium (Mg)	57.70
	Sodium (Na)	38.41
Micro elements	Iron (Fe)	6.27
	Copper (Cu)	1.06
	Manganese (Mn)	1.77
	Zinc (Zn)	1.02

Among the micro-elements (Table 3) iron was the predominat element present of Saidy date fruits (6.27 mg/100g on dry weight basis). The levels of Cu, Mn and Zn were 1.06, 1.77 and 1.02 mg/100g dwb of Saidy flesh, respectively. Saidy fruits recorded micro-elements levels ran with those reported by Sawaya *et al*. (1983), BA-Angood *et al.* (1984), Morton and Miami (1987), Ahmed *et al*. (1995), Al-Hooti *et al.* (1995), Youssef *et al.* (1998), Fadhl *et al.* (1999) and Hasnaoui *et al*. (2010).

Effect of packing, drying and irradiation treatments on physical characters of Saidy fruits during storage:

During the storage period (12 months) the pH value decreased from

6.72 to 5.41%, from 6.72 to 5.35%, from 6.69 to 5.29 and from 6.69 to 5.47% for the control, packaged under vacuum, dried and irradiated samples, respectively (Table 4). Benjamin *et al.* (1985) found that there were a relationship between the enzymes activity in date fruits and into pH value and color.

Table 4. Effect of treatments on physical characteristics of Saidy date fruits during storage period at room temperature:

Treatment	Storage time month	physical characteristics		
		pH value	Insect infestation (%)	Color (OD)
Control	0	6.72^{a}	3.48^{h}	0.449^{l}
	4	6.34^{b}	11.11^{d}	0.652^{h}
	8	5.69^{e}	14.29^{b}	0.872^{d}
	12	5.41^{h}	17.24^{a}	1.084^{a}
Packing under vacuum	0	6.72^{a}	3.48^{h}	0.449^{l}
	4	6.30^{bc}	0^{j}	0.635^{i}
	8	5.61^{f}	3.71^{gh}	0.773^{f}
	12	5.35^{i}	3.85^{g}	0.963^{c}
Drying	0	6.69^{a}	2.91^{i}	0.471^{k}
	4	6.18^{d}	3.84^{g}	0.707^{g}
	8	5.58^{f}	6.17^{f}	0.840^{e}
	12	5.29^{j}	12.11^{c}	1.004^{b}
Irradiation	0	6.69^{a}	0^{j}	0.434^{l}
	4	6.28^{c}	3.57^{h}	0.571^{j}
	8	5.73^{e}	7.35^{e}	0.722^{g}
	12	5.47^{g}	11.12^{d}	0.857^{d}

- Any letters charing the same symbol, have no significant difference in between.

From the data in Table 4 it was clear that the infestation percentage was 3.48% in fruits at zero time (control) and decreased up to zero after radiation process and after storage for 4 months of the packaged under vacuum date samples. While the dehydration led to decrease the insect infestation up to 2.91% compared that for the control (untreated sample). However, results showed that packing under vacuum is more effective for controlling the insect infestation (3.85%) of stored dates followed by the irradiated (11.12%), dried (12.11%). While, the control sample recorded 17.24%, which was stored in the same place and storage time (12 months). These results are in the same trend with those recorded by Emam *et al*. (1994) and Al-Kahtani *et al*. (1998).

Results in Table 4 observed that there is an increase in color intensity (as OD) of the studied date samples during storage periods. However, the treatments recorded a good effect against fruit color darkening, especially the irradiated followed by the packaged under vacuum and the dried

samples during storage periods compared with the control sample. The increase in fruit color intensity during storage probably due to tannins oxidation as recorded by Mohamed (2000). The pigments degradation associated with postharvest physiological reactions also influence the color stability.

Effect of packing, drying and irradiation treatments on chemical composition of Saidy fruits during storage:

The consumer's interest was mainly focused on the nutritional properties of the product. To draw up a date quality profile will, therefore, involve an evaluation of gross chemical composition as well as total phenolic content and antioxidant activity were determined (Table 5).

