# RESULTS AND DISCUSSIONS

- 6- T.S.S./acid ratio:

  It was estimated by dividing T.S.S.% by titratable acidity percentage.
- 7- Fruit flesh total sugars content:

  Total sugars content in flesh were determinated after extraction in 80% ethanol as the method described by Lans and Eynon (A.O.A.C., 1970).
- 8- Statistical analysis:

  All obtained data during both 1988 and 1989 seasons were subjected to statistical analysis and means were compared using the new L.S.D. values at 5% level according to Snedecor and Cochran (1972).

### IV- RESULTS AND DISCUSSION

### IV.1. APRICOT:

# IV.1.1. Changes in physochemical properties leading to maturity of developing Amaar apricot fruits:

In this regard some physical and chemical characteristics of Amaar apricot fruits were studied during their development in two successive seasons of 1988 and 1989. Since, periodical changes in average fresh weight of fruit, fruit dimensions "length and diameter", fruit shape index "L/D", fruit firmness and rind colour were the physical properties studied in this respect. However, fruit juice total soluble solids percentage (TSS%), titratable acidity% and TSS/Acid ratio were the investigated fruit chemical properties in this concern. Data obtained during both seasons of study were tabulated in Table (1).

### IV.1.1.a- Fruit fresh weight:

Data obtained during both 1988 and 1989 seasons showed clearly that fruit weight was gradually increased as the seasons was advanced. Such increase was significant as both values of fruit weight at a

given two consecutive measuring dates were compared throughout the whole period of measurement, except the fruit weight values last two dates where appreciably the same. On the other hand the increase occurred in fruit fresh weight by aging showed an intermediate rate which continued equally from starting measurement till May 13th or May 3rd , hence rate was suddenly increased and reached its maximum value during 1988 and 1989 seasons, respectively. Thereafter, the increase was nearly ceased or acutely reduced at the following measuring date i.e, 18th and 8th May of the first and second seasons, respectively.

This trend of increase in fruit weight during last phase of development is coincided with that previously found by earlier investigators in different stone fruit species i.e, Rand Lawa et al., (1963) and Barakat, (1969).

### IV.1.1.b- Fruit length

Data presented in Table (1) pointed out that trend of changes in fruit length of Amaar apricot cv. as influenced by aging was entirely the same during both 1988 and 1989 seasons. Moreover, such trend was to

great extent similar to that previously detected with the fresh fruit weight. However, the increase in fruit length was steadily continued throughout period of measurement at the same rate till May 13th and May 8th during 1st and 2nd seasons, respectively. Such increase was significant as fruit length at any sampling date was compared with that of either former or later dates, except, at the last two measuring dates where fruits gained a comparable values of fruit length.

### IV.1.1.c- Fruit diameter:

With regard to changes in diameter of fruit during its growth and development, data obtained declared obviously that a similar trend to that previously mentioned with fruit length was typically detected during both seasons of 1988 and 1989. Since, both were significantly increased by advancement of fruit age throughout period of measurements, as well as the rate of increase in both, especially at the first three sampling dates was the same. However, the increase in rate of fruit diameter at the last two measuring dates showed a slight tendency to be more greater than that of fruit length.

### IV.1.1.d- Fruit shape index:

As fruit index shape (fruit length: fruit diameter) in response to fruit age was concerned, data presented in Table (1) revealed clearly that it did not statistically differ as its obtained values at the different measuring dates were compared each to other during two seasons of 1988 and 1989. However, it tended to be decreased, especially at the last two measuring date as the season was advanced. Hence, fruits tended to be nearly of a round shape at maturity stage instead of the oblonged one at earlier (immature) ones. Such, trend could be easily explained on the fact that the rate of increase in both fruit dimensions (length and diameter) were equally the same during the early stages of fruit development, but later the rate of both were not parallelled since diameter showed relatively higher rate than the length when fruits attained the mature stage.

### IV.1.1.e- Fruit firmness:

Data presented in Table (1) disclosed that fruit firmness was continuously decreased as the fruit age was advanced, since younger fruit were always the firmer ones. Such trend was true during both seasons of

study, however the rate of decrease occurred at the first three measuring dates was more greater than that of the following sampling dates. In spite of the decrease in fruit firmness was actualy reduced after the third measuring date i.e, May 3rd and April 28th for both 1st and 2nd seasons respectively, but it was still remained significant except at the last date only where the decrease was insignificant. Softness of fruit tissue is a real phenomenon that associated with age progression of fruit which reflect the activity of some physiological processes which usually take place and finally leading to maturation and ripening. explanation is going with that reported by Chandler, (1957) who demonstrated that the decreasing in fruit firmness with growing was due to causes, the first is cells are becoming larger and the walls thinner, second is due to the gradual disappearance of the protection of the solid middle lamella of fruit cells which begins to be hydrolyzed to a softer constituency at the begining of maturity and during ripening.

### IV.1.1.f- Rind colour:

With respect to the periodical changes in ground colour of Amaar apricat fruit during developing and maturation, data in Table (1), showed that the colour was gradually changed from the very deep green "S.G 5/8 strong green colour" to yellowish green. Since, such changes were not the same during both seasons, so that it could not be used as an individual characteristic for determining the maturity stage. This results could be attributed to the change in the environmental condition from one season to another.

### IV.1.1.g- Fruit juice total soluble solidsk:

Concerning change in fruit juice total soluble solids percentage (TSS%) data obtained during both 1988 and 1989 seasons as shown in Table (1) disclosed obviously that a sigificant gradual increase was continuously occurred as age of fruit was progressed. However, TSS% was increased moderately at the second measuring date, thereafter it increased sharply until May sth or May std during the first and second seasons, respectively. Moreover, rate of increase was obviously decreased but it still significant as the fruit juice T.SS% of the collected sample at fifth date was

compared to that of the previous one, afterward the increase was statistically neglected. These results are in general agreement with that reported by earlier investigators, Tewari, (1965) and Barakat, (1969) on some stone fruit species.

### IV.1.1.h- Fruit juice total acidity%:

Concerning change in total acidity level of developing Amaar apricot fruits, it is quite evident that a steady gradual decrease was detected with the advancement of fruit age. However, such decrease was not acute since variance between the highest and lowest levels of fruit juice total acidity % throughout the whole period of study i.e as fruits at the first and last measuring dates were compared difference did not exceed 0.70% which represented about 20-25% of the initial level during both seasons of study. On the other hand diference in fruit juice total acidity % was not enough to reach level of significance as fruits at a given two consecutive sampling dates were compared each to other except the first two dates of measurement during both seasons of 1988 and 1989.

This result is in agreement with the finding of Visagie, (1985) who reported that variation in both fruit PH and acid content at different stages of fruit development were so small to be used as suitable indicetors for determining optimum maturity stage of some apricot cultivars. On the other hand Varady-Burgetti et al., (1983) out the importance of studying the changes of fruit juice acid content for determining maturity in some apricot cultivars. the conflict in both trends may be due to variation either in the own characteristics of investigated varieties or the environmental conditions under which studies were done. Anyhow it could be safely concluded that changes in fruit acidity of Amaar apricot cv. Could not be used solely as an indicator for determining maturity under the same condition of such region, Kalubia Governorate.

## IV.1.1.i- Total soluble solids/acid ratio:

As for change in fruit juice T.S.S./acid ratio of Amaar apricot cv. Was concerned, data obtained during both 1988 and 1989 seasons as shown in Table (1) revealed obviously that the ratio was continuously increased by fruit aging. Such increase showed a steady

pronounced rate till May 13th or 8th during both first and second seasons, respectively but the increase occurred at the last measuring date was negligible. Such results are in general agreement with the finding earlier investigators, since the increase T.S.S./acid ratio could be explained easily by the occurrence of the gradual increase in the total soluble solids which was correlated negatively to the changes in level of acidity and consequently the unparallelled trends of both T.S.S% and acility % was reflected on inducing such increase in the TSS/acid ratio with advancement of fruit age.

Generally it is easy to conclude, that Amaar apricot fruits grown under similar environment of Toukh "Kalubia Governorate" could be safely picked depending upon the following fruit physical and chemical characteristics which could be considered as maturity indices:

- 1- Fruit fresh weight of about 16.0 gm.
- 2- Fruit dimensions of (3.0, 3.3 cm for diameter and length, respectively).
- 3- Fruit flesh firmmens (9-10 lb/inch2). as an average of the last two readings was concerned.

Periodical changes in physical and chemical properties of developing Amaar apricot fruits during two successive 1988 and 1989 seasons. Table (1):

Samiling				Fruit ph	lysical cha	uit physical characteristics	F. chen	nical char	F. chemical characteristics
date	Fresh wt. in g.	Length in cm.	Diameter in cm.	Shape Index L/D	Firmess	Colour	T.S.S.	Acidity	Acidity T.S.S/Acid
						1988 season		-	
April 23rd	7.5e	2.4e	2, 1e	1.13a	30.0a	5 G 5/8 strong green	2 40	9 05.	
= 4	9.1d	2.7d	2.4d	1.12a	27.5b	2.5 Gy 8/9 brilliant vellow green		2.33d	0.81 1.40
May Struct	11.70	2°8	2.5c	1.12a	17.3c	2.5 Gy 8/9 brilliant yellow green		2.65c	1.40 2.50
	12.80 16.73	3, 10	2.7b	1.14a	15.5d	2.5 Gy 8/9 brilliant yellow green		2.45d	3.90
May 18th	16.8a	2.4 5.4	3, Zā	1.06a	10.8e	10 y 9/9 brilliant grensih yellow	_	2,3le	4.50
	5	۵ ۲ ۲	o. 0	I.Usa	ر م م	10 y 9/9 brilliant grenish yellow 10.5a		2,25e	4.70
						1989 season			
			1.8c	1.15a	30, 0a	F G 4/7 etwone anone			i
			1.90	1.22a		5 G 5/8 strong green	ج م		0.70
April 28th	9.4c	2 <b>.</b> 6c	2,30	,		2 d 3/0 strong green	٠ 8		1,30
Fay 37d			2.6b	_	15.0d	2.5 Gv 8/9 brillianc yellow	ည္က -		2,50
Ay Sth			2.9a	1.11a		2.56 9/9 brilliant yellow	<u>.</u> ۾		3,50
May 13th			3.0a	_		2.5G 9/9 brilliant grenish yellow 10.	g g	2,40e	<b>4.</b> 50
Means follo	Means followed by the same letters in each	ame lett	ers in eac		are not s	column are not statistically different at 5% level during each season.	during (	ach seaso	

- 4- Fading of skin colour from the deep green to yellowish green.
- 5- T.S.S% of about 10.
- 6- T.S.S./acid ratio of 4.5.

Both the last two characteristics could be considered as standar destructive measurements for determining maturity stage of Amaar apricot fruit, especially when both are associated with one or two of the aforesaid non destructive measurements.

# IV.1.2- Effect of tramsporting containers on mechanical damage of Amaar apricot fruits:

Data presented in Table (2) show the decay percentage of Amaar apricot fruits occurred through transportation from Toukh region to Horticultural Research Institute at Giza as influenced by kind of transporting containers used during both 1988 and 1989 seasons. Four types of transporting containers were examined, namely: padded bottom palm crate with perforated carton liner of about 15 kg. capacity, plastic box of about 15 kg. capacity, plastic box of about 15 kg. capacity, plastic box of about 10 kg. capacity and carton box of about 4 kg. capacity. In this regard four forms of mechanical

damage were observed at destination i.e., bruises, abrasions, punches and scratches.

Referring to decayed fruits due to bruises in relation to type of transporting containers used, data presented in Table (2) showed obviously that the highest percentage of bruises was detected as both palm crate with carton liner and plastic box of 15 kg. capacity were used for tramsportation during seasons of 1988 and 1989. since. both statistically exhibited higher percentage of bruises for Amaar apricat fruit over the other two kinds of containers used during both seasons of study. On the contrary, carton boxes of 4 kg. capacity generally the lowest percentage of bruises followed by the plastic boxes of 10 kg. capacity, while both were statistically about to be the same during both 1988 and 1989 seasons.

These results could be attributed to the container size, especially their depth which is usually reflected negatively on suitability of a given container for transportation of such perishable fruits. Moreover, these results go in line with the findings of Gerdt s and LaRue (1976), Foad (1984) and Kabeel (1987).

As for abrasions percentage, data obtained revealed that the palm crate with carton liner resulted statistically in the highest percentage during two seasons of study. The reverse was true as the carton box of 4 kg. Capacity was the transporting container used, however it did not statistically differ than both types of plastic boxes during the second season. In addition both types of plastic containers i.e., 15 and 10 kg. capacity were in between the above mentioned ones, although the smaller one was more suitable.

With regard to mechanical damaged fruits % due to occurrence of punches, data in Table (2) disclosed that the highest percentage was statistically found when palm crate with carton liner was used during both seasons of study. Moreover, other transporting containers i.e., both types of plastic boxes and the carton boxes not only showed a significant reduction in punches % than the padded bottom liner palm crate but also they had statistically the same effect during both 1988 and 1989 seasons.

Concerning fruit damage percentage due to scratches in relation to type of transporting

containers it is quite evident from data presented in Table (2) that the response was statistically varied during both seasons of study. Since, the palm crate showed significantly higher percentage of scratches over the other three types of containers. Moreover, plastic boxes of 15 kg. Capacity ranked second, followed by plastic boxes of 10 kg. capacity and finally carton boxes of 4.0 kg. capacity in a descending order during two seasons of study as the damaged fruit % due to scratches was concerned.

As for the effect of type of transporting to the total damaged fuits percentage due to the aforesaid four kinds of mechanical injuries data showed that highest value was always concomitant to the palm rate, followed by large type of plastic boxes of larger capacity, smaller plastic boxes and finally carton boxes of 4.0 kg. capacity in a descending order. The differences were significant as the percentage of the total mechanical damage of Amaar apricot fruits induced by a given type of transporting containers was compared to that exhitited by any of the other containers during two seasons of study.

