POLYETHYLENE WRAPPING AND PRE-COLD STORAGE CONDITIONING AFFECT FUERTE AVOCADO FRUITS QUALITY AND STORAGABILITY

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ABSTRACT

Wrapping by stretch polyethylene prolonged the storage period of Fuerte avocado fruits (12 days at 10°C and 6 days at controlled temperature room(20°C)CTR) and maintained fruit quality by reducing low temperature disorders. Par-cold storage conditioning supported the above positive effects of wrapping treatment where the fruits had better appearance compared with the fruits that were stored directly at low temperature. The wrapped fruits had significant lower weight loss during the storage period at 10°C or at CTR and in both experimental seasons. The wrapped fruits had higher flesh firmness and lower soluble solid content (SSC) values. The wrapped fruits without conditioning had the significant lower values of acidity in both seasons and there were no significant differences between the other treatments. Wrapping had significant effect on reducing the moisture loss of the fruits but the conditioning treatment had no effect. Wrapping treatment had no effect on fruit total fats in the second season only. Conditioning treatment had significant effect on the fruit total fats in both seasons.

INTRODUCTION

Avocado is seemed almost too luscious to be healthful, but the fat they contain is highly monounsaturated, the kind that is associated with a healthy heart. Avocados also are rich in vitamin E, another heart helper. Although the banana is thought of as an exemplary potassium source, the avocado actually supplies 60 % more potassium. Avocados are high in fiber, and provide substantial amounts of folate (folic acid), vitamin B6, and pantothenic acid, as well as some iron, copper and magnesium. On the phytochemical front, avocados contain glutathione, an antioxidant with anti-carcinogenic potential. They also contain a significant amount of a cholesterol-lowering phytosterol called beta-sitosterol (C. F. Avocados, www.wholehealthmd.com).

Since the fruits are living tissues, they respire and consume their stored foods, and most of the fruits weight loss is due to water loss. Water losses affect fresh appearance of the fruit that becomes shrunken, soft and deformed. Wrapping with polyethylene restricts the loss of water vapor from the fruit surface as polyethylene provide an immediate surroundings with relatively higher humidity which does not favor the water loss from the fruit tissue (Anthony *et al.*, 1989; El-Naggar, 1996 and Lambrinos and Manolopoulou, 2000).

The aim of this study was to determine:

1. The effects of pre-cold storage conditioning at room temperature and polyethylene wrapping on the appearance and storage disorders of Fuerte avocado fruits.
2. The storage potential of Fuerte avocado fruits in response to pre-cold storage conditioning and polyethylene wrapping.
3. The effects of the above treatments and the following storage temperatures on the physical (weight loss, moisture content and flesh firmness) and the chemical (SSC, titratable acidity and total fats content) changes of Fuerte avocado fruits during the storage period.

MATERIALS AND METHODS

The present investigation was carried out during 2003 and 2004 seasons on Fuerte avocado fruits harvested at 21 and 19 of September respectively, in both seasons with commercial maturity from Draniet orchard (private orchard) in Kafer El-Dawar, El-Behera province and immediately transported to the Post-harvest Center of Horticulture Crops, Faculty of Agriculture (El-Shatby), Alexandria University. Initial quality of the fruits at harvest was determined using 10 fruits and the data are tabulated .

Table(1) : Quality parameters at harvest.

Parameters	2003 Season	2004 Season
Fruit Weight (gm)	205.90	167.30
Seed Weight (gm)	44.30	42.47
Fruit Size (cm):		
Highness	11.57	10.43
Diameter	6.37	5.83
Flesh Thickness (cm)	1.37	1.20
Flesh Firmness (lb/in^2)	27.00	27.00
SSC	9.33	9.00
Acidity (%)	0.16	0.17
Total Fats (%)	12.30	7.88

Fuerte avocado fruits were carefully sorted to eliminate mechanical damaged of defected fruits. Sound fruits were packed into foam rubber plates (four fruits in each).

The plates that will be stored at cold storage of 10 °C and 85-90 % RH were divided into four sections (24 plates of each). Two of the above four sections were wrapped with stretch polyethylene (each plate was wrapped separately).

