J. Agric. Sci. Mansoura Univ., 29 (12): 7241 - 7253, 2004

EFFECT OF HOT WATER TREATMENT ON REDUCING LOW TEMPERATURE INJURY OF PAPAYA FRUITS

El-Naggar, Nermeen I.* and Ragaa M. El-Saedy **.

* Dep. Plant. Prod. (Pomology), Institute of Efficient Productivity, Zagazig University, Egypt.
** Maamoura Botanical Garden, Alex., Hort. Res. Ins., Agric. Res. Center, Giza, Egypt.

ABSTRACT

Hot water treatment of papaya fruits reduced the incidence of chilling injury and alleviated chilling symptoms. There was no clear effect of hot water treatment on the flesh firmness. However, hot water treatment significantly increased SSC and acidity than untreated ones in both seasons. In addition, the worked treatment had a slight or no effect on fruit water content and fruit flesh carotene content. However, loss in fruit weight was significantly increased in chilled stored fruits.

Keywords: Papaya fruits, hot water treatment, chilling injury, symptoms, low temperature storage.

INTERODUCTION

The ripe fresh fruits of papaya are eaten and manufacture of jam, soft drinks, ice-cream flavouring, crystallized fruits and canned in syrup. In addition, the seeds are used for their medicinal value. Papain (proteolitic enzyme) get out from immature fruits. Finally, fruits are rich in β–carotene and its important as a source of vitamin A (Bose, 1985).

Typical chilling injury symptoms in papaya fruits are surface pitting, uneven discoloration, enhanced softening and cell wall modifications and increased susceptibility to diseases. In addition, the chilled- stored fruits seemed to have a reduced capacity to synthesize and produce ethylene (Zainon *et al.*, 2000).

Post-harvest heating to kill or to weaken plant pathogen offers a pesticide-free method to reduce rot development and control Post-harvest diseases (Liquido, 1991; Nishuima, 1995 and Obenland *et al.*, 1999).

Heat treatment markedly maintained membrane stability (Chein, 2000), reduced texture changes and suppressed the activity of b-glactosidae, an important softening enzyme in papaya (Zainon *et al.*, 2000). Also, it decreased polygalacturonase activity and polyuronide solubility (Lazan *et al.*, 1989). On the other hand, heat treatment maintained the capacity of fruits to produce ethylene as compared to non-heat treated fruits (Zainon *et al.*, 2000).

As a result, heat treatment prolonged fruit storagability with maintaining its quality by reducing low temperature injury (Lazan *et al.*, 1989) and these finding may associated with the incidence of heat shock protein as a result to heat treatment shock response (Paul, 1990; Han *et al.*, 1996 and Chein, 2000).

The objective of the present study is to investigate the following characters of papaya stored fruits:

1-The effects of hot water treatment on the occurrence of chilling injuries in papaya fruits.

2-The histological characteristics of the sound and injured fruits.

3-The storagability of papaya fruits in response to the hot water treatment and the following storage temperatures.

4-The effects of hot water treatment and the following storage temperature on the physical (weight loss, water content and fruit firmness) and the chemical (soluble solids content, titratable acidity and flesh (β and total) carotene content).

MATERIALS AND METHODS

The present study was carried out on papaya (Solo cv.) harvested from a private orchard (MAFA) in El-Nobaria, Alexandria province.

Previously, studies were carried out on some physical and chemical characters of the harvested fruits before starting the experiment and the obtained data were recorded in Table (1) in two successive seasons (2003 and 2004).

Table (1): Some Physical and Chemical Characters of the Harvested Fruits (2003 and 2004, Seasons).

Parameters	2003 Season	2004 Season
Fruit Weight (g)	688.34	667.24
Fruit Size (cm):		
Highness	12.78	12.58
Diameter	12.72	12.76
Firmness (lb/in^2)	27.00	27.5
SSC %	9.87	10.73
Acidity %	0.15	0.17

Sound selected papaya fruits (uniform in size and free of mechanical damage or pathological disorders) were washed then divided into four groups (50 fruits for each of the first three groups and 20 fruits for the fourth group). 1) The first one was dipped in hot water (HW) at 45°C for 5 min. 2) The second group was dipped in hot water at 50°C for 5 min. 3) The third group was untreated (control). All the above three groups were air dried then stored at 5°C and 85- 90 % relative humidity (RH). 4) On the other hand, the fourth group of papaya fruits was stored at room temperature (RC) without any treatments except washing and draying.