Mechanical damage percentage of Amaar apricot fruits in relation to type of containers used for transporting during 1988 and 1989 seasons. Table (2):

Treatments		Number of dan	Number of damaged fruits percentage	entage	
"Transporting containers"	Bruises	Abrasions	Punches	Scratches	Total
			1988 season	-	-
<pre>1- Palm crate with carton liner, 15 kg. cap. 2- Plastic boxes, 15 kg. cap.</pre>	5.17a 6.10a	2.12a	1.35a	2.75a	11.40a
3- Plastic boxes, 10 kg. cap. 4- Carton boxes, 4 kg. cap.	1.81b 1.16b	0.70c 0.40d	0.01b 0.01b	1.55c 0.70d	4.62c 2.27d
			1989 season		
<pre>1- Palm crate with carton liner, 15 kg. cap. 2- Plastic boxes, 15 kg. cap.</pre>	3.40a 3.01a	2.16a 0.80b	1.03a	2.41a	8.84a
3- Plastic boxes, 10 kg. cap. 4- Carton boxes, 4 kg. cap.	1.22b 0.50b	0.50b 0.50b	0.37b 0.03b	0.45c	2.44c 1.22d
Value having the same letter in each column a	re not statisti	are not statistically different at 5% level.	t 5% level.		

Generally it could be concluded that bruises % was the main form that representative of mechanical damage, followed by scratches and abrasions, while punches % was of the least importance in this respect.

These results could be discussed on the fact that walls of the palm crate characterized by sharp edges and coarse surfaces from inside beside both relative larger size and distant depth than other ones.

On the contrary containers of smaller size with smooth surfaces from inside reduced the decay % of fruits due to the lighter pressure "weight" could be existed upon the lower layers at bottom. In addition findings of Gerdts and LaRue (1976), Foad (1984) and Kabeel (1987), supported the present results.

IV.1.3- Effect of some postharvest treatments on keeping quality of Amaar apricot fruits under different conditions of storage:

In this regard soaking fruits for 2-3 minutes either in hot water (45°C) or solution of borax + boric acid mixture (4,2% respectively) beside washing in tap water as control were the investigated treatments

during both 1988 and 1989 seasons. Storage was carried out under three different conditions, i.e, ambient (room condition of about 27°C ±2 and R.H. of 55-65%) and cold storage either at 5°C or 0°C with 80-90% R.H.

# IV.1.3.a- Effect on fruit physical characteristics of stored Amaar opricot fruits:

# IV.1.3.a.1- Periodical weight loss percentage:

As for the periodical loss% in fresh Weight of Amaar apricot fruits stored under room condition, data obtained during both 1988 and 1989 seasons presented in Table (3). It is quite evident that loss in weight took place continuously as storage period was extended. However the rate of loss "loss% in fresh weight during an interval of 2 days" was higher in ge neral but it reached its maximum value during the fifth interval i.e, after 10 days from starting storage during two seasons of study. Moreover, Amaar apricot fruits soaked in solution of borax + boric acid mixture "4,2% respectively" showed higher rate of loss% than other two treatments, but the difference was significant during the second season only. The relative higher rate of weight loss% under ambient condation may be due to higher temperature and lower R.H.%, since

Effect of some post harvest treatments on fresh weight loss percentage of Amaar apricot fruits stored under room condition during 1988 and 1989 seasons. Table (3):

		Periodical	loss% es	Periodical loss% estimated at 2 days interval on initial weight base	t 2 days f t base	nterval		:	
Treatments	Initial*	. 2	Time of	Time of storage in days	days 8	10		Mean	Total
			**	1988 season					
1- Control	0.00	06.0	6.10	5.00	2.40	6.10	0.50	3,50A	21.00
2- Borex + Boric acid 4, 25 mix.	0.00		7.40	4.00	4.50	7.90	09.0	4.30A	25.89
S- Mark Water "45°C"	0.00		4.10	7.90	0.60	4.10	1.50	3.20A	19, 10
rean	0.00		5.90a	5.60a	2.50b	6.00a	0.90b	00.0	0.00
			31	1989 season	÷ + + + + + + + + + + + + + + + + + + +	-			
1- Control	0.00	3.40	4.30	2.20	3.00	5.30	1.50	3,30B	19.70
2- Borax + Boric acid 4, 25 mix.	0.00		3,10	4.20	3.70	8.80	5.80	5.10A	30.30
3- Marter "45"C"	0.00		1,30	5.40	1.10	4.30	2.70	2.80B	16.80
rean	0.00		2.90b	3.90b	2.60b	6.10a	3.30b	0.00	0.00
New L.S.D. at P = 0.05 for:		Treatment		Storage interval	nterval	Interaction	ction	-	
	1988 season 1989 season	0.66 1.11		0.93 1.57		1.51	51 72		

\* Storage was started on May 21 and 15th in 1988 and 1989 seasons, respectively.

both were out of control. However, no logic explanation could be given for the increasing rate of fruit weight loos in "borax + boric acid" treated fruits during storage under room condition, accordingly further studies are needed in this respect.

With regard to fresh weight loss% in cold stored Amaar apricot fruits as responded to the prestorage treatments i.e, soaking either in mixture of borax + boric acid solution (4,2%) or in hot water "45°C" beside washing in tap water "control", data obtained during both 1988 and 1989 seasons are presented in Table (4) and (5) for refrigerated storage at  $5^{\circ}$ C and 0°C, respectively. It could be noticed obviously that Amaar apricot fruits were also continued to show a periodical loss in their fresh weight along the whole period of refrigerated storage during both 1988 and 1989 seasons. In spite of the measuring interval of loss% in fruit weight under cold storage was extended to 5 days instead of 2 only at room storage, but the rate was markedly reduced to an attractive lower level, especially with storage under 0°C where the decrease was more pronounced. However, no distinguished pattern

of loss rate could be firmly detected for all prestorage treatments throughout the whole period of storage under both cold temperatures i.e., at 5°C and 0°C, but to some extent it could be concluded with little interruption that the rate was slighty increased during the first 1/3 of storage period, thereafter it was reduced and keeping its minimum level during the middle third and finally it tended to increase again till the end of storage period.

Nevertheless, soaking fruits either in (borax + boric acid mixture at 4,2% respe.) or in hot water (45°C) generally resulted in decreasing the average rate of fresh weight loss percentage in Amaar apricot fruits as compared to control during refrigerated storage in both 1988 and 1989 seasons. However, such decrease was significant during both seasons of study under cold storage at 0°C., but it was significant during the second season only at 5°C. In addition, the decrease in weight loss percentage resulted by both treatments of soaking either in solution of "borax +boric acid mixture at 4,2%." or in hot water (45°C) below then control was more pronounced during the middle 1/3 of storage period under cold temperature (5°C/0°C) especially in the second season.

Effect of some post harvest treatments on fresh weight loss percentage of cold stored Amaar apricot fruits at "5°C" during 1988 and 1989 seasons. Table (4):

	Periodic	odical	loss% e	stimate	d at 5	Periodical loss% estimated at 5 days interval on initial weight base	terval	on init	ial wei	ght bas	e e		
Treatments	Initial*	က	10	15	Fine of	Time of storage in days 20 25 30	in day	35	\$	45	50	Mean	Total
					19	1988 season	c						
1- Control 2- Borax + Bords acid # 20	0.00	1.5	1.5	2.4	0.9	2.0	2.1	1.2		9°0	3.8	2.3A	22.7
3- Ware Ester "Asson"	00.0.XIII	1.2		4.6	6 °	8.0	ີ້ວ	3.0	2.9	2.5	2.3	2.6A	25.6
Mean	8.0	1.4 1.3ef	1.2 1.9de	3.4ab	0.9f	1.0 1.3ef	4.3 4.0a	2.3 2.2cd	ā	2.4 2.3 2 2.9bc 2.8bc (	2.3 2.8bc	2.3A 0.0	23,3
					198	1989 season						•	
1- Control 2- Borax + Boric acid 4, 2% mix.0.00	0.00 mix.0.00	0.5	0.9	1.0	3.1	4.9 1.8	4.9	3,3	2.5	2.9	3.7	2.8A	27.7
3- Marm water "45°C" Mean	0.00 0.00	1.4 1.1b	2.1 1.8b	2.1 1.9ab	1.4 2.2a	1.9 2.9a	1.2 2.7a	2.5 2.6a	1.9 2.0a	1.6 1.9ab	1.9 2.3a	1.8B 0.0	18.0 <b>0.0</b>
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	Treatments 0.40 0.56	<b>1</b> 0		Storag	Storage intervals 0.90 0.97	vals	Ā	Interaction 1.27 1.37	ion				

\* Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

Effect of some post harvest treatments on fresh weight loss percentage of cold stored Amaar apricot fruits at "O°C" during 1988 and 1989 seasons. Table (5):

	Periodica	ical l	Periodical loss% estimated at 5 days interval on initial weight base	timated	at 5 da	iys int	erval on	n initia	il weigh	t base		:	
Treatments	Initial*	വ	10	15	Time 20	of stor 25	Time of storage in days 20 25 30 35	days 35	40	45	20	Mean	Total
					196	1988 season	<b>9</b>						
1- Control	0.00	2.9	1.4	3.1	1.4	1.7		8.0	2.4	2.6	1.8	1.94	18.6
2 Users + Boric acid 4, 2% mix.0.00	mix.0.00	2.9	1.3	3°8	1.0	0.7		9.0	2.0	1.5	1.7	1.68	15.8
S- Marker "45"C"	0.00	2.3	1,3	3,5	1.4	8.0		6.0	1.5	2.3	1.5	1.6B	15.9
Rean	<b>8</b> .	2.7b	1.3e	3.5a	1.3e	1. lef	0.49	0.8f	2.0cd	2.1c	1.74	0.0	0.0
		,			198	1989 season	<b>E</b>		•				
1- Control	0.00	2.4	0.5	1.3	1.7	4.2	4.3	0.5	9.0	1.6	1.8	1,94	9
2- Borax + Boric acid 4, 2% mix.0.00	mtx_0.00	2.2	2.0	1.8	9.0	1.5	2.5	1.0	9.0	0.9	6.0	1.48	14.0
3- Warm Water "45°C"	0.00	1.6	1.7	1,3	1.0	1.4	1.1	1.7	6.0	1.1	1.1	1.38	12.9
	9.0	2. Ia	1.4b	1.5b	1.1bc	2.4a	2.6a	1.1bc	0.7c	1.2bc	1.3b	0.0	0.0
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	Treatments 0.17 0.33	40		Storag	Storage intervals 0.36 0.55	vals	Ā	Interaction 0.62 1.05	ion				

\* Storage was started on May 21 and 15 au h during 1988 and 1989 seasons, respectively.

These results may be attributed to the influence of both low temperature and higher relative humidity in retardation of the potential loss of fruit moisture content, as well as the inhibitory action of both treatments against the rot organizms which retard fruit softness. Moreover, the obtained results are supported by many researchers, i.e Smith and Redit, (1962) Smith and Bassett, (1964), and Smith and Penny (1972) all pointed out the utility of hot water treatment in reducing decay of peaches and other stone fruits. Moreover, these results are in general agreement with that reported by Guzewska et al., (1968).

### IV.1.3.a.2. Discarded fruits percentage:

Percentage of discarded fruits during the periodical sorting throughout the whole storage period of Amaar apricQt fruits in relation to the different prestorage treatments included both shrivelled and decayed "infected" ones. Data obtained during 1988 and 1989 seasons pertaining storage under room condition (27°C ± 2 with R.H. 55.0-65.0%) and cold storage either at 5°C or 0°C with R.H. 80-90% are presented in Tables (6), (7) and (8), respectively.

Regarding percentage of discarded fruits of Amaar apricot cv. during storage under ambient condition as affected by the prestorage treatments, data in Table (6) show clearly that the rate of decay was gradually increased with progress of storage period during both 1988 and 1989 seasons, regardless of the post-harvest treatment applied. On the other hand prestorage soaking in Warm Water (45°C) showed statistically the lowest average of discarded fruits as compared either with soaking in solution of (borax + boric acid 4,2% mix) or the control. Moreover, soaking in a solution of borax + boraic acid mixture "4,2%" was more effective than control, however the difference was significant in the 1989 season only. Anyhow, storage under room condition is not advisable for such perishable fruits even with any of both postharvest treatments investigated in this study due to higher rate of decay %, especially after 8 days from storage. But to some extent it could be recommended to use hot water (45°C) for less than one week storage under room condition.

As for the periodical discarding of decayed fruits during cold storage either at 5°C or 0°C data from Tables (7) and (8) showed no sign of decay could be

observed after 5 and 10 days of storage at 5°C and 0°C. respectively. This period of no decay incidence was extended to 15 days during second season except control at cold storage under 5°C. Thereafter, decay started and gradually increased with the advancement of storage time till the last sorting date, where it reached statistically its maximum rate during both seasons of study, regardless of degree of cold temperature under which Amaar apricot fruits were stored. On the other hand postharvest soaking of Amaar apricot fruits for 2-3 minutes either in solution of borax + boric acid mixture at 4,2% or in hot water (45°C) markedly decreased the average rate of discarded fruits. Such reduction was significant during two seasons as fruits were stored under 5°C, but it was significant in the second season only with cold storage at 0°C, where the decrease in the first season was so small to reach level of significance. In addition, it is quite evident that average rate of discarding fruits per an interval of 5 days under refrigerated storage was strikingly reduced to about 12.5 / 10.0% of that at storage under ambient condition, although the interval of sorting was prolonged under cold storage to 2.5 times much more than room temperature. However, such decrease in rate

of discarded fruits was more pronounced at  $5^{\circ}\text{C}$  than at  $0^{\circ}\text{C}$ .

These results could be explained on the base that both cold temperature and higher relative humidity play important role retarding evaporation in and consequently reduce fruit shrivelling. Beside, temperature inactivate germination of most fungi species, especially Rhizopus spp. which cause rots, since they are sensitive to chilling. Moreover, low temperature has a beneficial effect on delaying the rapid fruit softening by reducing the respiratory rate of fruits. In addition several investigators supported the present data, in this respect Pierson, (1966); Eckert and Sommer (1967); Matsumoto and Sommer, (1967); Guzewska et al., (1968); Coats et al., (1974); Kilany, (1982); Sommer, (1982) and Abd El-Ghani, (1986).

In addition obtained results regarding the utility of hot water as a postharvest treatments for reducing decay are in agreement with the finings of several investigators on some stone fruits, Smith and Basset (1964); Smith and Penny, (1972) and Well s, (1971).

Table (7): Discarded\* fruit percentage of Amaar apricot cv. in relation to some post harvest treatments during cold storage at 5°C in 1988 and 1989 seasons.