One of the two wrapped sections was stored directly at 10 °C and the other was stored at 10°C after storage for 24 hour at controlled temperature room (CTR) at 20°C (pre-cold storage conditioning). The same procedure was done for the two unwrapped

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sections where one of them was stored directly and the other was delayed for 24 hour at CTR before cold storage.

At CTR there were another two sections of wrapped and unwrapped avocado fruits (6 plates for each). So there were 6 treatments:

1. Wrapped fruits were stored directly at 10 °C (WF).
2. Wrapped fruits that were held at CTR for 24 hrs.then stored at 10 °C (WF+C).
3. Unwrapped fruits were stored directly at 10 °C (UWF).
4. Unwrapped fruits were held at CTR for 24 hrs.then stored at 10 °C (UWF+C).
5. Wrapped fruits were stored at CTR(WF).
6. Unwrapped fruits were stored at CTR (UWF).

Changes in physio-chemical properties were followed up in 6 days intervals throughout the experimental period (3 plates of each treatment were used).

5 plates of each treatment were labeled and were initially weighted to calculate fruit weight loss percent during the storage period in relation to its original weight.

Patches of skin were removed from 2 opposite sides around the equator of avocado fruit to measure flesh firmness by using the Effegi pressure tester with an eight mm. Plunger (Effegi, 48011 Alfosine, Italy).

Two opposite peeled segments from the rose to the stem of each fruit were taken and three samples of 50 gm from each treatment were weighed. Each sample was squeezed in 100 ml distilled water then was completed to 200 ml as total volume by distilled water. The dilution rate was calculated.

The obtained juice was used to determine the percentage of SSC by the use of a hand refractometer, and the titratable acidity as g. malic acid / 100 ml fruit juice (Chen and Mellenthin, 1981).

Moisture content (%) was determined by draying of three recorded weights of fruit flesh from each treatment. Subsequent periodical weight determinations were carried out to obtain a constant dry weight then the percentage moisture content was calculated in relation to the initial recoded weight.

Three samples of 10 gm were weighted from each treatment for the extraction of total fats. 40 ml of methanol and 20 ml of chloroform were added to each sample then the sample was macerated for 2 min. Further 20 ml of chloroform were added and the sample was macerated for 30 sec. 20 ml of water were added and the sample was macerated for 30 sec then was centrifuged for 10 min at 2000-2500 rpm. The lower chloroform layer was draw off (as much as without disturbing the supernatant layers by using a syringe), and was filtered. The chloroform was evaporated from 25 ml of the above filtrate on a steam bath and the drying was completed in an oven at 105 °C. This procedure was used for HPLC total fats identification according to Harold *et al.*, 1981.

The termination of the experiment was done when fruits firmness reached the average of 3 lb/in^2. All data obtained were statistically analyzed according to Snedecor and Cochran, 1980. The individual comparisons were carried out by using the Least Significant Difference (L.S.D) according to SAS Institute (1985). Simple regression coefficient between storage period and studied properties was calculated as referred by SAS Institute (1985).

RESULTS AND DISCUSSION

Fruit Appearance Quality and Storagability:

The tabulated data showed that wrapping by stretch polyethylene prolonged the storage period of Fuerte avocado fruits stored at 10°C by 12 days at both seasons and the same results were for the fruits stored at CTR where its storage period was prolonged by 6 days at both seasons. The results obtained in the present work were associated with the recommended results of Nwufo *et al.*, 1994.

It was obvious from the obtained data that wrapping treatment maintained fruit quality by reducing low temperature disorders (peel or flesh discoloration and soft texture) and the fruits retained a significantly better external and internal appearance compared with unwrapped fruits. These results were in line with those obtained by D'Aquino *et al.*, 1997 worked on Fuerte avocado. Also, wrapping reduced the shrinking of avocado fruits where the unwrapped fruits began to shrink before the wrapped ones by 12 days and by a high rate.

Per-cold storage conditioning supported the above positive results of wrapping treatment where the fruits had better appearance compared with the fruits that were stored directly at low temperature. That effect resulted from the conditioning of fruit before cold storage to reduce the cooling stress on the fruit tissue.