Five papaya fruits were taken to determine the initial physio-chemical properties of the fruits. Changes in such properties were followed up in four days intervals throughout the experimental period. 10 papaya labelled fruits in every treatment were initially weighed to calculate fruit weight loss (%) during the storage period in relation to its original weight.

Patches of skin were removed from 4 opposite sides around the equator of papaya fruit to measure flesh firmness by using the Effegi pressure tester with an eight mm Plunger (Effegi, 48011 Alfosine, Italy).

Four opposite peeled segments from the rose to the stem were squeezed and 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).

Water content (%) was determined by drying a recorded weight of fruit flesh. Subsequent periodical weight determinations were carried out to obtain a constant dry weight then the percentage water content was calculated in relation to the initial recoded weight.

Flesh total β-carotene content (IU / 100g fresh weight) was determined by HPLC (Harold Egon, 1981). Fruit extracts were prepared by alkaline hydrolysis and the unsaponifiable matter extracted with ether in the presence of an antioxidant or under nitrogen. Retinyl acetate was added as an internal standard and the ether evaporated off under reduced pressure. The residue was dissolved in methanol for application to HPLC columns packed with 5-µm C18 reversed phase. Acetone: water (95:5) was used as the developing solvent with UV detection at 440 nm.

Flesh total carotene content was determined in its acetone extracts (Grodzinsky and Grodzinsky, 1973). The absorption of the above extraction was measured spectrophotometerically at 663, 644 and 440 nm to determine chlorophyll a, b then carotene, respectively as mg / 100g fresh weight.

Preparation of papaya fruits for scanning electron microscopic studies (histological studies) was carried out as follows:1- Tissue samples consisting of small fragments of papaya fruits were fixed in universal E.M. (Mc Dowell and Trump, 1976) and after dissection they were kept at 4°C till processing. 2-Rinsing twice in 0.1 M phosphate buffer for 10min. 3- Post fixation in 1%, 0.2 %M phosphate buffered osmium tetroxide for 1 hour at 4°C. 4- Rinsing with phosphate buffer for 8 min, then dehydration started in 50,70,95 then 100 % ethyl alcohol changed twice for 10,8,10 and 15 min, respectively with continuous shaking in every step. 5- Drying to the critical point. 6- A thin coating of gold was done under vacuum using Sputterer coater JEOL.JFC-1100E. 7- Examining with scanning electron microscop 5300 JEOL.

After the storage period, chilled fruits symptoms in response to low temperature injury were also investigated. The obtained data were statistically analyzed according to Snedecor and Cochran (1980). The individual comparisons were carried out by using the Least Significant Difference (LSD) 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

Incidence of chilling injury:

Hot water treatments reduced the incidence of chilling injury and retarded its appearance. Chilling injury symptoms began to appear in untreated control fruits earlier by 8 days than hot water treated ones. In agreement with the obtained results (Zainon *et al.*, 2000) reported that the chilling injury symptoms in papaya fruits are surface pitting, uneven discoloration, enhanced softening and cell wall modification and increased susceptibility to diseases.

In this concern, chilling injury symptoms as shown in (Fig 1) were small deep green areas on the fruit surface then turned to big brown wateriness ones associated with very small cracking. Fruit peel in those suffered areas was easy to remove from the flesh by hand with the appearance of flesh grooves under those areas as a result of the cells pressuring. With the progress of chilling injury symptoms the fruits were fungal infected and the untreated fruits were the most suffered ones.

Heat treatment induces heat shock proteins, suppresses oxidative activity and maintains membrane stability (Chein, 2000 and Zainon, 2000). As a result, hot water treatment reduced the incidence of chilling injury and reduced its symptoms. One of the chilling injury results was the suppression of fruit ripening even when the fruits were transferred to the room temperature storage. Those results associated with the results of Lazan *et al.* (1989), Lam (1990), Wills (1990) and Wills and Widjanarko (1997).

Histological characteristics of sound and injured papaya fruits during Post-harvest storage:

Initial electron microscope scanning (EMS) of papaya fruits showed the sound fruit cells of surface (Fig 2-A) and flesh cells (Fig 3-B). With the beginning of chilling injury occurrence, small deep green areas appeared then turned to big brown wateriness ones (Fig 2-B) associated with the pressuring of the cells under those areas (Fig 3-B, 200 and 35 X) making a groove with the disconnecting of fruit peel in those areas.