The results indicated that the maximum decrease in the moisture contents was found during 0-4 months of storage time found to be 20.02, 12.41, 24.29 and 24.24% after 4 months. While, it was 39, 36, 41 and 38% in the storage period end for the untreated, packaged under vacuum, dried and irradiated samples, respectively. The dry matter content increase in both irradiated and non-irradiated dates might be a direct consequence of evaporation after storage for several months under ambient temperature (Azelmat *et al.,* 2006). Dates of over 24% moisture in a warm moist atmosphere were an easy target for microbial attack Barreveld (1994).

The total and reducing sugars on the control, packed under vacuum, dried and irradiated date samples increased gradually with increasing storage time (Table 5). The highest levels of sugars were obtained at the end of storage period in the control followed by the packing under vacuum, drying and irradiation treatment samples. The increase in storage time cause a decrease in starch contents in both irradiated and non-irradiated dates (Azelmat *et al*., 2006). On the other hand, Thomas (1986) reported that radiolytic products of carbohydrates could be formed when foods treated with ionizing energy; such products include glucuronic, gluconic, and saccharic acid, glyoxal, arabinose, erythrose, formaldehyde, and dihydroxyacetone. These resulted also in agreement with Al-Kahtani *et al.* (1998). They reported that irradiation at doses between 0.3 and 0.9 kGy, followed by 3 or 6 months storage at room temperature, significantly reduced fructose, glucose and total sugars content of dates (Khalas variety) immediately after irradiation.

The protein contents decreased from 2.52 to 1.97%; from 2.52 to 2.02%; from 2.57 to 2.15 and from 2.45 to 2.09% for the control, packed under vacuum, dried and irradiated samples, respectively at the end of storage. The maximum decreases in protein levels were found after the first 4 months of storage followed by a slowly decrease. The highest decrease was found in the control and vacuum samples while there was no difference between the dried and irradiated samples. The results are in close agreement with that reported by Khan *et al.* (1985).

Ihsanullah *et al.* (2005) reported that the irradiation up to 300Krads had no significant effect of the protein content of the irradiated date samples. Auda *et al*. (1977) reported

that the protein content of three Iraqi date varieties was not affected by irradiation at 0.7–2.7 kGy.

Results (Table 5) showed that the fiber content of the studied date samples was reduced during storage up to 12- months at room temperature. Data are in agreement with that reported by Ihsanullah *et al*. (2005). Mohammadzai *et al.* (2010) investigated the influence of various doses of gamma irradiation up to 300Krads of date fruit and reported that the fiber levels decrease gradually in all samples in irregular pattern.

The ash content of the studied date samples was decrease unnoticeable during 12- months of storage (Table 5). Stewart (2001) reported that irradiation does not alter the elemental composition of food.

The crude fat content was reduced from 1.49 to 0.86, from 1.49 to 0.89, from 1.46 to 0.78 and from 1.48 to 0.84% in the control, packed under vacuum, dried and irradiated date samples, respectively from 0 to 12 months of storage. Ihsanullah *et al.* (2005) studied the effect of various irradiation doses on fat content of Pakistani dates, found that after 5 months of storage the fat levels were decreased in all treatments.

During the storage period (12 months) the acidity increased from 0.168 to 0.377%, from 0.168 to 0.370%, from 0.173 to 0.351 and from 0.171 to 0.362% for the control, packed under vacuum, dried and irradiated samples, respectively.

The total phenolic content increased up to 4 months of storage in all studied samples followed by decrease up to the end of storage period (Table 5). The packaged date fruits under vacuum recorded the lowest decrease in total phenolic content (2.7%) followed by the dried (3.9%) and irradiated samples compared the untreated sample after 12-monthsof storage. Bravo (1998) has attributed the losses in phenolic content to binding of polyphenols with other organic substances such as carbohydrate or protein. The polyphenol oxidase enzyme may be activated, resulting in degradation and consequent losses of polyphenols (Jood *et al*., 1998, Saxena *et al.,* 2003 and Selim *et al*., 2012).

The data (Table 5) also, showed a good correlation between total phenolic content and antioxidant activity. This correlation indicated that phenolic compounds are the main micro constituents contributing to the antioxidant activity of date as reported by Kchaou *et al.* (2013).

Effect of packing, drying and irradiation treatments on the total microbial of the Saidy fruits during storage:

Results presented in Table 6 showed that total bacterial counts were reduced immediately after irradiation and drying to a greater extent, compared to the reduction in molds and yeasts. Since the laters are generally less sensitive to irradiation (Jay, 1986).