	ł		J.	scarded	fruit	Ulscarded fruit percentage estimated at 5 days interval	ge esti	mated	ıt 5 day	s inter	val			
Treatments	H		ம	10	15	Time 20	of stor 25	Time of storage in days 20 25 30 35	days 35	\$	45	20	Mean	Mean Total
						19	1988 season	<b>E</b>						
1- Control		•	0.0	9.0	1.0	1.5 2.1 2	2.1	2.5	2.1	3.1	4.2	8.3		25.4
2- Dorak + Boric acid 4, 25 mix.	×		0.0	0.0	9.0	8.0	1.0	1.2	1.7	2.1	2.7	4.0		14.1
STREET WEGGT -40-C.			9.0	9.0	9.0	9.0	8.0	1.0	8.0	1.2	1.9	3,1		11.2
	=	1	0.2e	0.4de	0.7de	1.0de	1.3cd	1.6cd	1.5cd	2.1bc	2.9b	5.1a	0.0	0.0
	,						1989 season	5						
1- Control		ı	0.0	9.0	1.0	1.7	2.5	3,1		3,1		15.6		39 5
2- Borax + Boric acid 4, 2% mix.	×	ı	0.0	0.0	0.0	0.8	8.0	9.0		1.0	1.9	4.4	1.18	10.5
STREET WATER "45"C"			0.0	0.0	0.0	0.0	8.0	1.0		9.0		8,5		13.9
			0.0e	0.2e	0.3e	0.8de	1.4cd	1.6cd	2,3c	1.6cd		9.5a		0.0
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	<u> </u>	Treatments 0.38 0.48	-		Storag	Storage intervals 0.85 0.97	/aTs		Interaction 1.58 1.80	rion				

\* No of both decayed "infected" and shrivelled fruits were periodically discarded after calculation and estimated as percentage of the initial number of ruits at 5 days interval. \*\* Storage was started on May 21 and 15<u>th</u> during 1988 and 1989 seasons, respectively. ţ

Discarded\* fruits percentage of Amaar apricot cv. in relation to some post harvest treatments during cold storage at 0°C in 1988 and 1989 seasons. Table (8):

		Disc	arded fruits percentage estimated at 5 days interval	its per	centage	estima	ted at	5 days	interval	_		;	
Treatments	Initial**	t t	10	15	Time (	of stor 25	Time of storage in days 20 25 30 3	days 35	40	45	20	<b>K</b> ean	Mean Total
					-	1988 season	son						
1- Control	•	0.0	0.0	1.9	2.7	3,1	4.4	5.6	2.0	2,5	4.4	3.0A	29.6
2- Warm Later Marson		0.0	0.0	9.0	1.7	2.7	4.6	5.0	4.4	2.5	3.7	2.5A	25.2
STREET TOTAL	1	0.0	0.0	9.0	1.5	1.7	2.3	1.9	5.6	4.3	6.1	2.4A	24.0
redi	ı	0.0	0.0	1.0e	2.0de	2.5d	3.8bc		5.0a	3. 1cd	4.7ab	0.0	0.0
					61	1989 season	uo						
1- Control	•	0.0	0.0	0.0	1.2	2.1	5.4	4.2	, .	7 9	14.4	<b>V</b> 0	30 0
2 June 11- Boric acid 4, 2% mix.	ı	0.0	0.0	0.0	9.0	1.5	2,3	4.0	4.3	6.2	10.8	3.0B	29.7
STREET WATER TABLE:	ı	0.0	0.0	9.0	1.0	2.0	2.1	3.1	3,5	6.9	11.5	3, 18	30.7
	t	0.0	0.0	0.2c	0.9dc	1.9d	3.30	3.8c	4.3c	6.6b	12.2a	0.0	0.0
New L.S.D. P = 0.05 for:	<b>Treatments</b>	ts		Storag	e inter	vals		Interaction	tion				
1989 season:	0.65			•	1.11 0.75			1.92	26				

\* No. of both decayed "infected" and shrivelled fruits were periodically discarded after calculation and estimated as percentage of the initial number of fruits at 5 days interval. \*\* Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

# IV.1.3.a.3. Periodical changes in fruit firmness:

Concerning changes in flesh firmness of Amaar apricot fruits as influenced by prestorage treatments i.e., soaking for 2-3 minutes in mixture solution of Borax + boric acid at 4,2% or in hot water (45°C), data obtained during both 1988 and 1989 seasons are presented in Tables (9), (10) and (11) for storage under ambient condition and cold storage either at 5°C or 0°C, respectively.

With regard to fruit firmness in response to postharvest treatments under storage of room condition,
data in Table (9) showed that it was gradually
decreased as the duration of storage was advanced until
the last sorting date during both seasons, irrespective
of prestorage treatment applied. However no specific
trend could be detected for all treatments but to some
extent it could be noticed that soaking fruits in
solution of borax + boric acid mixtures at 4,2%
respectively helped fruits to be stained relatively
more firmer. On the other hand; hot water treatment
enhanced fruit softining, especially after 6 days from
storage. However, control treatment was in between as
an average of two seasons was concerned.

Meanwhile, cold stored fruits of Amaar apricot cv. showed also a continuous decrease in their flesh firmness with the advancement of storage time. But the rate of fruit softening took place smoothly during the first three or five weeks from starting the refrigerated storage at 5°C or 0°C, respectively, then rate of firmness decline was suddenly decreased and thereafter it continued with an intermediate rate till the storage had been terminated during both 1988 and 1989 seasons.

As for the influence of the prestorage treatments the changes in fruit firmness data obtained revealed that no firm trend could be detected for both cold temperature (5 / 0°C) during two seasons of study. However, it could be concluded that hot water treatment showed generally lower value of fruit firmness, except 0°C stored fruits in the second 1989 season. On the other hand it could be noticed that the response of flesh firmness either to temperature of cold storage or sorting date was more pronounced than that occurred in relation to both prestorage treatments during two seasons of study.

Changes in fruit firmness of Amaar apricot cv. in response to some post harvest treatments stored under room condition during 1988 and 1989 seasons. Table (9):

		Fruit firmness (Ib/inch²) estimated at 2 days interval	ss (Ib/in	nch²) estim	ated at 2 d	ays interva	-	··
Treatments	Initial*	2	Time (	Time of storage in days	in days	10	12	Mean
			-	1988 season				
1- Control 2- Borax + Boric acid 4, 2% mix.	8.2 8.5	8.8	7.4	7.3	6.5 7.3	4.5 6.9	4.0	6.6B 7.4A
3- Marin water "45°C" Mean	9.2 9.2a	8 <b>8</b>	8.0 7.9c	6.8 7.2c	6.6 6.8d	4.4 4.6e	3.4 3.6f	6.78 0.0
				1989 season				
<pre>1- Control 2- Borax + Boric acid 4, 2% mix.</pre>	7.7	7.1	6.3	0°9 4	. <del>.</del>	4.0	2.9	5.7A
3- Marm water "45°C" Mean	7.7 7.7a	6.9 7.0b	5.8 6.2c	5.6 5.8d	5.4e	3.3 3.7f	2.2 2.6 <u>6</u>	5.6A 5.2B 0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.26 0.30		Storage ii 0.37	Storage interval 0.37	Interaction 0.64 0.51	ion	

\* Storage was started on May 21 and 15<u>th</u> in 1988 and 1989 seasons, respectively.

Table (10): Changes in fruit firmness of Amaar apricot cv. in response to some post harvest treatments during cold storage at "5°C" in 1988 and 1989 seasons.

		Fruit fi	rmness (Ib	Fruit firmness (Ib/inch²) estimated at one week interval	timated at	one week	interval		:
Treatments	Initia1*		Time 2	Time of storage in weeks	in weeks	5	9	7	Mean
				1988 season					
1- Control	9.2	8.7	8.6	7.0	5.4	0.9	4.4	3.8	6.5A
2 Manual Control of the Control of t	o. 6	9.0	8.2	9.9	5.0	4.6	4.1	3.4	6.2AB
C. Maria Mater "40"C"	9.2	8 9	7.8	<b>6.</b> 2	4.6	4.2	3.7	3.0	5.98
	9.2a	8.6b	8.2b	<b>9</b> •9	5.0d	<b>4.</b> 0d	<b>4.</b> 0e	3.4f	0.0
				1989 se	season				
1- Control	7.7	7.1	7.1	6.8	5.4	4.6	4.0	3.5	5.7A
2- Borax + Boric acid 4, 2% mix.	7.7	7.0	6.9	6.3	4.8	4.1	3.7	3.2	5,58
3- Harm Water "45°C"	7.7	7.1	6.9	6.3	4.4	3.7	3.4	3.0	5.38
Rean	7.7a	7.1b	7.0b	9.50	<b>4.</b> 9d	<b>4.</b> le	3.7f	3.2g	0.0
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	Treatments 0.31 0.20		Storage 10 0.51 0.35	Storage intervals 0.51 0.35	Int	Interaction 0.89 0.60			

\* Storage was started on May 21 and 15<u>th</u> during 1988 and 1989 seasons, respectively.

Table (11): Changes in fruit firmness of Amaar apricot cv. in relation to some post harvest treatments during cold storage at "O°C" in 1988 and 1989 seasons.

		Fruit f	irmess (Ib	/inch²) es	Fruit firmness (Ib/inch²) estimated at one week interval	one week	interval	-	:
Treatments	Initial*	1	Tim 2	e of stora	Time of storage in weeks	co	<u> </u>	7	Mean
				1988 season	ason	•	,	•	
1- Control	9.2	80	8.2	7.8	7.4	7.0	5	4	7 38
2- Borax + Boric acid 4, 2% mix.	9.2	0.6	8.6	8.2	7.4	7.0	2 0	4.2	7.4A
3- Farm Water "45°C"	<b>5.</b> 5	0.6	8.2	8.0	7.5	9.9	5.0	3,4	7.1B
Tean	9.2a	8 <b>.</b> 9a	8.3b	8.0c	7.4d	6.9e	5.2f	<b>4.</b> 1g	0.0
				1989 season	ason				
1- Control	7.7	7.3	7.4	6.9	6.4	5.2	4.2	3,9	6.28
2 Home and Margon	7.7	<b>7.</b> 6	7.1	9*9	9.9	5.5	5.1	4.2	6.3AB
C. Reiter Water 45 C.:	7.7	7.5	7.4	6.9	6.5	5.6	5.3	4.3	6.4A
	7.7a	7.5b	7.36	<b>6</b> .8c	<b>6.5</b> d	5.4e	5.1f	4.1g	0.0
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	Treatments 0.21 0.13		Storage intervals 0.32 0.24	intervals	Inte	Interaction 0.56 0.41			

Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

The present results could be generally discussed on the fact that retardation of fruit softening may be due to the direct effect of temperature on activity of hydrolysis enzymes of the unsoluble pectinc compounds, especially protopectin. Besides, the findings of Coats et al., (1974) and Mitchell et al., (1977) are in general agreement with the present result, regarding the effect of storage temperature on flesh softening of peach and nectarine fruits. Moreover, Kilany (1982) concluded that Le-conte pear fruits recorded rapid loss in flesh firmnes, when kept under room To where cold stored fruits were twice harder than those held under room temperature.

- IV.1.3.b.1. Fruit juice total soluble solids (TSS):

Regarding changes in fruit juice total soluble solids (TSS) percentage of Amaar apricot cv. as affected by prestorage dipping in solution of borax + boric acid mixture and hot water either stored under ambient condition or cold temperature ( $5 / 0^{\circ}$ C) data are presented in Tables (12), (13) and (14) respectively. It is quite evident that a gradual

increase in TSS% was obviously occurred as the storage duration was advanced, irrespective of condition or prestorage treatment applied. However, such increase significant as the values of TSS% consecutive sorting dates of the same treatment under a given condition of storage were compared each to other. Such trend was true with little interruptions for refrigerated storage, especially at the last three sorting dates of storage period where the differences were statisically significant during both 1988 and 1989 seasons. On the other hand the rate of TSS% increment under room condition was more higher than that detected under cold storage, since its trend was negatively related to storage temperature even under refrigeration condition.

As for the response to the prestorage treatments, obtained data revealed that dipping in hot water (45°C) treatment resulted statistically in increasing fruit juice TSS% as compared either with control or dipping in borax + boric acid mixture at 4,2% concentrations, regardless of condition under which Amaar apricot fruits were stored during both seasons of study. In addition TSS% of both untreated fruits "control" and (borax + boric acid) treated ones showed generally the

Table (12): Fruit juice total soluble solids percentage (T.S.S.) of Ammar apricot cv. as affected by some post harvest treatments stored under room condition during 1988 and 1989 seasons.

		Fruit ju	ice T.S.S.	Fruit juice T.S.S. % estimated at 2 days interval	fat 2 days	interval		
Treatments	Initial*	7	Time 4	Time of storage in days	in days	10	12	Mean
-				1988 season				
1- Control 2- Borax + Boric acid 4, 2% mix. 3- Marm water "45°C"	10.5 10.5	10.7	11.0	11.7	12.0	12.8 11.9	13.2	11.7A 11.3B
Mean	10.5e	10.8 10.7de	11.0d	12.0 11.6c	12.3 11.9c	12.9 12.50b	13.7 13.1a	11.9A 0.0
				1989 season				
1- Control 2- Borax + Boric acid 4, 2% mix.	10.9 10.9	11.0	11.3	11.6	12.0	12.8	13.6	11.98
3- Warm water "45°C" Mean	10.9 10.9f	11.2 11.1f	11.7 11.5e	12.3 11.9d	12.6 12.3c	13.4 13.1b	13.8 13.6a	12.3A 0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.31 0.32	ss ·	Storage interval 0.44	interval 44 32	Interaction 0.75	oo.	
_		!		;	J	00.0		

\* Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

Changes in fruit juice total soluble solids (T.S.S.) percentage of Amaar apricot cv. in response to some post harvest treatments during cold storage at "5°C" in 1988 and 1989 seasons. Table (13):

		Fruit j	uice T.S.S	.% estimat	ed at one	Fruit juice T.S.S.% estimated at one week interval	- <u>F</u>		
Treatments	Initial*	<b>-</b>	Ti.	Time of storage in weeks	age in wee	ks 5	9	7	Mean
				1988	1988 season	•			
1- Control 2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C" Mean	10.5 10.5 10.5	10.8 11.0 11.1 11.0e	11.4 11.7 12.2 11.8d	12.3 12.8 13.5 12.9c	12.8 13.3 14.0 13.4b	13.4 13.7 14.1 13.8ab	13.6 13.9 14.3 13.9a	13.7 14.0 14.4 14.0a	12.3C 12.6B 13.0A 0.0
				1989	season				
1- Control 2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C" Mean	10.9 10.9 10.9	11.2 11.3 11.5 11.5	12.0 12.0 12.2 12.1d	12.6 13.0 13.3 13.0c	13.2 13.6 13.8 13.5b	13.5 14.0 14.3	13.7 14.0 14.3	13.8 14.1 14.4	12.6C 12.9B 13.1A
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	Treatments 0.27 0.16		Storage 11 0.44 0.28	Storage intervals 0.44 0.28	Ä	Interaction 0.77			

\* Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

Table (14): Changes in fruit juice total soluble solids (T.S.S.) percentage of Amaar apricot cv. in response to some post harvest treatments during cold storage at "0°C" in 1988 and 1989 seasons.