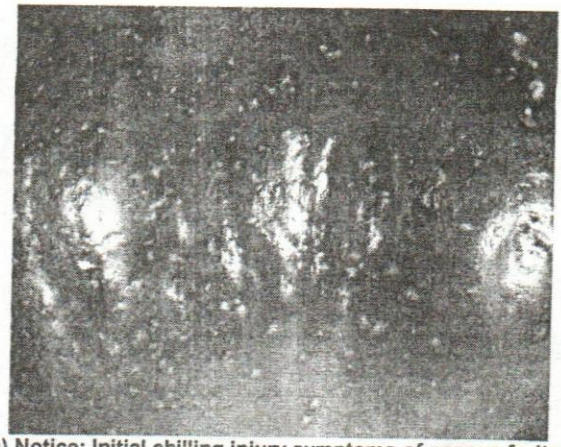
The above wateriness areas were associated with the development of microscopic cracking (Fig 2-C) with the development of cracked areas in the opposite flesh cells (Fig 3-C). Those cracking areas were most likely sites for fungal infection which increased with the progress of storage period (Fig 2-D).

At the end of storage period the cells of papaya flesh in the injured areas became leaky unshaped cells (Fig 3-D). Similar symptoms were investigated histologically by Cohen *et al.* (1994) on citrus.

Flesh firmness:

As shown in Table 2 there was no clear effect of hot water treatment on the flesh firmness of papaya fruits. The differences were not significant, except the less significant firmness of 50°C hot water treated fruits in some storage intervals in the first season. The same above treatment had the least (not significant) fruit firmness in the second season. Papaya fruits lost 94.15 and 93.20 % of its initial flesh firmness after 4 days of storage at room temperature.

Generally, the storage temperature of 5°C retarded the ripening processes of papaya fruits with the progress of storage period as a result of the chilling injury and the most suffered fruits were the untreated ones because of its reduced capacity to synthesize and produce ethylene (Zainon *et al.*, 2000). On the other hand, hot water treatment reduced the effect of chilling injury with maintaining of fruit texture where it maintained membrane stability (Chein, 2000) and suppressed the activity of b- glactosidase, an important softening enzyme in papaya (Zainon *et al.*, 2000) and decreased the activity of poly galacturonase in polyuronide solubilization (Lazan *et al.*, 1989).



a) Notice: Initial chilling injury symptoms of papaya fruits.

b) Notice: Brown wateriness area of chilled papaya fruits.

c) Notice: Flesh of Grooves of chilled papaya fruits.

Fig. 1 (a, b and c): Effect of low temperature storage on chilling injury symptoms of papaya fruits.