Table 6. Effect of packing, drying and irradiation treatments on the total microbial count of Saidy fruits during storage at room temperature:

Treatment	Total microbial count	Storage time month (log cfu/gm)			
		0	4	8	12
Control	Total bacterial count	5.320^{a}	4.432^{b}	3.992^{c}	3.544^{f}
	Molds + Yeast	3.760^{a}	2.730^{c}	2.224^{e}	1.698^{h}
Vacuum	Total bacterial count	5.320^{a}	3.810^{e}	2.650^{j}	2.301^{m}
	Molds + Yeast	3.760^{a}	2.618^{d}	1.845^{g}	1.460^{i}
Drying	Total bacterial count	3.880^{d}	3.146^{h}	2.775^{i}	2.393^{l}
	Molds + Yeast	2.923^{b}	2.243^{e}	1.890^{g}	1.544^{i}
Irradiation	Total bacterial count	3.233^{g}	2.747^{i}	2.480^{k}	2.251^{m}
	Molds + Yeast	2.841^{b}	2.063^{F}	1.685^{h}	1.291^{J}

- Any letters charing the same symbol, have no significant difference inbetween.

The microbial flora of all treatments and control dates remained low until the end of storage (12 months). The irradiated samples had the lowest microbial counts, followed by the packaged under vacuum and dried samples. The low moisture content along with high sugar contents has made and increase the resistance to microbial deterioration the conditions unfavorable for the growth of microorganisms (Ahmed *et al.* 1995 and Al-Kahtani *et al.,* 1998). This result (Table 6) indicates that the microbi-

ological quality of dates can be substantially improved by irradiation, packing under vacuum and drying treatments.

Effect of packing, drying and irradiation treatments on sensory evaluation of the Saidy fruits during storage:

Sensory evaluation is concerned an important technique to determine product quality. Because of genetic differences variable and growth conditions, date show a wide variation in their final appearance and quality. With respect to consumers, important quality criteria of the product and appearances including color, taste, flavor ….etc. (Wills *et al.,* 1998).

The results of organoleptic evaluation (Table 7) show that the panelists could not discriminate between the non-irradiated and the irradiated date fruits. Furthermore, all treatments have no detectable adverse effect on the preference rating of the fruits by a taste panel.

The results are shown in Table (7) that all tested samples were convergent in their texture and appearance values up to 4 months of storage. While, the texture and appearance values of the packaged under vacuum fruits gradually decreased during storage recorded the lowest values (5.14 and 5.71, respectively) at the end of storage period, followed by the control, dried and irradiated date sample. The color value of all samples recorded a gradually decrease during storage period, the control sample had the lowest color value followed by the dried, packaged under vacuum and the radiated sample at the end storage period. The taste value of control sample decreased to the lowest value (5.07) followed by irradiated (6.36), packaged under vacuum (6.43) and dried (6.93) date sample. Finally, the irradiated samples were occupied the first rank in overall acceptability followed by the dried, packaged under vacuum and control samples. These results are in the same trend with those recorded by Grecz *et al*. (1988), Al-Kahtani *et al*. (1998), Ismail *et al*. (2008), Kenawi *et al*. (2011) and Abd El-Bar *et al.* (2014).

Table 7. Effect of packing, drying and irradiation treatments on sensory evaluation of Saidy date fruits during storage at room temperature:

Treatment	Storage time month	Sensory evaluation				
		Color	Taste	Texture	Appearance	Overall acceptability
Control	0	8.71^{a}	8.57^{a}	8.71^{a}	8.71^{a}	8.71^{a}
	4	7.14^{b-d}	7.86^{a-c}	7.14^{bc}	7.29^{b-e}	7.14^{bc}
	8	6.57^{de}	6.21^{e}	7.07^{b-d}	6.86^{c-g}	6.71^{b-d}
	12	5.86^{e}	5.07^{f}	5.86^{ef}	5.86^{fg}	5.71^{d}
Packing under vacuum	0	8.71^{a}	8.57^{a}	8.71^{a}	8.71^{a}	8.71^{a}
	4	7.50^{b-d}	8.14^{ab}	6.57^{c-e}	7.00^{b-f}	7.79^{ab}
	8	6.86^{c-e}	7.71^{a-c}	6.07^{d-f}	6.00^{fg}	6.93^{bc}
	12	6.57^{de}	6.43^{de}	5.14^{f}	5.71^{g}	6.36^{cd}
Drying	0	8.14^{ab}	8.29^{ab}	7.71^{ab}	8.00^{a-c}	8.43^{a}
	4	7.79^{a-c}	8.21^{ab}	7.14^{bc}	7.93^{a-d}	7.79^{ab}
	8	7.14^{b-d}	7.43^{a-d}	6.93^{b-d}	7.07^{b-f}	7.21^{bc}
	12	6.43^{de}	6.93^{c-e}	6.36^{c-e}	6.29^{e-g}	6.79^{b-d}
Irradiation	0	8.71^{a}	8.21^{ab}	8.57^{a}	8.71^{a}	8.71^{a}
	4	8.29^{ab}	7.29^{b-e}	8.29^{a}	8.21^{ab}	8.36^{a}
	8	7.57^{a-d}	7.21^{b-e}	7.14^{bc}	7.36^{b-e}	7.64^{ab}
	12	7.14^{b-d}	6.36^{de}	6.57^{c-e}	6.71^{d-g}	7.07^{bc}

- Any letters charring the same symbol, have no significant difference inbetween.

Conclusions

The irradiation and packing under vacuum was found to be superior to drying treatment for improving the quality as well as prolonging the marketable period of Saidy date fruit.

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تأثير بعض المعاملات على التركيب الكيميائى وخصائص جودة البلح الصعيدى أثناء التخزين

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الملخص

اجريت هذه الدراسة لتحسين جودة وفترة صلاحية ثمار البلح الصعيدى خلال تخزينها لمدة ١٢شهر على درجة حرارة الغرفة باستخدام التعبئة تحت تفريغ ، التجفيف والأشعاع (١كيلو جراى). وأظهرت النتائج أن التعبئة تحت تفريغ أكثر فاعلية للسيطرة على الأصابة الحشرية (٣,٨٥%) تليها العينة المشععة (١١,١٢%) ثم المجففة (١٢,١١%) فى حين سجلت العينة الكنترول ١٧,٢٤% عند نهاية فترة التخزين (١٢شهر). وأن محتوى الرطوبة فى العينة الكنترول انخفض من ١٥,٢٣ الى ٩,٢٩% فى نهاية فترة التخزين وانخفض من ١٥,٢٣ الى ٩,٦٧% ، من ١٥,١٥ الى ٨,٩٢% ومن ١٥,٨٠ الى ٩,٦٧% لكل من العينات المعبئة تحت تفريغ ، المجففة والمشععة على التوالى. وأظهرت البيانات أيضا انه خلال فترات التخزين (١٢شهر) انخفضت محتويات البروتين من ٢,٥٢ الى ١,٩٧% ، من ٢,٥٢ الى ٢,٠٢% ، من ٢,٥٧ الى ٢,١٥% و من ٢,٤٥ الى ٢,٠٩% لكل من العينات الكنترول ، المعبئة تحت تفريغ ، المجففة والمشععة على التوالى. وقد تبين أن العدد الكلى للبكتيريا انخفض مباشرةً بعد التشعيع والتجفيف الى حد كبير مقارنة بالانخفاض فى الخمائر والفطريات. اضافة الى بقاء العدد الميكروبى منخفضاً فى كل المعاملات حتى نهاية فترة التخزين ، واحتوت العينة المشععة على أقل محتوى ميكروبى تلتها المعبئة تحت تفريغ والمجففة. ومن نتائج التقييم العضوى الحسى لم يظهر أى تمييز بين عينات التمور المشععة وغير المشععة. وقد تبين كذلك أن جميع المعاملات ليس لها أى تاثير سلبى على درجة تقبل الثمار، وقد احتلت العينة المشععة المرتبة الأولى فى درجة التقبل العام تلتها العينة المجففة ثم العينة المعبئة تحت تفريغ. وتشير هذه النتائج الى أن التعبئة تحت تفريغ ، التجفيف والتشعيع يمكن أن تستخدم كوسائل بديلة لتحسين جودة ثمار البلح الصعيدى فضلاً عن اطالة فترة تسويقه على درجة حرارة الغرفة لمدة ١٢شهر أو أكثر.