The use of polyethylene wrapping allowed a modified atmosphere to develop (Bower and Cutting, 1988) and that atmosphere with high concentrations of carbon dioxide and low concentrations of oxygen coupled with low temperature has proved successful in delaying ripening and senescence in avocado fruits (Rhodes, 1981 and Meir *et al.*, 1995) indicating that the two gases have a synergistic effect on inhibiting ripening (Meir *et al.*, 1995).

Also, the above results were associated with the effect of polyethylene wrapping on reducing fruit water loss where the most severe chilling disorders occurred where loss was not controlled, suggesting the symptom is strongly influenced by dehydration (Donkin and Cutting, 1994; Bower *et al.*, 1995 and Yahia and Gonzalez, 1998).

The effect of wrapping in delaying ripening and senescence was associated with delaying skin color changes. The unwrapped avocado fruits began to color by purple/black color before wrapped ones by 12 days . These results were in harmony with those obtained by Meir *et al.*, 1997).

Color change in avocado fruits from green to purple then black results from an initial decrease in chlorophyll content, followed by an increase in the levels of the anthocyanine, cyanidin 3-O-gluciside (Cox *et al.*, 2004) and those changes in color reached its characteristic dark color at full softening (Meir *et al.*, 1997 and Jeong *et al.*, 2003).

Fruit Weight Loss (%):

Polyethylene wrapping treatment affected weight loss of Fuerte avocado fruits where the wrapped fruits had significant lower weight loss during the storage period at 10°C or at CTR and in both experimental seasons (Table 2) .

Table (2): Effect of polyethylene wrapping and pre-cold storage conditioning on weight Loss (%) of Fuerte avocado fruits on 2003 and 2004 seasons.

Treatment	Storage period (days)							r^2
	0	6	12	18	24	30	36	
2003								
10 °C								
WF	0.00a	0.55c	1.15d	1.73b	2.26c	2.59b	3.12b	0.99**
WF+C	0.00a	1.24c	1.72cd	2.22b	2.70c	3.08a	3.56a	0.99**
UWF	0.00a	1.85c	3.12bc	4.19a	5.05b			0.95**
UWF+C	0.00a	2.21c	3.51b	5.33a	7.01a			0.99**
CTR								
WF	0.00a	6.69b	12.07a					
UWF	0.00a	14.63a						
L.S.D $_{0.05}$	-	1.801	1.520	1.157	1.372	0.368	0.401	
2004								
10 °C								
WF	0.00a	0.56e	1.07d	1.64b	2.17b	2.71a	3.26a	0.96**
WF+C	0.00a	1.31ed	1.74d	2.23b	2.70b	3.07a	3.56a	0.99**
UWF	0.00a	2.17d	4.14c	6.15a	8.38a			0.96**
UWF+C	0.00a	3.47c	5.09b	6.73a	8.60a			0.99**
CTR								
WF	0.00a	5.83b	11.70a					
UWF	0.00a	15.20a						
L.S.D $_{0.05}$	-	1.274	0.879	1.348	1.733	0.417	0.441	

Means within columns (in same season) having a common letter are not significantly different.
r^2 =Determination coefficient

On the other hand, pre-cold storage conditioning had the opposite effect on fruit weight loss where the conditioned fruits had higher weight loss percentages but the differences were not significant in most of the storage intervals.

The results of many researchers such as González *et al.*, 1990; Saucedo *et al.*, 1995; Meir *et al.*, 1997; Meir *et al.*, 1998 and Yahia and González, 1998 pointed out the same results obtained in the present study.

Fruit weight loss of all treatments in both seasons increased significantly (r^2 values are highly significant) with the advancing of storage period and the changes were most rapid in fruits stored at CTR.

Since the fruits are living tissues they respire and consume the store foods in them, and most of the fruit weight loss is due to water loss. It is known that at higher temperature (CTR) the fruit tissues lose more water to the surrounding air that could carry more humidity than it will in lower temperatures. Wrapping with polyethylene restricts the loss of water vapor from the fruit surface as polyethylene provide an immediate surroundings with relatively higher humidity which does not favor the water loss from the fruit tissues (Cutting and Wolstenhome, 1992; Parodi and Lerner, 1995 and Ismail and El-Menshawy, 1997).