		Fruit j	uice T.S.S	Fruit juice T.S.S.% estimated at one week interval	ed at one n	week interv	- E		
Treatments	Initial*	7	71	Time of storage in weeks	ige in weel	ks 5	9	7	Mean
•				1988 season	eason				
<pre>1- Control 2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C"</pre>	10.5 10.5	10.7	11.0	11.3	11.7	12.2 13.0	12.8 13.0	13.2	11.7B
Wean	10.5d	10.9d	12.0 11.4c	12.4 11.8c	12.9 12.3b	13.7 13.0a	13.8 13.2a	13.8 13.4a	12.5A 0.0
•				1989 season	eason				
<pre>1- Control 2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C"</pre>	10.9	11.1	12.0	12.4	12.6 12.7	12.7	13.1 13.2	13.5	12.3B
Mean	10.9e	11.7de	13.0 12.3cd	13,4 12,7bcd	13.7 13.0abc	13.8 13.1ahc	14.1	14.5	13.3A
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	Treatments 0.32 0.60		Storage in 0.48		II	Interaction 0.83	13. Jab	13.98	0.0
	+ + + + + + + + + + + + + + + + + + + +		76.0	-4		7			

\* Storage was started on May 21 and 15<u>th</u> during 1988 and 1989 seasons, respectively.

same response, in most cases. However, dipping in hot water (45°C) treatment resulted in a relative increase of TSS% over the control which reached the level of significance only under refrigerated storage at (5.0°C) during both seasons of study.

Obtained results concerning the increase in TSS% during storage may be attributed to the fact that fruits loss some of their water content through evaporation at a relative higher rate than that happened with dry matter loss by respiration which certainly well be reflected on concentrating fruit juice total soluble solids. Moreover, such results are confirmed by the findings of Kilany, (1982) and Abd El-Ghani (1986) on Le-Conte pear and Anna apple fruits, respectively.

# IV.1.3.b.2. Fruit juice total acidity:

As regard to the periodical changes in fruit juice titratable acidity & of Amaar apricot cv. as influenced by some post-harvest treatments, data obtained during both 1988 and 1989 seasons are presented in Tables (15), (16) and (17) for fruits stored under ambient condition, cold storage at 5°C and ... at 0°C, respectively. From data in Table (15) it could be clearly noticed that the fruit

juice total acidity % of Amaar apricot fruits stored under ambient condition was gradually decreased with the advancement of storage period. Meanwhile, rate of decrease took place smoothly during the first onethird of storage time where data of both first two sampling/sorting dates i.e. after 2 and 4 days from starting storage under room temperature showed no significant variation in acidity % during two seasons study. Thereafter, the rate of decrease was increased, and differences in values of acidity percentage due to prolonging storage that occurred from the third sorting date and so on for a given as compared treatment reached level of significant to that of former or later sorting dates during both 1988 and 1989 seasons.

Amaar apricot fruits either in solution of "borax +boric acid mixture" or in hot water "45°C" significantly decreased the fruit juice total acidity than control for fruits stored under room condition. On the other hand, hot water "45°C" was more effective than (borax + boric acid solution) in this respect, however difference was significant during only 1988 season.

Table (15): Changes in fruit juice total acidity percentage of Amaar apricot cv. as affected by some post harvest treatments stored under room condition during 1988 and 1989 seasons.

		t juice aci	dity perce	entage estim	nated at 2	Fruit juice acidity percentage estimated at 2 days interval	1 1 1	Mean
Treatments	Initial*	. 2	Time of	Time of storage in days	n days 8	10	12	
			<b>≓</b> .	1988 season				
1_ Control	2,25	2.20	2.14	2.06	1.90	1.50	1,30	1.91A
2- Borax + Boric acid 4, 2% mix.	2,25	2,18	2,10	2,00	1.81	1.30	1.20	1.838
3- Warm water "45°C"	2.25	2.15	2.05	1.75	1.60	1.10	0.93 1.50£	1.09.C
Mean	2.25a	2.18ab	2.10b	1.94c	D//-T	1.30e	1.00	3
	•	:	1	1989 season		•		
1 Gratus	2,35	2.31	2.25	2, 15	2.03	1,75	1,53	2.05A
1- control 2. Borde acid 4. 2% mix.	2,35	2,25	2, 18	2,10	1,95	1.65	1.41	1.98B
2. Parm mater #45°C"	2,35	2.23	2.14	2.04	1.83	1.60	1,35	1.938
Kean	2.35a	2.26b	2.19b	2.10c	1.94d	1.67e	1.43f	9.6
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatment 0.071 0.052		Storage int 0.096 0.078	Storage interval 0.096 0.078	Interaction 0.174 0.139		

\* Storage was started on May 21 and 15th for 1988 and 1989 seasons, respectively.

As for the juice total acidity percentage of cold stored Amaar apricot fruits in relation to the investigated prestorage treatments i.e., either in solution of borax + boric acid (4,2%) or in hot water (45°C), beside washing in tap water as control, data obtained during both 1988 and 1989 seasons are tabulated in Tables (16) and (17) refrigerated storage under 5°C and for respectively. Obtained data declared clearly that total acidity percentage of cold stored Amaar apricot fruits were also continued to be decreased along the whole period of storage during both seasons of study. The rate of decrease under cold storage was greatly reduced as compared with that previously detected at ambient condition, however measuring interval was prolonged to one week at refrigerated storage instead of 2 days for room storage. In addition, reduction in rate of decreasing total acidity due to cold storage was more pronounced at 0°C during two seasons of study.

As for the effect of prestorage treatments data in Tables (16) and (17) revealed clearly that storage under cold temperature showed generally similar trend to the aforesaid found with storage at ambient temperature. However, soaking in hot water increased the level of fruit juice total acidity %, but

Fruit juice total acidity percentage of Amaar apricot cv. in relation to some post harvest treatments during cold storage at "5°C" in 1988 and 1989 seasons. Table (16):

		ruit juic	e total ac	idity % es	timated at	Fruit juice total acidity % estimated at one week interval	nterval		Moon
Treatments	Initial*		Tim 2	e of stora	Time of storage in weeks 3 4	N S	· •	7	
		V		1988 season	Seson				
1- Control	2,25	2,17	2,10	2,05	1.96	1.92	1.85	1.78	2.01A
2- Borax + Boric acid 4, 2% mix.	2,25	2.11	2.04	1.95	1.87	1.80	1.73	1.66	1.938
3- Marie water "45°C" Mean	2.25 2.25a	2.06 2.11b	1.91 2.01bc	1.82 1.94cd	1.75 1.86de	1.70 1.81ef	1,63 1.74fg	1.56 1.67g	1.84C 0.00
				1989 season	евзоп				
1- Control	2,35	2.26	2,19	2.05	2.00	1.94	1.89	1.80	2.06A
2- Borax + Boric acid 4, 2% mix.	2,35	2.30	2.21	2.12	1.99	1.89	1.80	1.70	2.05A
3- Marm water "45°C" Mean	2,35 2,35a	2.18 2.25ab	2.14 2.18bc	2.01 2.06cd	1.85 1.95de	1.80 1.88e	1.73 1.81ef	1.65 . 1.72f	1.968 0.00
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	Treatments 0.055 0.078	·	Storage int 0.102 0.151	Storage intervals 0.102 0.151	: u	Interaction 0.181 0.271			

\* Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

Changes in fruit juice total acidity percentage of Amaar apricot cv. as affected by some post harvest treatments under cold storage at "0°C" in 1988 and 1989 seasons. Table (17):

		Fruit ju	ice total a	cidity %	stimated	Fruit juice total acidity % estimated at one week interva	interval	1 1 1 1	Mean
Treatments	Initial*		Time 2	Time of storage in weeks	je in week 4	r.	9	7	
				1988 season	ason			,	
1. Control	2.25	2,20	2, 15	2.11	2.08	2.01	1.92	1.85	2.07A
2. Borax + Boric acid 4. 2% mix.	2.25	2.16	2,12	2.08	2.00	1,95	1.85	1,76	2.02AB
A Mark pater Adroca	2.25	2,15	2, 10	2.05	1.95	1,89	1.75	1.67	1.98B
Wean	2,25a	2.17ab	2,12bc	2.08bc	2.01cd	1.95de	1.84ef	1.76f	0.00
	·	-		1988	1988 season				
1- Control	2,35	2,30	2,26	2.17	2,13	2.09	1.98	1.92	2.15A
2. Rorax + Roric acid 4, 2% mix.	2,35	2.28	2.24	2.18	2.10	2.01	1.90	1.83	2.11A
2. Mars safer "Afoc"	2,35	2,25	2,21	2.12	2.04	1,95	1.84	1.75	2.06A
Mean	2.35a	2.28ab	2.24ab	2.17bc	2.09cd	2.02de	1.91ef	1.83f	0.00
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	Treatments 0.081 0.141		Storage int 0.112 0.261	Storage intervals 0.112 0.261	<b>u</b> I	Interaction 0.200 0.462			

\* Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

differences could be statatistically neglegted during storage under 0°C. While at 5°C it was significantly differed as compared either with soaking in salution of (borax + boric acid mixture) or control.

This result is in general agreement with the findings of Kilany, (1982); Millim et al., (1982); Chen et al., (1983); Abd El-Ghani (1986) and Shicherbatko et al., (1986), all demonstrated that titratable acidity in fruit juice of different pomes and stone fruits species decreased as the storage period was prolonged.

### IV.1.3.b.3. Fruit juice TSS/Acid ratio:

Referring to periodical changes in ratio of fruit juice total soluble solids: total acidity in Amaar apricot fruits stored under room condition, data are presented in Table (18). Obtained data revealed clearly that the ratio was continuously increased as duration of storage prolonged during both 1988 and 1989 seasons. However, the change took place smoothly during the first half of storage period, therafter the rate was sharply increased till the last measuring date, during both seasons of study.

Table (18): Fruit juice T.S.S./Acid ratio of Amaar apricot cv. as affected by some post harvest treatments during storage under room condition in 1988 and 1989 seasons.

	Fruit	t juice T.S	.S./Acid r	juice T.S.S./Acid ratio estimated at 2	Fruit juice T.S.S./Acid ratio estimated at Z days interval	/s interval		Mean
Treatments	Initial*	2	Time (	Time of storage in days	n days 8	10	12	
				1988 season				
1- Control	4.66	4.86	5,14	5.67	6.31	8.53	10, 15	6.47
2- Borax + Boric acid 4, 2% mix.	4.66 4.66	<b>4.</b> 86	5,14 5,51	5.60 6.85	6.35 7.68	9.15 11.72	14.42	7.98
3- Namm Water 40 C	4.66	4.91	5.26	6.04	6.78	9.80	11.60	0.00
				1989 season				
1- Control	4.63	4.76	5.02	5,39	5.91	7.31	88.8	5,98
2- Borax + Boric acid 4, 2% mix.	4.63	4.93 5.02	5.27 5.46	5.61 6.02	6.30 6.88	7.8/ 8.37	9.30 10.22	6.65
3- Marin Water "40'C" Mean	4.63	4.90	5.25	2.67	6.36	7.85	9.53	0.00

\* Storage was started on May 21th and 15th during 1988 and 1989 seasons, respectively.

As for the effect of the prestorage treatments on the TSS/acid ratio it could be noticed that a general trend could be detected, where the dipping in hot water treatment showed a tendency to increase the ratio than fruits of other treatments during both seasons.

concerning effect of the above mentioned prestorage treatments on TSS/acid ratio in cold stored Amaar apricot fruits, data obtained during both 1988 and 1989 seasons are tabulated in Tables (19) and (20) for storage at 5°C and 0°C, respectively. It could be noticed that the same trend that previously found at ambient temperature was also detected for cold storage, as the periodical changes in relation to advancement of storage time was concerned, regardless of the cold temperature under which fruits were stored. However the rate of increase under cold storage was obviously lower than that occurred under room temperature.

On the other hand, the increase in TSS/acid ratio was steadily took place during the whole period of cold storage during two seasons of study.

Neverthless, the response of TSS/acid ratio to the different prestorage treatments for Amaar apricot furits stored under 5°C or 0°C showed nearly the same trend previously detected under room condition, where the lowest ratio was that of untreated fruits (control). While the reverse was true with the hot water soaked fruits as well as (borax + boric acid) treatment was intermediate in this concern.

be easily could results Generally, this TSS% that increase in the explained by the corresponded a reduction in fruit juice acidity by extending storage period as previously mentioned individually with each of both fruit characteristics. In addition the earlier findings of El-Kilany, (1982); Millim et al., (1982); Chen et al., (1983); Abd El-Ghani, (1986) and Shicherbatko et al., (1986) on stored fruits of some pomes and stone-fruits species demonstrated similar trend. All reported that fruit total acidity decreased but total soluble solids increased and consequently the TSS/acid ratio was greatly increased as the duration of storage was prolonged.

Table (19): Fruit juice T.S.S./Acid ratio of Amaar apricot cv. in relation to some post harvest treatments during cold storage at "5°C" in 1988 and 1989 seasons.