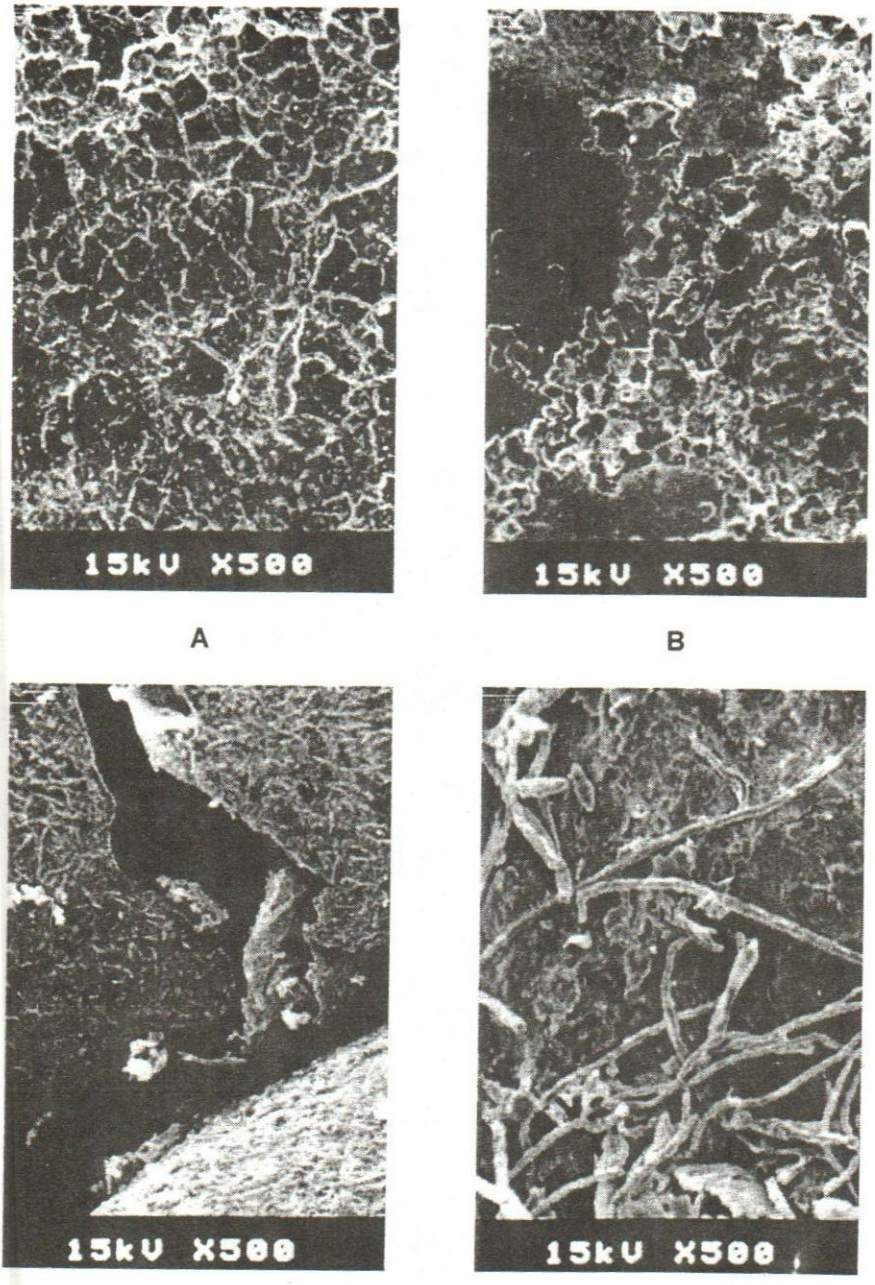


Fig. 2 (a, b, c and d): The development of chilling injury symptoms of papaya fruits (surface) stored at 5°C.