Fruit Flesh Firmness (lb/in^2):

Polyethylene wrapping had no significant effect on flesh firmness of avocado fruits in the beginning of the storage period at 10°C (Table 3) but the significant effect appeared, in both seasons, after 18 days where the wrapped fruits had significant higher flesh firmness compared with the unwrapped ones, and this significant effect was obtained also avocado with the fruits stored at CTR in both seasons.

Table (3): Effect of polyethylene wrapping and pre-cold storage conditioning on flesh firmness (lb/in^2) of Fuerte avocado fruits on 2003 and 2004 seasons.

Treatment	Storage period (days)							r^2
	0	6	12	18	24	30	36	
2003								
10 °C								
WF	27.00a	27.00a	27.00a	27.00a	10.08ab	5.23a	1.07a	0.97**
WF+C	27.00a	26.77a	27.00a	27.00a	14.58a	2.93a	1.63a	0.82**
UWF	27.00a	27.00a	25.87a	26.10a	1.72b			0.74*
UWF+C	27.00a	27.00a	27.00a	16.11b	1.92b			0.76*
CTR								
WF	27.00a	20.00b	3.58b					
UWF	27.00a	3.60c						
L.S.D $_{0.05}$	-	4.030	1.774	7.308	10.675	3.086	1.259	
2004								
10 °C								
WF	27.00a	27.00a	27.00a	27.00a	16.77a	4.93a	1.03a	0.80**
WF+C	27.00a	27.00a	27.00a	26.80a	22.00a	6.43a	1.27a	0.79**
UWF	27.00a	27.00a	27.00a	16.83b	2.35b			0.75*
UWF+C	27.00a	27.00a	27.00a	20.93b	1.62b			0.75*
CTR								
WF	27.00a	21.33b	2.57b					
UWF	27.00a	2.07c						
L.S.D $_{0.05}$	-	3.129	1.680	5.670	6.791	2.807	0.916	

Means within columns (in same season) having a common letter are not significantly different.
r^2 =Determination coefficient

Also, wrapping treatment reduced the rate of flesh firmness loss where the wrapped fruits maintained its firmness longer than those unwrapped ones by 12 days.

The above results are associated with those of González *et al.*, 1990; Saucedo *et al.*, 1995 and Yahia and González, 1998.

The rate of softening increased with the progress of the storage period (determination coefficient was highly significant) with most rapid increasing in fruits stored at CTR.

An important aspect of avocado fruit ripening concerns the cell membrane system and in particular the plasma membrane. It has previously been thought that ripening results in a loss of membrane integrity with increasing permeability (Sacher, 1976). With the avocado fruit softening, it was found that the middle lamella begins to disappear, with pectin removal from the matrix of cell walls. Later, a loss of organization and density in the walls occurs. Finally, the walls almost completely disappeared during the post-climacteric phase (Platt-Aloia and Thomson. 1981).

Scott *et al.*, 1963 reported
major constituent of avocado
consequently it is reasonable to expect cellulase to play a major role in avocado softening. Also, Pesis *et al.*, 1978 found a rapid increase in this enzyme accompanying with softening, which was closely correlated with respiratory climacteric and ethylene. On the other hand, the solubilization of the cell walls during softening cannot be due to cellulase alone (Platt-Aloia *et al.*, 1980). The early stages of softening in the avocado fruits appears to be due to cellulase, controlled at least in part by ethylene, with polygalacturonase responsible for final softening.

As mentioned above, ethylene is important for cellulase activity and for softening process. So, wrapping reduced the rate of softening by reducing the cellulase activity as a result of the inhibition of ethylene by the accumulation of carbon dioxide and the resulting low oxygen (Beyer, 1977).

Soluble Solids Content (SSC):

The wrapping treatment started to be affect of SSC values of Fuerte avocado fruits after 24 days of storage at 10°C in both seasons (Table 4). The wrapped fruits had significant lower values of SSC compared with unwrapped ones. This effect was at CTR after 6 days of storage and in both seasons the significant lower SSC values were for wrapped fruits, also.