		T.S.S./	Acid ratio	estimated	T.S.S./Acid ratio estimated at one week interval	ek interva	_		N Sec
		j 	<u> </u>	Time of store	Time of storage in weeks		,		
Treatments	Initia]*		2	m	4	ń	٥	•	
				1988	1988 season				
1- Control	4.66	4.97	5.42	00.9	6.53	6.97	7.35	7.69	6.19
2- Borax + Boric acid 4, 2% mix.	4.66	5.21	5.73	6.56	7.11	7.61	8.03	8.43	99.9
3- Warm water "45°C"	4.66	5,38	6.38	7.41	8.00	8.29	8.65	9.23	7.25
Hean	4.66	5.18	5.84	6.65	7.21	7.62	8.01	8.45	0.00
				1989	1989 season				
1- Control	4.63	4.95	5.47	6.14	09*9	. 6.95	7.24	7.66	6.20
2-Borax + Boric acid 4, 2% mix.	4.63	4.91	5.42	6.13	6.83	7.40	7.77	8.29	6.42
3- Warm water "45°C"	4.63	5.27	5.70	6,61	7.45	7.94	8.26	8.72	6.82
Mean	4.63	5.04	5.53	6.29	96.9	7.43	7.75	8.22	0.00

Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

Fruit juice T.S.S./Acid ratio of Amaar apricot cv. in response to some post harvest treatment during cold storage at "0°C" in 1988 and 1989 seasons. Table (20):

	-	T.S.S.//	Acid ratio	estimated	T.S.S./Acid ratio estimated at one week interval	ek interval	)           	1 1 1 1	Mean
				ne of stor	Time of storage in weeks	ks 7	<b>ب</b> د	1	
Treatments	Initial*	<b>-</b>	7	9	t	•	•	•	
				1988	1988 season				
1 - Cantural	4.66	4.86	5,11	5,35	5.62	90*9	99*9	7.13	5,68
I = CONTINUE OF STATE ST	4 66	5.04	5,33	5.67	6.15	99*9	7.02	7.55	6.01
Z- BOTAX + BOFIC ACIA ++ Z# mix-	99.4	5.11	5.71	6.04	6.61	7.24	7.88	8.26	6.43
Samen water 45 c	4.66	5.00	5,38	5.68	6.12	6.65	7.18	7.64	0.00
				1989	\$C850ft				
-	69 7	4.82	5.30	5.71	5,91	6.07	6.61	7.03	5.76
I- CONTROL  O Desert A Desert a sett A 24 mix	A 63	4.91	5,35	5.64	6.04	6.41	6.94	7,43	5.91
2- DOFAX + DOFIC ACID +; EA INIA:	4 63	5,68	5.88	6.32	6.71	7.07	99*/	8.28	6.52
Jan Marier 40 C. Mean Mean	4.63	5,13	5.51	5.89	6.22	6.51	7.07	7.58	0.00

Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

## IV.1.3.b.4. Fruit juice total sugars percentage:

Concerning fruit juice total sugars percentage in response to some prestorage tr, eatments data obtained on Amaar apricot fruits during both 1988 and 1989 seasons are tabulated in Tables (21), (22) and (23) for storage under room condition and cold temeprature at 80-90% RH either at 5°C or 0°C, respectively. The present results showed clearly that the sugars percentage was continuously increased as the storage period advanced during both seasons of study, irrespective of prestorage treatment applied or conditions under which Amaar apricot fruits were stored. Such increase was significant with Amaar apricot fruits stored under room condition as the values obtained at the different measuring dates were compared each to other through both 1988 and 1989 season except the last date i.e. after 12 days of storage where the sugars & tended to be decreased. The decrease in sugar percentage occurred at the 6th determining date was significant as compared with that found at the previous ones during both seasons of study with all prestorage treatments. Moreover, data in Table (21) showed that the hot water (45°C) treatment significantly increased sugar content in fruits stored under ambient condition as compared either with soaking in "borax + boric acid" or

washing with tap water "control" during both 1988 and 1989 seasons.

As for the response of fruit sugars % to the different prestorage treatments in cold stored Amaar apricot fruits, data in Tables (22) and (23), revealed that a similar trend to that previously found with storage under room temperature was also detected during both seasons as the periodical changes due to extending the storage time was rate of increase was However the concerned. relatively lower under cold storage, especially at 0°C during two seasons of study. Moreover, variance between different values of the total sugars percentage determined during the last 3-4 weeks of storage period for a given treatment under cold storage was greatly reduced and appreceably did not statistically differ. On the other hand, the last measuring date showed a relative reduction in total could decrease percentage. Such sugars statistically neglected, except with cold storage at 0°C during 1988 season where the difference reached level of significance.

As for the effect of the prestorage treatments under cold storage, data in Tables (22) and (23)

pointed out that the highest value of total sugars percentage was usually concmitant to the hot water (45°C) during both seasons of study, regardless of temperature degree of cold storage. Meanwhile, such trend was more pronounced in Amaar apricot fruits stored under 5°C than those kept at 0°C, especially during the second season of 1989. In addition the reverse was true with the soaking in solution of borax + boric acid mixture at (4,2% respectively), while the water washing treatment (control) ranked last, however both treatments in most cases were statistically of the same influence during both 1988 and 1989 seasons.

The present results concerning the gradual increase in fruit sugars percentage with the advancement of storage period may be attributed to the direct effect of the relative hisher rate of water loss through transpiration and evaporation than that of dry weight loss exhibited by respiration process which leads to higher concentrations of sugars and other solids constituents of fruit juice. Besides these findings go in line with those reported by Kilany, (1983); Abd El-Ghany, (1986) and Kabeel (1987) on fruits of Le-conte pear, Anna apple and Meet-Ghamr peach, respectively.

Fruit juice total sugar % of Ammar apricot cv. as affected by some post harvest treatments during storage under room condition in 1988 and 1989 seasons. Table (21):

	FTC	Fruit juice total sugar % estimated at 2 days interval	tal sugar	% estimated	at 2 days	ys interval	1 1 1 1	Mean
Treatments	Initial*	2	Time of	Time of storage in days		10	12	
			16	1988 season				
1. Control	5.0	6.2	9.9	8*9	7.2	7.3	7.0	6.78
2- Borax + Boric acid 4, 2% mix.	. o. c	6.4	8.0	6.9	7.3	7.5	7.1	6.8AB 6.9A
3- Marin water "45"C" Mean	5.9f	6.3e	6.8d	9.9cd	7.3ab	7.4a	7.1bc	0.0
			31	1989 season				
1 Contact	1.9	6,5	6.9	7.0	7.3	7.6	7.4	7.0B
2- Borax + Boric acid 4, 2% mix.	6.1	6.4	6.5	6.9	7.5	7.8	<b>7.</b> 6	7.0B
3- <b>Warm water "45°C"</b> Mean	6.1 6.1f	6.6 6.5e	6.9 6.8d	7.1 7.0c	/./ 7.5b	7.8a	7.6b	0.0
New L.S.D. at P = 0.05 for:	1988 season	Treatments 0.17 0.13		Storage interval 0.25 0.19	interval 25 19	Interaction 0.42 0.31	ion	

\* Storage was started on May 21 and  $15\underline{th}$  in 1988 and 1989 seasons, respectively.

Fruit juice total sugars percentage of Amaar apricot cv. in response to some post harvest treatments during cold storage at "5°C" in 1988 and 1989 seasons. Table (22):

		Fruit ju	ice total	sugars % e	stimated a	Fruit juice total sugars % estimated at one week interval	interval	] [ ]	Mean
Treatments	Initial*		7 ti	Time of storage in weeks	ge in weel	S 5	9	_	
		;	•	1988 season	eason				-
1_ Control	5°0	6,3	6.4	8.9	7.2	7.4	7.5	7.3	6.9AB
2- Borax + Boric acid 4, 2% mix.	တိုင်	6.2	6.4	7.1	7.1	7.3	7.6	7.5	7.0A
3- Warm water "45"C" Mean	5.9d	6.30	6.50	7.0b	7.2ab	7.4a	7.5a	7.3ab	0.0
				1989	season				
	-	6.4	6.5	7.0	7.1	7.3	7.5	7.5	26.9
I- Control		· · ·	9.9	7.1	7.2	7.4	7.6	7.4	7.0B
Z- Borax + Boric acid +, ZA MIA.		<u>د</u>	6.7	7.4	7.6	7.7	7.8	7.9	7.2A
Acan Water 40 C	6.1e	6.4d	9*9	7.2b	7.3b	7.5a	7.6a	7.6a	0.0
New L.S.D. P = 0.05 for: 1988 season: 1989 season:	Treatments 0.15 0.10		Storage 0	Storage intervals 0.31 0.16	<b>.</b>	Interaction 0.47			

\* Storage was started on May 21 and 15th during 1988 and 1989 seasons, respectively.

Moreover, the response to hot water treatment may be due to its stimulating effect on enhancing ripening processes. Meanwhile, Kabeel (1987), coincided such finding on peach fruits.

#### IV.2. Guava:

IV.2.1. Effect of transporting containers on mechanical damage of Balady guava fruits:

Data in Table (24) shows the percentage of damaged Balady guava fruits exhibited during transportation from Shebein El-Kanater region to Horticultural Research Institute at GIza in response to type of transporting containers used during 1988 and 1989 seasons. In this regard, palm crate with carton liner "15 kg cap.", plastic boxes "25 kg. cap", plastic boxes "20 kg cap" and carton boxes "5 kg. cap." were used. At destination fruits were examined and damaged ones were classified to different forms.

Data obtained disclosed that bruises was the domenant form of damage occured at distination, regardless of type of transporting containers used for guava fruits during both seasons of study. Meanwhile both abrasions and punches were the other two kinds observed after sorting at destination, since scratches was obsent. Nevertheless, the palm

crate with liner significantly resulted in the highest value of total damaged fruits percentage, followed by the bigger plastic box "25 kg cap.", smaller plastic box "20 kg cap" and finally carton box of 5 kg cap which ranked last in a descending order during both 1988 and 1989 seasons.

for bruises% in relation to type As container, data in Table (24) revealed that the modified palm crate induced the greatest value i.e., about 15% as an average of two seasons was concerned. However, both types of plastic boxes 25/20 kg cap. reduced bruisest to about one half of such rate that previously mentioned with palm crate. Both types of plastic boxes statistically came next to palm crate from one side, but generally they were to great extent of a comparable effect from the other side. On the other hand carton boxes "5 kg cap." proved its superiority for using in transportation of Balady guava fruits, since it showed the lowest value of bruises as compared with the three other types of containers during two seasons of study. In addition, as for the response of both abrasions and punches% to the type of transporting containers, it is quite evident that a similar trend to that detected with bruises% was also found during both 1988 and 1989 seasons.

Mechanical damage percentage of Balady guava fruits in relation to type of transporting containers used during 1988 and 1989 seasons. Table (24):

		Number of dam	Number of damaged fruits percentage	ntage	9 1 1 2 9 9
Treatments "Transporting containers"	Bruises	Abrasions	Punches	Scratches	Total
			1988 season		
1 Dalm crate with carton liner. 15 kg. Cab.	17.5a	3,38	2.1a	0.0	22,9a
2 Disette hoves of ke can.	8.86	0.86	0.5b	0.0	10.1b
2- Diseff hoves 20 kg. cap.	8.3b	0.4c	0.5b	0.0	9.2b
4- Carton boxes, 5 kg. cap.	3.2c	0.10	0.00	0.0	3.30
			1989 season		
1- Palm crate with carton liner. 15 kg. cap.	13.2a	2.8a	2.0a	0.0	18.0a
2- Plastic boxes, 25 kg. cap.	9°6	0.7b	0.5b	0.0	11.1b
3_ Plactic boxes, 20 kg. cap.	8.4c	0,1b	0.5b	0.0	9°0c
4- Carton boxes, 5 kg. cap.	2.0d	0.00	0.2c	0.0	2.2d

Means followed by the same letter in each column are not statistically different.

These results could be easily explained by different capacities of varied types of containers which are closely related to their dimensions, especially the depth that usually will be reflected negatively on suitability of a given container due to greater preasure could be existed upon lower layers of packed fruits, especially such perishable ones like as guava. Smoothness of the inner sides and bottom of container plays an important role in reducing/eliminating mechanical damage, especially abrasions and punches, so that plastic boxes and carton boxes were more effective in this regard. Moreover, these results are coincided by the findings of Gerdts and La-Rue, (1976); Foad, (1984) and Kabeel (1987).

IV.2.2. Effect of some prestorage treatments on keeping quality of Balady guava fruits under different conditions of storage:

In this respect three prestorage treatments namely, 1-soaking in hot water "45°C" for 2-3 minutes, 2-soaking in solution of borax + boric acid mixture at concentration of 4,2%, respectively, 3 coating fruit surface with a very thin layer of paraffinic oil, beside washing with tap water "control" were examined during storage under three

different conditions i.e, room condition "of about 22°C±2 and RH of 50-60%" and cold storage either at 15°C or 10°C with RH of 80-90% during both 1988 and 1989 seasons.

Regarding the periodical loss percentage in fresh weight of stored Balady guava fruits under ambient condition as affected by the different prestorage treatments data obtained during both 1988 and 1989 seasons are presented in Table (25). It could be noticed clearly that the loss in fresh weight of Balady guava fruits took place continuously during the whole period of storage "15 days" under room temperature during both 1988 and 1989 seasons. However the loss% in fresh weight per an interval showed relatively higher rate for Balady guava fruits stored under room conditions, especially during the first interval (after 5 days from starting storage). Such trend was true during both seasons where the fresh weight loss percentage during the first 5 days of storage represented about 50% of the total loss weight through 15 days of storage under room condition. On the other hand, the rate of weight

loss responded significantly to the different prestorage treatments, where the surface coating with paraffinic oil reduced it significantly and showed the lowest value of loss & during two seasons. Such decrease was significant as compared either with those of control or soaking in hot water and borax + boric solution treatments. On the other hand, control showed generally higher rate of loss% as compared either with soaking in hot water "45°C" or borax + boric acid mixture, however the differences were significant during the second season only. Moreover, both treatments of soaking either in hot water "45°C" or in solution of borax + boric acid mixture 4,2% respectively were statistically of the same effect during two seasons of study in this respect.

The present results regarding the relative higher rate of fresh weight loss % of stored Balady guava fruits under room condition could be discussed on the fact that higher temperature associated with the lower RH % both stimulate evaporation to take place greatly.

As for the periodical weight loss percentage in cold stored Balady guava fruits in relation to the different prestorage treatments i.e., soaking either in hot water "45°C" or solution of borax + boric

Table (25): Effect of some post harvest treatments on fresh weight loss percentage of Balady guava fruits stored under room condition during 1988 and 1989 seasons.