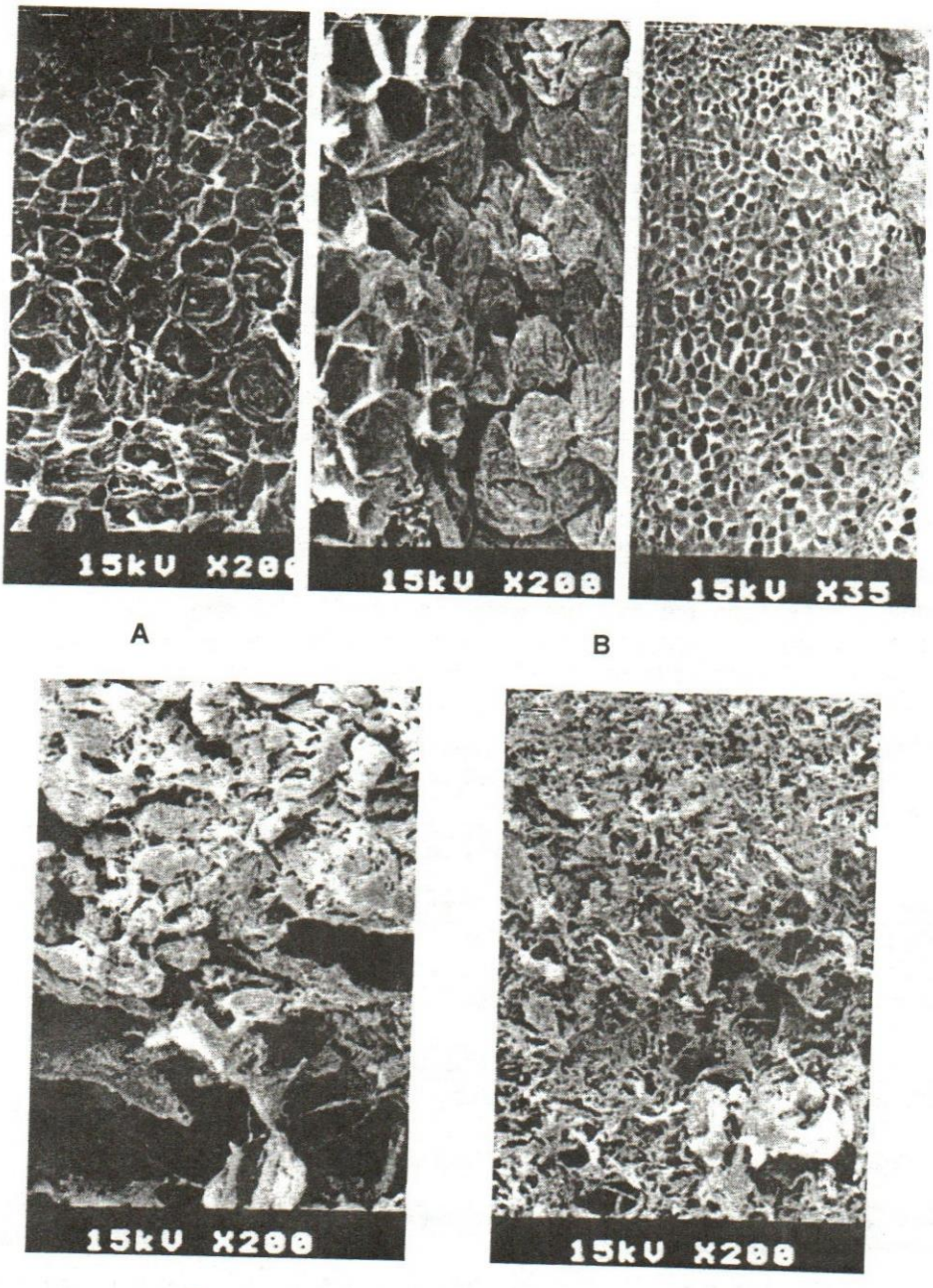


Fig. 3 (a, b, c and d): The development of chilling injury symptoms of papaya fruits (cells) stored at 5°C.

Table (2): Effect of Hot Water Treatment and Following Storage Temperature on Flesh Firmness (lb/in^2) of Papaya Fruits (2003 and 2004 seasons).

Treatments	Storage period (days)						
	0	4	8	12	16	20	r^2
	First season						
45°CHW	27.00a	27.00a	25.10a	24.15a	25.58a	24.00a	0.66*
50°CHW	27.00a	25.73b	25.42a	19.65b	22.42b	24.18a	0.36
Control	27.00a	27.00a	24.58a	26.42a	24.87ab	24.93a	0.50
RT	27.00a	1.58c					
	Second season						
45°C HW	27.50a	23.80b	27.00a	26.73a	25.45a	24.12a	0.18
50°C HW	27.50a	26.70a	26.62a	25.63a	23.40a	24.00a	0.87**
Control	27.50a	26.83a	25.57a	26.57a	24.40a	24.87a	0.74*
RT	27.50a	1.87c					

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

SSC and titratable acidity:

Table (3) indicate that hot water treated fruits had higher significant SSC than untreated ones in both seasons, but the differences were not significant between the two hot water treatment of 45 and 50°C. SSC increased with progress of storage period and with increasing of storage temperature (RT stored fruits had 21.58 and 19.15 % increasing percentages in SSC in both seasons, respectively).

Table (3): Effect of Hot Water Treatment and Following Storage Temperature on Flesh SSC of Papaya Fruits (2003 and 2004 Seasons).

Treatments	Storage period (days)						
	0	4	8	12	16	20	r^2
	First season						
45°CHW	9.87a	11.27b	11.60a	11.27a	11.07a	10.87a	0.13
50°CHW	9.87a	10.73bc	10.73b	11.07a	11.03a	11.00a	0.67
Control	9.87a	10.40c	10.20b	9.33b	9.67b	10.00b	0.11
RT	9.87a	12.00a					
	Second season						
45°C HW	10.13a	11.93a	10.80ab	11.47a	11.30a	11.03a	0.08
50°C HW	10.13a	10.53b	11.73a	11.33a	11.37a	11.40a	0.55
Control	10.13a	9.93b	10.07b	9.33b	9.87b	10.40b	0.01
RT	10.13a	12.07a					

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

Data recorded in Table (4) declare that fruit malic acid content showed the same findings of fruit SSC, where hot water treated fruits had higher significant acidity compared with control fruits during storage period at 5°C. Acidity of all treatments increased with the progress of storage period at 5°C or RT.

Table (4): Effect of Hot Water Treatment and Following Storage Temperature on Titratable Acidity (%) of Papaya Fruits (2003 and 2004 Seasons).

Treatments	Storage period (days)						
	0	4	8	12	16	20	r^2
	First season						
45°CHW	0.15a	0.18a	0.23a	0.18ab	0.18a	0.18a	0.04
50°CHW	0.15a	0.17a	0.19b	0.19a	0.18a	0.15b	0.01
Control	0.15a	0.14a	0.15c	0.16b	0.16a	0.16b	0.62
RT	0.15a	0.16a					
	Second season						
45°C HW	0.17a	0.16b	0.16b	0.18a	0.16a	0.17a	0.02
50°C HW	0.17a	0.19a	0.18a	0.16ab	0.15a	0.15ab	0.62
Control	0.17a	0.18ab	0.15c	0.15b	0.15a	0.14b	0.73*
RT	0.17a	0.18ab					

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

Increasing in SSC and higher content of malic acid of hot water treated fruits may be due to its effect on regulate respiration and perhaps other metabolic processes during storage. The above results and the associated discussion agree with the investigation of Lazan *et al.* (1989) on Backcross Solo papaya.