As mentioned above, polyethylene wrapping allowed a modified atmosphere to develop (Bower and Cutting, 1988) with high concentrations of carbon dioxide and low concentrations of oxygen coupled with low temperatures has proved successful in delaying ripening and senescence in avocado fruits (Rhodes, 1981 and Meir *et al.*, 1995) indicating that

the two gases have a synergistic effect on inhibiting ripening (Meir *et al.*, 1995) by inhibiting ethylene action (Beyer, 1977 and Durand *et al.*, 1984) which is known to play a vital role in ripening process of avocado as a climacteric fruit.

Table (4): Effect of polyethylene wrapping and pre-cold storage conditioning on SSC of Fuerte avocado fruits on 2003 and 2004 seasons.

Treatment	Storage period (days)							r^2
	0	6	12	18	24	30	36	
2003								
10 °C								
WF	9.33a	9.67b	8.67a	7.47a	6.67b	11.47b	6.33a	0.41
WF+C	9.33a	9.67b	9.67a	8.53a	7.20b	13.60a	7.33a	0.01
UWF	9.33a	8.67bc	8.33a	7.73a	10.87a			0.67
UWF+C	9.33a	9.00b	10.33a	7.73a	12.00a			0.08
CTR								
WF	9.33a	7.33c	9.67a					
UWF	9.33a	13.20a						
L.S.D $_{0.05}$	-	1.411	2.101	1.375	1.442	1.959	1.309	
2004								
10 °C								
WF	9.00a	10.33b	9.33ab	7.47b	7.20c	12.27a	5.67b	0.06
WF+C	9.00a	9.00b	8.33ab	9.33a	8.00c	10.67a	7.67a	0.08
UWF	9.00a	7.67bc	8.00b	8.27ab	10.67b			0.14
UWF+C	9.00a	8.67b	9.67a	8.27ab	13.33a			0.27
CTR								
WF	9.00a	5.67c	9.33ab					
UWF	9.00a	15.00a						
L.S.D $_{0.05}$	-	2.750	1.485	1.739	1.442	3.311	2.618	

Means within columns (in same season) having a common letter are not significantly different.
r^2 =Determination coefficient

Another reason to delay ripening process by wrapping that the avocado fruits lost less water and that was associated by delaying ripening process (Adato and Gazit, 1974 and Bower and Cutting, 1987).

On the other hand, pre-cold storage conditioning had no significant effect on fruit SSC in the first season except for the wrapped fruits after 30 days of storage. But, generally the conditioned fruits had higher SSC values. In the second season, the significant differences were clear and the conditioned fruits had higher SSC values. With the advances of the storage period at 10 °C there was no constant trend of SSC (r^2 values were not significant). Generally, those SSC values increased after 24 days for the wrapped fruits and 30 days for the unwrapped ones then decreased.

Titratable Acidity (%):

From the obtained data of malic acid content of Fuerte avocado fruits (Table 5) it was noticed that wrapped fruits without conditioning had the significant lower values of malic acid content in both seasons and there was no significant differences between the other treatments.

The increasing values of malic acid content of unwrapped fruits could be due to the increasing in its concentration as a result to the increasing in water loss in those fruits.

The above results are associated with those of El- Naggar(1996) on dates where the wrapped fruits had higher malic asid values. This increment may be due to the accumulation of different organic acids as a products of respiration. That accumulation in acids was faster than their consumption as a result of wrapping with polyethylene which made as a modifided atmosphere surrounding the fruits.

Table (5): Effect of polyethylene wrapping and pre-cold storage conditioning on malic acid content (%) of Fuerte avocado fruits on 2003 and 2004 seasons.