	Periodical	Periodical loss% estimated at 5 days interval "on initial weight base"	5 days interval ht base"		Mean	Total
	Initial*	Time of storage in days	in days 10	15	7	
		1988 season	rson			
•	c	13.1	6.8	6.5	9.5A	28.5
1- Control		α 	6.9	6.7	8.1A	24.4
2- Borax + Boric acid 4, ZX mix.	9 0	16.0	8	0.9	9.3A	27.8
3- Warm water "45°C"	9 0	0.01	2.0	8	2.38	6.8
4- Paraffination Mean	• • • • •	11.0a	5.9b	5.0b	0.0	0.0
		1989 season	ISON.			
1	c	9 71	10.0	6.1	10.2A	30.9
1- Control	•	0.0	7.5	6,3	8.28	24.7
2- Borax + Boric acid 4, Zz mlx.	0 0	10.3	2.7	7.1	8.88	26.5
3- Farm seter "45°C"		70.0	2.7	1.2	2.40	7.2
4- Paraffination Mean	0.0	0°0	7.2b	5.2c	0.0	0.0
New L.S.D. at P = 0.05 for:	1988 season	Treatments n 2.26	Storage interval	rval	Interaction 3.20 2.30	

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

mixture "4,2% respectively", surface coating with paraffinic oil and Washing in tap water "control", data obtained during both 1988 and 1989 seasons are presented in Tables (26) and (27) for refrigerated storage under 15°C and 10°C, respectively. It is quite evident that a gradual decrease in fresh weight of cold stored Balady guava fruits was also resulted continuously as the storage period was prolonged during both seasons of study. The rate of fresh weight loss percentage in guava fruits per an interval "5 days" was obviously reduced to show only one-half or one-third value of the loss exhibited under room condition for cold storage at 15°C and 10°C, respectively during both seasons of study. The rate of loss & under refrigerated storage was relatively higher during the first interval, thereafter it decreased suddenly and continued at nearly the same intermediate level after the second sorting date till the last one for a given treatment.

Regarding direct response of fresh weight loss % in cold stored guava fruits to the different prestorage treatments, data obtained in Tables (26) and (27) revealed that paraffination treatment resulted in significant reduction in the average value of loss % per an interval as compared to the

other three prestorage treatments during both seasons of study, irrespective of temperature of cold storage. On the other hand both prestorage treatments of soaking guava fruits either in hot water (45°C) or solution of borax + boric mixture reduced slightly the average value of loss % per the measuring interval, but such decrease was significant under 15°C during the first 1988 season only.

The obtained results may be attributed to the retarding influence of both lower temperature and higher relative humidity on the potential loss of fruit moisture content, beside the inhbitory action of both borax + boric and hot water (45°C) againest rots organism which delayed fruit softness consequently decreased weight loss. Moreover, surface coating with paraffinic oil or other anti-transpirant reduce evaporation and transpiration through stomata and finally decreased loss % of fruit fresh weight. In addition the findings of Smith and Redit, (1962); Smith and Bassett, (1964) and Smith and Penny, (1972) supported \_ \_\_\_ the present results regarding the utility of hot water treatment. Moreover, Srivastava (1962); Agnihotre and Ram (1971); Bhargava and Singh (1974); Garg et al., (1976) and Brown (1983) all reported that surface coating of guava fruits with

Table (26): Effect of some post harvest treatments on periodical fresh weight loss percentage of Balady guava fruits stored at "15°C" during 1988 and 1989 seasons.

	Periodical	loss% at 5	days in	cal loss% at 5 days interval estimated on initial weight base	ated on in	Itial wei	ght base	Mean	Total
Treatments	Initial*	rc.	Time o	Time of storage in days	days 20	52	30		
				1988 season					
1- Control		6.1	4.6	5,2	5.0	4.2	3.5	4.8A	28.6
2- Borax + Boric acid 4, 2% mix.	1	4.6 -	4. Ա. դ	4°2 7°4	+ <b>4</b>	, e.	3.4	4.0B	24.2
3- Mars Water "45°C"	1 1	0.7	9.0	1.5	1.4	2.0	1.8	1.30	0.0
4- Faratticación Mean	1	4. la	3.3bc	3.6abc	3.7ab	3.4bc	3.0c	0.0	o 0
				1989 season					
	•	6.3	5,9	2°	5.2	4.3	2.9	5.0A	30.1
I CONTROL	. 1	6.4	4.1	3.6	3.3	3.5	3.1	3.8A	22.5
2- Borax + Boric acid 4, 20 mix.		, cc	4.6	3.7	3,3	3.1	2.8	3.9A	21.2
3- Maria Water 45 C	ı :	, - 6		1.4	1,1	1.0	1.2	1.28	7.4
4- Paraffination Mean	: I	<b>4.</b> 6a	4.0ab	3.6abc	3.2bc	3.0bc	2.5c	0.0	0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.75 1.41	s,	Storage interval 0.65 1.22	interval	Interaction 1.30 2.45	action 1.30 2.45		

\* Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

Table (27): Effect of some post harvest treatments on periodial fresh weight loss percentage of Balady guava fruits stored at "10°C" during 1988 and 1989 seasons.

Perfodical	Periodical loss% estimated at 5 days interval on initial weight base	oss <b>% e</b> sti	mated at	5 days inte	rval on ir	itial weig	ht base	Mean	Total
Treatments	Initial*	S	Time o	Time of storage in days	n days 20	52	30		
				1988 season					
1- Control	•		დ ო ო ო	2.6 2.6	2.4 2.5	2.5 2.4	2.3	3.3A 2.9A	19.5
2- Borax + Boric acid 4, Zk mix. 3- Warm water "45°C" 4- Paraffination	!	4.9 1.2 3.9a	2.9 1.1 2.8b	2.0 1.2 2.1c	2.1 1.0 2.0c	1.9 1.1 2.0c	2.2 1.0 2.2c	2.7A 1.1B 0.0	16.0 6.6 <b>0.0</b>
Mean				1989 season	e				
1- Control	ı	<b>4</b>	9.0	2.4 5.4	2.2	2.1 2.2	2.7	2.9A 3.0A	17.3
2- Borax + Boric acid 4, 2% mlx. 3- Warm water "45°C" 4- Paraffination Mean	1 1 f t 1	4.5 1.1 3.5a	3.9 0.9 3.1a	2.0 1.0 2.0b	1.9 1.9b	2.5 1.0 2.0b	2.6 1.3 2.4b	2.9A 1.1B 0.0	17.4 6.5 0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments n 0.62 n 0.69	ts	Storage interval 0.54 0.60	nterval 4 0	Interaction 1.16 1.20	tion 5		

\* Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

mineral oils or wax reduced weight loss. The finding of Roberto and Maria (1990), supported the present results concerning the beneficial effect of both lower temperature and higher relative humidity on reducing weight loss.

### IV.2.2.a.2. Discarded\* Fruits percentage:

Data obtained concerning the effect of the above mentioned prestorage treatments on periodical decay % of Balady guava fruits stored either under room condition or cold storage "15°C/10°C" are presented in Tables (28), (29) and (30) respectively.

With regard to the response of Balady guava fruits stored under ambient temperature to the different prestorage treatments, data obtained revealed that decay took place after one week from starting storage during the 1988 season, except with paraffination treatment where one week more was needed to pass before its incidence. Meanwhile, decay was occurred with the control treatment only at the first sorting date in the second season. The rate of decayed "discarded" fruits % was gradually increased

<sup>\*</sup> Discarded fruits included both shrivelled fruits and decayed "infected" ones.

to show its maximum value at the third "last" sorting date, regardless of prestorage treatment during both seasons of study. On the other hand the average decay % was obviously responded to the different prestorage treatments, as the fruits were kept up under the room condition. Since, paraffination treatment reduced significantly the rate of discarded fruits compared either with control or other two prestorage treatments. Moreover, soaking in solution of borax + boric mixture significantly decreased the decay % as compared either with control or hot \_wter (45°C) 1989 seasons. treatment during both 1988 and Meanwhile, soaking Balady guava fruits in hot water condition before remaining under LOOM (45°C), generally decreased the rate of discarded fruits% than the control, however, the difference significant during the first season only.

As for the periodical response to the prestorage treatments on the discarded percentage of cold storaged Balady guava fruits either at 15°C or 10°C, data presented in Tables (29) and (30) showed that the incidence of decay was clearly delayed. Since, 2/3 weeks were nearly needed to pass before decay occurrence under 15°C and 10°C, respectively during both seasons of study. Moreover, the rate of

discarding percentage of decayed fruits per an interval "week" was gradually increased by advancing of the storage time till the last sorting date (5 weeks from starting storage) where the maximum value of discarded \( \) was detected, regardless of temperature of cold storage.

Nevertheless, paraffination treatment statistiprestorage treatments all exceeded cally prolonging the life storage of Balady guava fruits, where the highest value of faultless fruits was always concomitant to it. On other hand such trend was more pronounced with 10°C stored fruits than those at 15°C, since the total decay % after 5 weeks storage period as an average of two seasons was concerned amounted about 19.0% and 13.0% for cold storage at 15°C and 10°C, respectively. Moreover, superiority of paraffination treatments in decreasing decayed fruits % than others could be obviously noticed throughout the first weeks of cold storage either at 15°C or 10°C during both 1988 and 1989 seaosns. Moreover, soaking fruits of Balady guava cv. in solution of borax + boric mixture at concentration of 4,2% respectively, ranked second to paraffination in reducing discarded fruits %, where the differences were significant in comparison either to hot water "45°C" or control treatments during both seasons of study.

The obtained results could be explained on the fact that the lower temperature and surface coating with a very thin layer of paraffinic oil reduce the respiratory rate and activities of other enzymes which certainly reflected posotively on delaying ripening processes and prolonging storage life of Balady guava fruits. Such findings are previously supported by Srivas Tava (1962); Agnihotre and Ram (1971); Bhargava and Singh (1974) and Brown et al., (1983) who pointed out that surface coating with wax or mineral oil helped in extending storage life and marketing ability of guava fruits. In addition, the beneficial effect of relative lower temperature associated with the higher RH % as the present results indicated with guava fruits, generally go in line with that reported by Gupta et al., (1979); Brown, (1983); Wills et al., (1983) and Roberto and Maria, (1990), who mentioned that the relative lower temperature and higher RH helped in remaining guava fruits in acceptable condition for longer time.

Generally, it could be safely concluded that surface coating guava fruits with paraffinic oil or

Discarded\* fruits percentage of Balady guava in relation to some post harvest treatments during storage under room condition in 1988 and 1989 seasons. Table (28):

	Discarded fru	Discarded fruit percentage at one week interval	one week inter	rval	Mean	Total
Treatments	Initial**	Time of storage in weeks	in weeks	m		
		1988 season	nosı			
i Contact	0-00	2.20	14.3	20.6	12.4A	37.1
2 Domes & Bowle acid & 2% mix	0.00	0.70	7.1	15.0	7.60	22.8
2 Director "Afor" of the mixe	0.00	2,60	12.5	16.2	10.4B	$\frac{31.3}{1}$
A District of the Control of the Con	0.00	00.00	1.4	0.9	2.50	7.4
Mean	00.0	1.40c	8.8b	14.5a	0.0	0.0
		1989 season	ason			
1 6.00+00.1	00.00	4.50	00.6	16.7	10.1A	30.2
I - CONCION - Bonda soid A 24 mix	00.0	0.00	9,70	13.7	7.88	23.4
2 DOFAX + BOLIC ACID 13 CA MIN.	0.00	0.00	11.40	17.8	9.7A	29.2
A Demofetantion	00-0	0.00	1,40	8.5	3,30	6.6
4- Farai mation Mean	0.00	1.10c	7.6b	14.2a	0.0	0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 1.69 1.16	Storage interval 1.91 1.30	erval	Interaction 3.82 2.61	

\* No. of both decayed and shrivelled fruits were periodically discarded at one week interval. \*\* Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

Discarded\* fruits percentage of Balady guava in relation to some post harvest treatments during cold storage at "15°C" in 1988 and 1989 seasons. Table (29):

	of.	scarded fru	its % esti	mated at o	discarded fruits % estimated at one week interva	val	Kean	Total
Treatments	Initial**	Tim	e of stora 2	Time of storage in weeks 2	<b>8</b>	ഹ		
			1988 season	eason				
1 Control	ı	0.0	0.0	10.3	13.6	28.0	10.4A	51.9
2 Doney 4 Bondo actd A 2% mix	•	0.0	0.0	3.8	5.9	18.8	5.70	28.5
2 Lime Later HAROCH	•	0.0	0.0	9.9	0.6	21.0	7.38	36.6
A Donnéstantion	•	0.0	0.0	9.0	3.8	14.8	3.8D	19.2
Hean	i	po.0	P0°0	5,30	8.1b	20.7a	0.0	0.0
			1989	season				
1 Content	ı	0.0	0.0	12,3	16.1	25.7	10,8A	54.1
1- Control Conf. acid A 2% mix		0.0	0.0	9.9	10.4	21.8	7.80	38.8
2. Union Laten MAROCH	•	0.0	. 0.0	ۍ ۍ	15.0	22.0	9.38	46.5
A Danaffination		0.0	0.0	0.0	0.9	13.6	3.90	19.6
Wean	•	0.0d	p0°0	7.1c	11.9b	20.8a	0.0	0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 1.58 1.24	Storage	interval .76	Interaction 3.54 2.78		·	

\* No. of both decayed and shrivelled fruits were periodically discarded at one week interval. \*\* Storage was started on November 19 and  $29 \frac{1}{24}$  in 1988 and 1989 seasons, respectively.

Discarded\* fruits percentage of Balady guava in relation to some post harvest treatments during cold storage at "10°C" in 1988 and 1989 seasons. Table (30):

	4-	scarded fru	its % esti	discarded fruits % estimated at one week interva	e week inte	rval	Mean	Total
Treatments	Initial**	-	Time of storage in 2	corage in we	weeks	ហ		
			1988	1988 season				
	ı		0.0	2.8	8.5	20.8	6.4A	32.1
1- CORECTOR  9- December 4- December 2007 mix	•		0.0	0.0	2.8	15.0	3°6C	17.8
Z= BOFAX + BOFFC ACIA +; Z# HIA+	•		0.0	0.0	5.0	18.0	4.6B	23.0
S- Maria Water 40 C	i (		0.0	0.0	8.0	14.2	3.00	15.0
4- Parattination Mean	ı <b>I</b>	P0.0	<b>P0.0</b>	0.7c	4.3b	17.0a	0.0	0.0
			1989	1989 season				
- Contract	ı	0.0	0.0	1.6	7.6	21.8	6.2A	31.0
1- CONICOI 3 December - Bonfo acid A 2% mix			0.0	0.0	1.8	14.2	3.20	16.0
2 DOTAL TOURING TO EA MINE		0.0	0.0	0.0	4.6	17.1	4.38	21.7
A Democration	•		0.0	0.0	1.5	9.5	2.2D	11.0
4: 75/2:	ı	-	P0.0	0.4c	3.9b	15 <b>.</b> 6a	0.0	0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.99 0.76	Storag	Storage interval 1.11 0.85	Interaction 2.42 1.71	ion		

No. of both decayed and shrivelled fruits were periodically discarded at one week interval. Storage was started on November 19 and 29<u>th</u> in 1988 and 1989 seasons, respectively. ‡

soaking in borax + boric (4,2%) help greatly in extending storage life with no sign of decay under relative lower temperature (10-15°C) and RH of 80-90% for four or three weeks, respectively.