Water content and weight loss:

Data in Table (5) showed that hot water treatment had insignificant effect on papaya fruit water content. On the other hand, hot water treated fruits had higher significant weight loss (Table 6) during the storage period at 5°C in the first season, but the differences were not significant on the second season between 50°C hot water treated fruits and the control fruits.

Table (5): Effect of Hot Water Treatment and Following Storage Temperature on Water Content (%) of Papaya Fruits (2003 and 2004 Seasons).

Treatments	Storage period (days)						
	0	4	8	12	16	20	r^2
	First season						
45°CHW	88.53a	87.07b	87.87a	88.80a	88.00a	87.20a	0.05
50°CHW	88.53a	90.27a	88.93a	89.47a	89.07a	88.53a	0.06
Control	88.53a	87.87b	88.67a	87.20a	88.00a	88.40a	0.03
RT	88.53a	88.50ab					
	Second season						
45°C HW	89.60a	87.47a	88.67a	87.20a	87.73a	88.40a	0.16
50°C HW	89.60a	88.40a	89.47a	90.00a	88.80a	89.60a	0.02
Control	89.60a	88.13a	86.80a	88.80a	88.00a	87.73a	0.19
RT	89.60a	88.40a					

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

The above results agree with those obtained by Saucedo *et al.* (1995) on Manila mangoes, Mc Guire (1997) on Ruby guavas and Tayel (2001) on Florda Prince, Desert Red and Hermosa peaches.

Table (6): Effect of Hot Water Treatment and Following Storage Temperature on Weight Loss (%) of Papaya Fruits (2003 and 2004 Seasons).

Treatments	Storage period (days)						
	0	4	8	12	16	20	r^2
	First season						
45°CHW	0.00a	1.49bc	2.31a	3.58a	4.85a	5.77a	0.99**
50°CHW	0.00a	1.81b	2.56a	3.61a	4.64a	5.67a	0.99**
Control	0.00a	1.00c	1.41b	2.17b	2.97b	3.78b	0.99**
RT	0.00a	4.38a					
	Second season						
45°C HW	0.00a	1.28b	2.14a	3.46a	4.65a	5.86a	0.99**
50°C HW	0.00a	1.57b	2.09a	2.98a	3.60b	4.66b	0.99**
Control	0.00a	1.04b	1.51b	2.35b	3.27b	4.18b	0.98**
RT	0.00a	5.34a					

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

Heat treatments caused stress condition on fruits resulted in more water loss (Philips, 1982). The results also showed that the percentages of weight loss significantly increased gradually with the progress of the storage period and with the increasing of storage temperature.

Flesh carotene content:

Initial and final β-carotene concentrations (IU / 100g fresh weight) of papaya flesh are tabulated in Table 7. There were insignificant changes in β-carotene contents of papaya flesh during the storage period at 5°C but those changes were significant in the fruits stored at RT where β-carotene concentrations decreased by 45.48 and 58.54 % in the first and the second season, respectively.

Table (7): Effect of Hot Water Treatment and Following Storage Temperature on Flesh β-Carotene Content (IU / 100g fresh weight) of Papaya Fruits (2003 and 2004 Seasons).

Treatments	Initial	Final
	First season	
45°CHW	301.7	342.9
50°CHW	301.7	311.4
Control	301.7	426.3
RT	301.7	164.5
	Second season	
45°C HW	398.9	343.0
50°C HW	398.9	259.3
Control	398.9	516.5
RT	398.9	165.4

There was insignificant effect of hot water treatment on flesh total carotene content of papaya fruits in both seasons (Table 8) and those results were in agreement with those of Paull and Chen (1990) on papaya fruits. Changes in flesh carotene content were temperature and time dependent. The fruits stored at RT had higher significant content of flesh total carotene than those stored at 5°C after 4 days of storage. Also, papaya flesh total carotene content increased with the duration of storage period where the determination coefficient were significant in the first season and for the 45°C hot water treatment in the second season.