Treatment	Storage period (days)							r^2
	0	6	12	18	24	30	36	
2003								
10 °C								
WF	0.16a	0.22b	0.15b	0.24a	0.18b	0.18b	0.17a	0.11
WF+C	0.16a	0.32ab	0.25a	0.34a	0.32a	0.31a	0.20a	0.01
UWF	0.16a	0.34a	0.18ab	0.26a	0.33a			0.25
UWF+C	0.16a	0.38a	0.21ab	0.31a	0.34a			0.25
CTR								
WF	0.16a	0.28ab	0.16ab					
UWF	0.16a	0.37a						
L.S.D $_{0.05}$	-	0.098	0.097	0.178	0.099	0.025	0.168	
2004								
10 °C								
WF	0.17a	0.22b	0.18b	0.21b	0.15c	0.17b	0.14a	0.01
WF+C	0.17a	0.35a	0.17b	0.38a	0.25bc	0.32a	0.22a	0.01
UWF	0.17a	0.38a	0.18b	0.29ab	0.34ab			0.18
UWF+C	0.17a	0.29ab	0.21b	0.29ab	0.38a			0.67
CTR								
WF	0.17a	0.23b	0.29a					
UWF	0.17a	0.31ab						
L.S.D $_{0.05}$	-	0.122	0.046	0.097	0.106	0.081	0.139	

Means within columns (in same season) having a common letter are not significantly different.
r^2 =Determination coefficient

Pre-cold storage conditioning treatment had no significant effect on malic acid content of unwrapped fruits but the conditioning treatment affect wrapped fruits where they had significant higher values of malic acid in both seasons.

There was no constant trend of malic acid values with the progress of the storage period (r^2 values were not significant) in both seasons, but generally it decreased by the end of the storage period at 10° C. Malic acid is a respiratory substrate and its consumption in respiration increases with the increasing of storage temperatures and with the progress of storage time, as the malic acid could be used as an organic substrate in the respiration process.

The above results and discussions agree with those reported by Wang *et al.*(1993) ; Kamal, *et al.*(1996) ; Mohamed *et al.*(1999) ; Tayel (2001) on peaches and El- Naggar (1996) on dates.

Fruit Moisture Content:

The effect of wrapping treatment on reducing water loss from avocado fruits reflected on its moisture content. The wrapped fruits had significant higher moisture content compared with the unwrapped ones in both seasons (Table 6).

Table (6):Effect of polyethylene wrapping and pre-cold storage conditioning on fruit moisture content (%) of fuerte avocado fruits on 2003 and 2004 seasons.

Treatment	Storage period (days)							r^2
	0	6	12	18	24	30	36	
2003								
10 °C								
WF	80.11a	81.78a	82.22a	82.89a	82.89a	80.44a	79.78a	0.01
WF+C	80.11a	81.50a	78.67b	80.89ab	81.33ab	79.56a	78.45a	0.003
UWF	80.11a	77.11b	77.11b	78.00b	79.78ab			0.01
UWF+C	80.11a	78.67ab	77.33b	78.00b	76.22ab			0.14
CTR								
WF	80.11a	80.00ab	77.33b					
UWF	80.11a	78.89ab						
L.S.D $_{0.05}$	-	3.591	3.192	3.548	5.322	2.045	4.089	
2004								
10 °C								
WF	79.00a	83.50a	81.55a	81.78a	84.44a	80.67a	80.00a	0.001
WF+C	79.00a	80.67ab	79.33ab	79.11ab	80.45ab	78.67b	78.22a	0.14
UWF	79.00a	80.33ab	78.00ab	79.33ab	78.89b			0.05
UWF+C	79.00a	77.89b	77.33b	77.78b	81.78ab			0.48
CTR								
WF	79.00a	79.78b	77.78ab					
UWF	79.00a	78.89b						
L.S.D $_{0.05}$	-	3.295	3.900	3.009	4.957	1.508	1.954	

Means within columns (in same season) having a common letter are not significantly different.
r^2 =Determination coefficient

On the other hand, the pre-cold storage conditioning had no effect on the fruit moisture contents where the differences were not significant in most storage intervals in both seasons and that reflected on the good appearance of the treated wrapped fruits.

There were no significant changes in the moisture content of avocado fruits with the advancing of the storage period at 10 °C where the r^2 values were not significant.

The above results were in line with those obtained by El- Naggar and El - Saedy, 2004 on papaya fruits and El- Saedy and El- Naggar, 2004 on peaches fruits.

Total Fats Content (%):

In this experiment, Fuerte avocado fruits contained initially percentages of total fats of 12.30 and 7.88 % for 2003 and 2004 seasons, respectively (Table 7).