## IV.2.2.a.3. Periodical changes in fruit firmness:

With regard to periodical changes in flesh firmness of Balady guava fruits as affected by some prestorage treatments namely soaking for 2-3 minutes either in solution of borax + boric mixture "at 4,2%" or in hot water (45°C) and paraffination as well as washing in tap water (control), data obtained during both 1988 and 1989 seasons are tabulated in Tables (31), (32) and (33) for storage under room condition and refrigerated storage at 15°C and 10°C, respectively.

Data in Table (31) show that ambient stored fruits of Balady guava cv. were gradually softened with the extention of storage time during both seasons. The decrease in flesh firmness was significant as flesh firmness value at a given sorting date was compared to that of the previous one for the same treatment during both 1988 and 1989 seasons. However, fruit firmness was sharply declined at the third (last) week and showed the greatest rate

continued, especially during the last half of storage period instead of that occurred sharply with storage under room condition. However, the rate of decrease was relatively higher after one week from starting storage, thereafter it was gradually decreased with both temperature degrees of cold storage 15/10°C during both seasons of study. Such trend of decreasing the rate of flesh softening was more pronounced for such fruits of Balady guava cv. stored under 10°C, than those under 15°C, regardless of the prestorage treatment applied in both seasons.

Nevertheless, flesh firmness of cold stored guava fruits was greatly responded to the different prestorage tratments as shown in Tables (32) and (33). The surface coating of fruits with paraffinic oil showed the greatest importance in retarding quick decline of flesh firmness than other prestorage treatments. Since the paraffinic surface coated guava fruits showed statistically the hardest flesh either at 15°C or 10°C in both 1988 and 1989 seasons. In addition, soaking fruits of Balady guava cv. either in hot water (45°C) or solution of borax + boric mixture (4,2%) resulted in remaining fruits more firmer than control, where the differences were significant in most cases. On the other hand both

aforesaid prestorage treatments were statistically equally effective, in this regard.

The obtained data regarding the beneficial effect of the relative lower temperature of storage on remaining fruits with more firmer flesh may be due to the retardation influence of lower temperature on activities of pectinase and cellulase which are the main enzymes responsible for flesh softening.

Moreover, the findings of Brown, (1983); Wills et al., (1983) and Roberto and Maria (1990) are in general agreement with the present results regarding the effect of storage temperature. On the other hand obtained data concerning the utility of surface coating fruits of guava are in harmony with that reported by Srivstava (1962), Agnihotre and Ram (1971); Garg et al., (1976); Brown, (1983); Kartar and Chauhan (1983) and Subhashchandra et al., (1983), since all concluded that dipping in wax emulsion or paraffination resulted in longer shelf life of guava regarding data obtained addition, In fruits. response of fruit softening to immersion either in hot water or borax + boric acid are in partial agreement with Well:s (1971) and Smith and Penny (1972).

Table (32): Changes in firminess of Balady guava fruits as affected by some post harvest treatments during cold storage at "15°C" in 1988 and 1989 seasons.

	Fruit	Fruit firminess in "Ib/inch" estimated at one week interval	/inch²" esti	mated at o	ne week interva		Mean
Treatments		T 1	Time of storage in weeks	ige in week 3	۵ 4	ശ	
•			1988 season	Sason			
1- Control	12.4	ක <b>ර</b>	7.1	ນ ໝູ	5.0 5.8	3.7	7.1C 7.8B
2- Borax + Boric acid 4, 2% mix.	12.4 12.4	% & % &	7.5	7.0	. O.	9.4	7.6BC 8.7A
4- Paraffination Mean	12.4 12.4a	10.2 9.2b	8.8 7.9c	9°-2	7.0 5.9e	4.8f	0.0
			1989 season	eason			
		9.5	7.8	9.9	5.8	4.7	7.90
1- Control 2- Borax + Boric acid 4, 2% mix.		8.6	8.7	7.5	7.0	ວຸດ	8.08C
3- Warm water "45°C"		7.01	8.5 70.7	/•/ 9.5	8.2	7.0	9.8A
4- Paraffination Mean	13.0a	9.9b	8.8	7.8d	7.1e	5.9f	0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments n 0.56 n 0.76	Storage interval 0.70 0.82	nterval 0 i2	Interaction 1.40 1.70		

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

Table (33): Changes in frirmness of Balady guava fruits as affected by some post harvest treatments during cold storage at "10°C" in 1988 and 1989 seasons.

	Fruit fir	wness in "Ib/	inch²" estim	ated at on	Fruit firmness in "Ib/inch <sup>2</sup> " estimated at one week interval		Mean
Treatments	Initial*		Time of storage in weeks	ge in week	۵ 4	ro.	
			1988 season	nosa			
	12.4	0.6	7.5	6.2	4.8	3.8	7.30
2. Down + Bowfe acid A 2% mix	12.4	, sc	8 5 2	7.8	. 6.2	5.7	8.48
C. DOTAL Lates MAROCK	12.4	0.6	8.0	7.5	6.3	5.8	8.2B
	12.4	10.7	6	8°0	8.2	7.1	9.5A
4- rarallinacion Mean	12.4a	9.6	8.4c	7.6c	<b>6.4</b> d	2.6d	0.0
			1989 se	season			
1 Control	13.0	7.6	ۍ ه	7.2	6.6	5.2	8.30
1- control 2- Borsv + Boric acid & 2% mix.	13.0	10.5	9.5	8,3	7.2	6.1	9.18
2- Dorm Later MAROCH	13.0	8	9.2	8.2	7.4	6.3	9.0B
A Desptation	13.0	11,2	10.3	9.5	8.8	7.8	10.1A
Mean	13.0a	10.3b	9.30	8 <b>.</b> 3d	7.5d	6.4e	0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.90 0.69	Storage interval 1.08 0.86	iterval	Interaction 2.18 1.87		

\* Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

IV.2.2.b- Effect on fruit chemical characteristics:
IV.2.2.b.1- Fruit juice total soluble solids (TSS):

Concerning the periodical changes of fruit juice total soluble solids percentage (TSS%) in Balady guava fruits as influenced by some prestorage treatments i.e., paraffination, immersions in hot water (45°C), solution of borax + boric acid and tap water "Control", data obtained during both 1988 and 1989 seasons are presented in Tables (34), (35) and (36) for holding under room condition and cold storage at 15 or 10°C, respectively.

Data in Table (34) showed clearly that a gradual increase in the TSS% values took place continuously as duration of storage under ambient condition was extended during two seasons of study. Such increase was significant as average values of the determined TSS% at different intervals were compared. On the other hand, TSS% of surface coated fruits with paraffinic oil showed statistically the lowest value as compared either to control or two others prestorage treatments. The reverse was true with immersion in hot water "45°C" treatment, however the increase was significant as compared with that of borax + boric acid soultion (4,2%) only during both seasons of study. Meanwhile, control treatment was intermediate in this concern.

As for the periodical response of fruit juice TSS% in cold stored fruits of Balady guava, data in Tables (35) and (36) revealed that a general trend to that found under room conditions was also detected for storage at 15°C or 10°C. However, the rate of increase in TSS% was more lower for cold stored fruits, especially at 10°C. In other words variances in TSS values due to advancement of storage period were not significant as average values of both two consecutive intervals were compared each to other. Moreover, fruit juice TSS% of stored guava fruits was slightly decreased after four weeks of starting storage either at 15 or 10°C during both seasons. Such decrease in TSS% exhibited at the last sorting date (fifth week) was not significant during both seasons, regardless of temperature of cold storage. On the other hand, paraffination treatment, resulted in the lower value of TSS% as compared to the other prestorage treatments, where the differences were signiunder storage at 15°C or ficant either Meanwhile, two other prestorage treatments did not statistically differ as compared with control from one side or each to other from the other during both 1988 and 1989 seasons, irrespective of temperature of refrigerated storage.

The increment in fruit juice TSS% occurred by extending of storage duration may be considered as a direct reflection of the unparallelled loss rates of both moisture and dry matter from fruit tissues through evaporation and resperation, respectively. Since water loss showed a relative higher rate which will be certainly reflected on a higher concentration of TSS% of fruit juice during storage. Moreover, the relative lower TSS% of the surface coated guava fruits below the other prestorage treatments could be easily discussed by the dilution effect that may be attributed to the previously mentioned lower loss rate in fresh weight due to paraffination treatment.

Nevertheless, Gupta et al. (1979), reported that TSS% in stored fruits was slightly increased by time up to about one week, followed by a decrease. Besides Roberto and "Maria" Colinas-Leon, (1990) concluded similar results regarding the periodical change in TSS% by extending storage, but the increase was more pronounced with the relative higher temperature of cold storage.

Changes in fruit juice total soluble solids percentage of Balady guava as affected by some post harvest treatments during storage under room condition in 1988 and 1989 seasons. Table (34):

	1.5.5	T.S.S.% estimated at one week Interval	eek intervai 	1	Mean
Treatments	Initial*	Time of storage in weeks	n weeks 2	m	
		1988 season			
1- Control 2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C" 4- Paraffination	11.0 11.0 11.0	11.6 11.5 11.7 11.2	12.3 12.2 12.6 11.8 12.2b	12.9 12.6 13.4 12.2 12.8a	12.0AB 11.8BC 12.2A 11.6C 0.0
Fean		1989 season	g		
1- Control 2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C" 4- Paraffination	10.4 10.4 10.4 10.4	11.0 10.8 11.0 10.6	11.8 11.5 11.9 11.1	12.7 12.3 12.9 11.7	11.5A 11.3B 11.6A 11.0C
Mean New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.37 0.25	Storage interval 0.37	al Interaction 0.75 0.51	tion 5 1

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

Table (35): Changes in fruit juice total soluble solids percentage of Balady guava as affected by some post harvest treatments during cold storage at "15°C" in 1988 and 1989 seasons.

		T.S.S.% estimated at one week interval	mated at on	week inte	rva] 	1 1 1 1 1	Mean
Treatments		1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	Time of storage in weeks	ge in weeks	4	ĸ	
			1988 season	ason			
1- Control	11.0	11.5	12.0	12.5	13.3 12.9	12.8 12.2	12.2A 11.9A
2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C"	0.11	11.6	12.0 11.4	12.4	13.2	12.9 12.0	12.2A 11.5B
4- Paraffination Mean	11.0 11.0e	11.4d	11.8c	12.2b	12.8a	12.5ab	0.0
			1989 season	ason			
1- Control	10.4	10.9	11.6	12.1	12.9 12.5	12.6 12.1	11.7A 11.5A
2- Borax + Boric acid 4, 2% mlx. 3- Warm water "45°C" 4- Paraffination	10.1 10.4 4.6	11.1	11.6 10.8 11.3bc	12.0 11.2 11.8ab	12.8 11.5 <b>12.4a</b>	12.5 11.7 12.2a	11.7A 11.1B 0.0
Mean New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.32 0.58	Storage interval 0.39	nterval 9 9	Interaction 0.79 1.38	· .	

Storage was started on November 19 and 29<u>th</u> in 1988 and 1989 seasons, respectively.

Changes in fruit juice total soluble solids percentage of Balady guava as affected by some post harvest treatments during cold storage at "10°C" in 1988 and 1989 seasons. Table (36):

		T.S.S.% est	T.S.S.% estimated at one week interval	ne week int	erval		Moan
Treatments	Initial*	1 Th	Time of storage in weeks	je in weeks 3	4	ស	
			1988 season	sson			
1- Control	11.0	11.2	11.8	12.2	12,9	12.5	11.9A
2- Borax + Boric acid 4, 2% mix.	11.0	11.3	11.5	11.9	12.5	12.1	11.7A
3- Marm Water "45-C" 4- Paraffination	11.0	1 - 4 1 - 1	11.1	11.3	11.4	11.6 11.6	11.38
Nean	11.0e	11.3de	11.5cd	11.9bc	12.4a	12. lab	0.0
			1989 season	eason			
1- Control	10,4	10.9	11.4	11.8		12.3	11.5A
2- Borax + Boric acid 4, 2% mix.	10.4	11,1	11.2	11.5	12.2	11.9	11.4A
3- Warm water "45°C"	10.4	11.2	11.5	11.7		12.1	11.5A
4- Paraffination	10.4	10.7	10.7	10.9		11.3	10.9B
Nean	10.4e	11.04	11.2cd	11.5bc		11.9ab	0.0
New L.S.D. at P = 0.05 for:	1988 season	Treatments 0.40 0.45	Storage interval 0.49 0.55	nterval 3	Interaction 1.04 1.11		
		2					

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

## IV.2.2.b.2- Fruit juice total acidity%:

With regard to the periodical changes in fruit juice total acidity percentage of Balady guava fruits in response to the different prestorage treatments, data obtained during both 1988 and 1989 seasons are presented in Tables (37), (38) and (39) for storage under ambient condition and cold storage at 15°C and 10°C, respectively.

evident that acidity percentage was continuously decreased by time up to the last measuring date under ambient condition. The decrease was significant along the whole duration of storage during both 1988 and 1989 seasons. On the other hand all prestorage treatments did not significantly differ than control as an average of each treatment was compared to those of other ones during both seasons of study.

As for the response of cold stored guava fruits, data in Tables (38) and (39) disclosed generally the same trend that previously mentioned at room condition. However, the rate of decrease by prolonging storage time at cold storage 15/10°C was obviously lower than that found at ambient condition, espeailly throughout the last three weeks of duration.

Table (37): Changes in fruit juice total acidity percentage of Balady guava as affected by some post harvest treatments under room condition storage during 1988 and 1989 seasons.