Table (8): Effect of Hot Water Treatment and Following Storage Temperature on Flesh Total Carotene Content (mg / 100g fresh weight) of Papaya Fruits (2003 and 2004 Seasons).

Treatments	Storage period (days)						
	0	4	8	12	16	20	r^2
	First season						
45°CHW	1.15a	1.23b	1.22a	1.29a	1.36a	1.33a	0.86**
50°CHW	1.15a	1.17b	1.21a	1.27a	1.65a	1.57a	0.79*
Control	1.15a	1.24b	1.32a	1.40a	1.76a	1.53a	0.74*
RT	1.15a	2.86a					
	Second season						
45°C HW	1.20a	1.21b	1.22a	1.35a	1.51a	1.45a	0.82*
50°C HW	1.20a	1.09b	1.23a	1.27a	1.39a	1.32a	0.63
Control	1.20a	1.32b	1.22a	1.23a	1.21a	1.36a	0.15
RT	1.20a	2.91a					

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

ACKNOWLEDGEMENT

Special thanks to all members of the Alexandria Post-harvest Center, Pomology Department. Faculty of Agriculture (El-Shatby). Alexandria University for providing laboratory facilities to conduct the search work.

REFRENCES

Bose, T.K. (1985). Fruits of India tropical and sub-tropical, Naya Prokash: Calcutta Six: India. Chapter II.

Chein, Y. W. (2000). Post-harvest techniques for reducing low temperature injury in chilling-sensitive commodities. IIR Conference October 2000, Murcia, Spain.

Chen, P. M. and W. M. Mellenthin (1981). Effects of harvest date on ripening capacity and Post-harvest life of d'Anjou pears. J. Amer. Soc. Hort. Sci., 106 (1):38-42.

Cohen, E.; B. Sapiro; Y. Shalom and J. D. Klein (1994). Water loss: a nondestructive indicator of enhanced cell membrane permeability of chilling-injured citrus fruit. J. Amer. Soc. Hort. Sci., 119 (5): 983-986.

Grodzinsky, A. M. and D. M. Grodzinsky (1973). Short reference in plant physiology. Naukova Domka Riev., R. U. R.: 433-434.

Han, T.; L. Liping and Gexing (1996). Physiological effect of heat shock treatment on peach fruit stored at low temperature. Plant Physiology Communications, 32 (3): 184-186. (C. F. Hort. Abst., 67:5686).

Harold Egon (1981). Pearson's Chemical Analysis of Food. BSc, PhD (London). DLC cchen FR Sc Fifst, Laboratory of Government Chemst., London, 8Ed.

Lam, P. F. (1990). Respiration rate, ethylene production and skin colour change of papaya at different temperature. Acta Hort., 269:257-266. (C. F. Hort. Abst., 61:11633).

Lazan, H.; Z. M. Ali and W. C. Sim (1990). Retardation of ripening and development of water stress in papaya fruit seal-packaged with polyethylene film. Acta Hort. 269: 345-358. (C. F. Hort. Abst., 62: 867; 1992).

Lazan, H.; Z. M. Ali; K. S. Liang and K. L. Yee (1989). Polygalacturonase activity and variation in ripening of papaya fruit with tissue depth and heat treatment. Physiologia Plantarum, 77(1): 93-98. (C. F. Hort. Abst., 61: 10545).

Liquido, N.J. (1991). Infestation rates of oriental fruit fly (Diptera: Tephritidae) in Sunrise papaya by visual and colorimetric ripeness indices. J. Economic Entomology, 84 (3): 948-953. (C. F. Hort. Abst., 62: 1711).

Mc Dowell, E. M. and B. F. Trump (1976). Histologic fixative suitable for diagnostic light and electron microscopy. Arch. Pathol. Lab. Vol. 100: 405-413.

Mc Guire, R. G. (1997). Market quality of guavas after hot-water quarantine treatment and application of carnauba wax coating. HortScience 32 (2): 271-274.

Nishuima, W. T. (1995). Effect of hot-air and hot water treatments of papaya fruits on fruit quality and incidence of diseases. Acta Hort., 370:121-128. (C. F. Hort. Abst., 67:10075).

Obenland, D. M.; M. L. Arpain and L. H. Aung (1999). Quality of nectarine cultivars subjected to forced-air heat treatment for Mediterranean fruit fly disinfestations. J. Hort. Sci. Biotec., 74(5):553-555. (C. F. Hort. Abst., 69: 10226).

Paull, R. E. (1990). Post-harvest heat treatments and fruit ripening. Post-harvest News and Information, 1 (5): 355-363. (C. F. Hort. Abst., 61: 933).