Table(7): Effect of polyethylene wrapping and pre-cold storage conditioning on total fats content (%) of Fuerte avocado fruits on 2003 and 2004 seasons.

Treatment	2003 Season	2004 Season
Initial	12.32c	7.88e
Final:		
10 °C		
WF	29.31b	19.70c
WF+D	33.60ab	23.81b
UWF	27.33b	11.88d
UWF+D	41.61a	31.50a
CTR		
WF	13.20c	8.10e
UWF	3.22d	3.95f
L.S.D $_{0.05}$	8.646	2.779

Means within columns (in same season) having a common letter are not significantly different

Klein, 1995 reported that the fat content (by weight) of avocado fruits varies from 7.0 to 26.0 % acoording to the variety, averaging 15.0 %. Approximately 63.0 % of the fat in avocado is monounsaturated, 20.0 % is polyunsaturated and 17.0 % is saturated.

On the other hand, Luza *et al.*, 1990 extracted lipids from Ampolleta Grand, Negra La Cruz and Fuerte avocado fruits which had been stored for 14, 28 or 33 days at 3 temperatures (4, 7 or 18 °C) and then held for 6 days at 18 °C. About 78.0 % of the lipids extracted were monounsaturated fatty acids, 8.63 to 13.32 % were polyunsaturated and 12.01 to 14.94 % were saturated fatty acids.

Those values of total fats decreased in unwrapped avocado fruits after 5 days of storage at CTR but it un significantly increased in the wrapped fruits after the same period at CTR. On the other hand, total fats percentages increased significantly in all treatments at the end of the storage period at 10 °C (24 and 36 days for unwrapped and wrapped fruits, respectively). The fatty acid composition of fruits varied between cultivars but did not change during storage and those results were in agreement with that of Eaks, 1990 on Fuerte and Hass avocados but were not agree with the results of Ozdemir and Topuz, 2004 which showed statistically significant differences in the fatty acid compositions during the postharvest ripening period of Fuerte and Hass avocados.

Wrapping treatment had no significant effect on fruit total fat in the first season but the effect was significant in the second season. Pre-cold storage conditioning treatment had significant effect on the fruit total fat in both seasons except for the wrapped fruits in the first season.

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الملخص العربى

تاثر جودة ثمار الأفوكادو فيورت وقابليتها للتخزين بكل من التغليف بالبولى ايثيلين و التهيأة قبل التخزين المبرد

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أدى التغليف بالبولي ايثيلين المطاطى الى زيادة فترة تخزين ثمار الأفوكادو صنف فيورت(١٢ يوم على درجة ١٠°م و ٦ ايام على درجة حرارة الغرفة ٢٠°م) كما حافظت على جودة الثمار بتقليل اضرار الحرارة المنخفضة. و بالاضافة الى ذلك فان معاملة التهيأةعلى درجة الحرارة المنخفضة قبل التخزين المبرد أدت الى زيادة الاثار الايجابية للتغليف حيث كان مظهر الثمار هو الافضل بالمقارنة بالثمار المخزنة مباشرة بدون اجراء عملية التهيأة على درجات الحرارة المنخفضة. و قد أدى تغليف الثمار الى تقليل الفقد فى الوزن خلال فترة التخزين المبرد أو على درجة حرارة الغرفة وذلك فى كلا موسمى التجربة ، كما أن الثمار المغلفة كانت أعلى فى قيم الصلابة وأقل فى محتواها من المواد الصلبة الذائبة ، و قد أعطت الثمار المغلفة بدون تهيأة اقل القيم معنويا للحموضة فى كلا الموسمين ، اما المعاملات الاخرى فلم تكن الفروق بينهما معنوية.وقد كان للتغليف تأثيرا معنويا على تقليل الفقد فى المحتوى الرطوبى للثمار فى حين لم تكن لمعاملة التهيأة أى تأثير. وقد أثر التغليف معنويا على محتوى الثمار من الدهون الكلية فى الموسم الثانى فقط. كما أن معاملة التهيأة كان لها تأثيرا معنويا على محتوىالثمار من الدهون الكلية فى كلا الموسمين .