Paull, R. E. and N. J. Chen (1990). Heat response in field-drown, ripening papaya fruit. J. Amer. Soc. Hort. Sci., 115 (4):623-631.

Pillips, J. D. (1982). Changes in peaches after hot-water treatment. Plant Disease, 66 (6): 487-488.

SAS Institute (1985). SAS user` guide statistics for personal computers version 5th ed. SAS Inst. Cary NCO.

Saucedo, V. C.; G. N. Mena and S. H. Chávez (1995). Effect of hydrothermal treatments for quarantine purpose on the physiology and quality of Manila mango. J. Amer. Soc. Agric. Eng., 276-281. (C. F. Hort. Abst., 65: 11228).

Snedecor, G. W. and W. G. Cochran (1980). *Statistical Methods*. 7th Ed., Fourth Printing, the Iowa State Univ. Press Ames., Iowa U. S. A.

Tayel, E. A. (2001). Non-chemical Post-harvest treatments to maintain fruit quality and improve storagability of three peach cultivars grown in west coast region of Egypt. Ph.D. Thesis, Alex. Univ., Alex., Egypt.

Wills, R. B. H. (1990). Post-harvest technology of banana and papaya in ASEAN: an over view. ASEAN Fd. J., 5 (2): 47-50. (C. F. Hort. Abst., 61:10506).

Wills, R. B. and S. B. Widjanarko (1997). Effects of storage at subambient temperatures on ripening of Australian papaya. Australian J. Exper. Agric., 37 (1): 127-129. (C. F. Hort. Abst., 67: 9048).

Zainon, M. A.; C. H. Ng; S. T. Chua; L. M. Nor; R. Othman and H. Lazan (2000). Heat treatment alleviates chilling injury symptoms, retards texture changes and maintains the capacity to produce ethylene in papaya fruits. IIR Conference October 2000, Murcia, Spain.

تاثير المعاملة بالماء الساخن على تقليل اضرار البرودة على ثمار الباباظ اثناء التخزين

نرمين اسماعيل النجار* ــ رجاء موسي الصعيدي**

*** قسم الانتاج النباتي (البساتين – فاكهه) معهد الكفايه الانتاجيه ، جامعه الزقازيق.**

**** الحديقه النباتيه بالمعموره ــ الأسكندريه، معهد بحوث البساتين ، مركز البحوث الزراعيه (الجيزة)**

يمكن استهلاك الباباظ كثمار طازجة كما يمكن تصنيعها للعديد من المنتجات. وتستخدم البذور لقيمتها الطبية العالية، ويمكن استخراج انزيم البابيين (هاضم للبروتين) من الثمار غير مكتملة النمو وأخيرا فإن الثمار غنية بالبيتا كاروتين والذى ترجع أهميته كمصدر لفيتامين A . ولقد أجريت هذه الدراسة على ثمار الباباظ صنف "سولو" والتى جمعت من مزرعة خاصة (المغربى) بالنوبارية وفى معامل مركز الحاصلات البستانية بعد الحصاد بكلية الزراعة (الشاطبى) ــ جامعة الأسكندرية خلال موسمى ٢٠٠٣ ــ ٢٠٠٤ حيث قسمت الثمار السليمة المتجانسة والمغسولة والمجففة هوائيا إلى أربع مجاميع الأولى غمرت لمدة ٥ دقائق فى ماء ساخن (٤٥م°) والثانية كانت حرارة الماء(٥٠م°) والثالثة لم تعامل بالماء الساخن ثم خزنت الثلاث مجاميع تخزين بارد على درجة حرارة ٥م° ودرجة رطوبة نسبية حوالى ٨٥-٩٠% أما المجموعة الرابعة فلقد خزنت على درجة حرارة الغرفة ١٨م° بدون أى معاملات وكانت أهم النتائج المتحصل عليها كالآتى:ــ

قللت معاملة ثمار الباباظ بالماء الساخن من حدوث اضرار التبريد ومن اعراضها. ولقد احتوت الثمار المعاملة بالماء الساخن على مواد صلبة ذائبة كلية وحموضة أعلى معنويا من الثمار غير المعاملة فى كلا الموسمين، كما كانت الثمار المعاملة لها فقد وزن أعلى معنويا خلا فترة التخزين. فى حين لم يكن هناك تأثير واضح للمعاملة بالماء الساخن على صلابة الثمار أو على محتواها الرطوبى أو على محتوى اللحم من الكاروتينات.