	Fruit juice a	Fruit juice acidity % estimated at one week interval	one week interval	ŀ	Mean
Treatments	Initial*	Time of storage in weeks	n weeks 2	· •	
		1988 season			
1- Control	0.75	69.0	0.54	0.47	0.61A 0.62A
2- Borax + Boric acid 4, 2% mix.	0.75	0.69		0.46	0.61A
3- Warm water '45'C 4- Paraffination Mean	0.75 0.75a	0.70 0.69b	•	0.48 0.47d	¥70•0
. •		1989 season			
1- Control 2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C" 4- Paraffination	0,93 0,93 0,93 0,93	0.81 0.78 0.77 0.82 0.79b	0.60 0.59 0.58 0.63	0.52 0.51 0.52 0.57 0.53d	0.71A 0.70A 0.70A 0.70A
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.054 0.043	Storage interval 0.054 0.028	Interaction 0.109 0.065	Æ

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

Changes in fruit juice total acidity percentage of Balady guava as affected by some post harvest treatments during cold storage at "15°C" in 1988 and 1989 seasons. Table (38):

	F	Fruit juice acidity % estimated at one week interval	lity % estim	ated at one	week interval		Mean
Treatments	Initial*		Time of storage in weeks	e in weeks	4	ស	
			1988 season	ason			
1- Control 2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C"	0.75 0.75 0.75	0.72 0.71 0.73	0.69 0.68 0.67	0.67 0.65 0.64	0.63 0.63 0.62	0.60 0.61 0.62 0.60	0.67A 0.67A 0.67A 0.68A
4- Paraffination Mean	0,75 0,75a	0.72ab	0.68bc	0.66cd	0.624	0.60e	0.00
			1989 season	eason			
1- Control	0.93	0.84	0.76	0.73	0.71	0.66	0.77A 0.77A
2- Borax + Boric acid 4, 2% mix. 3- Warm water "45°C" 4- Paraffination	0,93 0,93 0,93	0.83 0.85 0.85	0.81 0.81 0.79c	0.74 0.75 0.73d	0.73 0.75 0.72de	0.69 0.72 0.68e	0.78A 0.80A 0.00
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.043 0.031	Storage interval 0.053 0.041	nterval 53 41	Interaction 0.106 0.677		

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

Changes in fruit juice total acidity percentage of Balady guava as affected by some post harvest treatments during cold storage at "10°C" in 1988 and 1989 seasons. Table (39):

	Fruit	Fruit juice total acidity % estimated at one week interval	idity % est	imated at on	e week interva		Mean
Treatments	Initial*	. Tin	Time of storage in weeks	e in weeks 3	4	ស	
			1988 season	ason			
,	7	0.71	0.69	99.0	0.65	09.0	0.67A
1- Control	0./5	7.0	68	0.67	99.0	0.64	0.68A
2- Borax + Boric acid 4, Zz mix.	0,70	0.0	0.71	0.69	0.66	99*0	0.69A
3- Mars water "45°C"	0,10	7.0	0 72	0.71	0.68	99.0	0.70A
4- Paraffination Mean	0.75a	0.71ab	0.70b	0.68bcd	0.66cd	0.64d	0.00
			1989 season	sson			
	0 03	0.87	0.82	0.78	0.76	0.72	0.81A
1- Control	600	88	0.83	0.80	0.77	0.73	0.82A
2- Borax + Boric acid 4, ZA mix.	200	28.0	0.81	0.78	0.76	0.72	0.81A
3- Harm Water "45"C"	200	6	0.86	0,83	0.81	0.77	0.85A.
4- Paraffination Mean	0.93a	0.88b	0.83c	0.79cd	0.77de	0.74e	00.0
		Treatments	Storage interval	nterval	Interaction		
New Labour at T 2 0.03 101.	1988 season 1989 season	0.041	0.049	49	0.990 0.068		

\* Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

Meanwhile, the effect of the investigated prestorage treatments on total acidity percentage in guava fruits stored either at 15°C or 10°C was significantly absent as the average value of each treatment was compared either with control from one side or compared each to other during both seasons of study.

This result is in partial agreement with the findings of Yagi (1976) and Roberto and "Maria" Colinas-Leon (1990), but in disagreement with that reported by Gupta et al. (1979) on guava fruits.

## IV.2.2.b.3- Fruit juice TSS/Acid ratio:

Concerning changes in juice TSS/acid ratio of Balady guava stored fruits in relation to the different prestorage treatments investigated during both 1988 and 1989 seasons data are presented in Tables (40), (41) and (42).

As for the response of fruits stored under ambient condition, data in Table (40) showed clearly a gradual increase by advancing storage period. However, the rate of increase in TSS/acid value was more pronounced at the second and third measuring dates during both seasons of study. On the other hand prestorage soaking either in hot water or solution of

Table (40): Fruit juice T.S.S./Acid ratio of Balady guava cv. as affected by some post harvest treatments during storage under room condition in 1988 and 1989 seasons.

	Fruit juice T.	Fruit juice T.S.S./acid ratio estimated at one week interval	itimated at one w	eek interval	3
	<b>.</b>	Time of storage in weeks	ige in weeks		FEGI
Treatments	Initial*		2	ო	
		1988 season	ason		
1- Control	14.6	16.8	22.7	27.4	20.3
2- Borax + Boric acid 4, 2% mix.	14.6	16.4	22.1	26.2	19.8
3- Harm water "45°C"	14.6	16.9	23.3	29.1	20.9
4- Paraffination	14.6	16.0	21.4	25.4	19.3
Mean	14.6	16.5	22.3	27.0	0.0
		1989 season	звоп		
1- Control	11.1	13,5	19.6	24.4	17.1
2- Borax + Boric acid 4, 2% mix.	11.1	13.8	19.4	24.1	17.1
3- Warm water "45°C"	11.1	14.2	20.5	24.8	17.6
4- Paraffination	11.1	12.9	17.6	20.5	15.5
Mean	11.1	13.6	19.2	23.4	0.0

\* Storage was started on November 19 and 29th during 1988 and 1989 seasons, respectively.

borax + boric acid mixture (4,2%) did not show specific response in value of TSS/acid ratio as compared to that of untreated fruits "control" during two seasons of study. On the contrary paraffination treatment resulted in an obvious decrease in the TSS/acid ratio of fruits remained under room temperature as compared with the three other treatments.

With regard to cold stored guava fruits of Balady cv., it could be noticed easily from Tables (41) and (42) that a similar trend to that previously mentioned at ambient condition was also found as the periodical changes in TSS/acid ratio in relation to advancement of storage duration was concerned during both 1988 and 1989 seasons. However, the rate of increase was greatly reduced\_under\_cold storage than that at room temperature as shown from data in Tables (41) and (42). Moreover, such reduction was more pronounced with 10°C stored fruits than those at 15°C. In addition, the response to the differenial prestorage treatments was generally the same, since condition of storage "room/refrigeration" did not modify it as an average of each treatment along the whole duration of storage was concerned. Since, the paraffination treatments showed the lowest value of TSS/acid ratio as compared to the other treatments

Fruit juice T.S.S./Acid ratio of Balady guava cv. in relation to some post harvest treatments during cold storage at 15°C in 1988 and 1989 seasons. Table (41):

		T.S.S./Ac	T.S.S./Acid ratio estimated at one week interval	imated at one	week interva		S S
			Time of storage in weeks	ige in weeks			
Treatments	Initial*	-	<b>2</b>	m i	4	ഹ	
Α.			1988	1988 season			
1- Control	14.6	15.9	17.3	18.6	20.7	21.3	18.1
2- Borax + Boric acid 4, 2% mix.	14.6	16.0	17.2	18.6	20.4	20.0	17.8
3- Warm water "45°C"	14.6	15.8	17.9	19.3	21.2	20.8	18.2
4- Paraffination	14.6	15.4	16.5	17.2	18.8	20.0	17.1
Mean	14.6	15,7	17.2	18.4	20.2	20.5	0.0
			1989 s	season			
1- Control	11.1	12,9	15.2	16.5	18,1	19.1	15.4
2- Borax + Boric acid 4, 2% mix.	11.1	12.9	14.4	16.3	17.3	18,3	15.0
3- Warm water "45°C"	11.1	13.3	14.3	16.2	17.5	18.1	15.1
4- Paraffination	11.1	12.5	13.3	14.9	15,3	16,2	13.8
Mean	11.1	12.9	14.3	15.9	17.1	17.9	0.0

Storage was started on November 19 and 29th during 1988 and 1989 seasons, respectively.

Fruit juice T.S.S./Acid ratio of Balady guava cv. in relation to some post-harvest treatments during cold storage at "10°C" in 1988 and 1989 seasons. Table (42):

	Periodical	changes in	Periodical changes in T.S.S./Acid ratio estimated at one week interval	io estimated a	t one week	interval	Mean
Treatments	Initial*	1	Time of sto	Time of storage in weeks	4	ស	
			1988	1988 season			
1- Control	14.6	15.7	17.1	18.4	19.8	20.8	17.7
2- Borax + Boric acid 4, 2% mix.	14.6	16.1	16.9	17.7	18.9	18.9	17.1
3- Warm water "45°C"	14.6	15.8	16.4	17.3	19.2	18.4	16.9
4- Paraffination	14.6	15,2	15.4	15.9	16.7	17.5	15.8
Wean	14.6	15.7	16.4	17.3	18.6	18.9	0.0
			1989	1989 season			
1- Control	11,1	12.5	13.9	15.1	16.4	16.8	14.3
2- Borax + Boric acid 4, 2% mix.	11,1	12.6	13.4	14.3	15.8	16,3	13.9
3- Warm water "45°C"	11.1	12.8	14.1	15.0	16.1	16.8	14.3
4- Paraffination	11.1	11.8	12.4	13,3	13.7	14.6	12.8
Mean	11.1	12.4	13.4	14.4	15.5	16.1	0.0

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

during two seasons of study, but latter they were generally of about the same influence.

The obtained data could be easily explained on the unparallelled response of both TSS% and total acidity % in fruit juice of Balady guava during storage as the aforesaid data for each of both components were indvidually mentioned.

## IV.2.2.b.4- Fruit juice total sugars percentage:

Data in Tables (43), (44) and (45) showed the periodical changes in fruit juice total sugars % of Balady guava fruits as influenced by the differential prestorage treatments during both 1988 and 1989 seasons for storage either under room condition or cold temperature at 15°C and 10°C "with 80-90% RH" respectively.

As for fruits remained at ambient condition, Table (43) shows clearly that a significant increase was occurred during the first two weeks of storage time as the advancement of duration was concerned during both 1988 and 1989 seasons. Thereafter no statistical variance was happened as values of total sugarst determined at the last (third) week for a given prestorage treatment was compared to that of

Table (43): Fruit juice total sugars percentage of Balady guava as affected by some post harvest treatments during storage under room condition in 1988 and 1989 seasons.

	Total sug	Total sugars % estimated at one week interval	one week interva	<b>-</b> -	3
Treatments	Initial*	Time of storage in weeks	in weeks	: m	Nean
		1988 season			
1- Control	6.3	7.4	8.8	8 2	7.7A
2- Borax + Boric acid 4, 2% mix.	6.3	7.3	8.5	8.6	7.6A
3- Warm water "45°C"	£.9	7.9	8,9	8.7	7,9A
4- Paraffination	6.3	7.0	8.1	8.3	7.4A
Mean .	6.3c	7.4b	8.5a	8.5a	•
		1989 season	Bon		
1- Control	6.1	7.8	8.6	0.6	8,1A
2- Borax + Borfc acid 4, 2% mix.	6.1	7.9	9.4	9.6	8.2A
3- Warm water "45°C"	6.1	8.0	6.6	9.1	8.2A
4- Paraffination	6.1	7.2	8.8	8.9	7.7A
Mean	6.1c	7.7b	9 <b>.</b> 4a	9.la	ľ
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.95 1.10	Storage interval 0.98	_	Interaction 1.82 2.31

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

the previous week in both seasons. On the other hand, no statistical difference was noticed in total sugars values of the different "four" prestorage treatments, however, paraffination resulted in a slight decrease in comparison with the other prestorage treatments and control.

Nevertheless, the trend of response for guava fruits stored either at 15°C or 10°C showed nearly the same trend that previously detected for ambient stored fruits as the periodical changes with the advancement of storage time was concerned. However, the rate of increase was relatively lower under cold storage. Such trend was true during the four weeks passed from starting storage, while one week more (last one) the increase in total sugar\* was not only ceased but also the response took the other way around, regardless of temperature of cold storage. Meanwhile, such decrease in total sugars\* found at the last (fifth) week was so slight to reach level of significance during both seasons.

In regard to the response of the fruit juice total sugarst to the differential prestorage treatments, for cold stored guava fruits, data from Tables (44) and (45) showed a general tendency toward reduc-

e.

tion in surface coated fruits with paraffinic oil as compared to those of other treatments. On the contrary, the higher value of fruit juice total sugars was that of hot water "45°C" soaked fruits, which showed a significant increase over that of paraffination treatment during both seasons of study. Meanwhile, the increase in fruit juice total sugars due to soaking in hot water was so small to reach level of significance as compared with those of control and other prestorage treatment i.e., borax + boric acid storage.

The present result concerning the increase in fruit juice total sugars percentage with advancing the duration of storage may be due to the gradual loss in moisture content from tisses of stored fruits as had been mentioned before. Meanwhile, the relative lower loss% of water from surface coated fruits with paraffinic oil than the other prestorage treatments may be provide a logical explanation for the decrease in total sugar% for such case. But the increase in sugars% of hot water soaked fruits may be considered as a direct reflection of the higher rate of water loss % in such fruits than those of the other treatments.

Changes in fruit juice total sugars percentage of Balady guava as affected by some post harvest treatment during cold storage at (15°C) in 1988 and 1989 seasons. Table (44):

		Total sugar	s % estimat	ed at one w	Total sugars % estimated at one week interval		Me of
Treatments	Initial*		Time of storage in weeks	age in weel 3	(S	ഹ	
			1988 season	sason			
1- Control	6.3	6-9	7,3	7.9	8.8	8.2	7.5A
2- Roray + Roric acid 4, 2% mix.	9	6.7	7.0	7.4	8.7	8.4	7.4AB
2. Uses water "Afor"	· · ·	7.0	7.5	8.0	9.2	8.6	7.7A
A. Daraffination	9.3	6.7	6.9	7.1	7.5	7.9	7.08
Wean	6.3e	6.8de	7.1cd	7.6bc	8.5a	8.2ab	0.0
			1989 season	eason			
1- Control	6.1	7.1	7.9	8	10.0	9.5	8.2AB
2. Borax + Roric acid 4. 2% mix.		7.6	8.0	0.6	10.0	9.7	8.4AB
3- Warm Water "45°C"	6.1	7.8	8,1	9.1	11.0	10.0	8.6A
4- Paraffination	6.1	7.2	7.4	8.8	9,1	9.2	7.98
Mean	6.14	7.4c	7.8c	8.9b	10.0a	9.6ab	0.0
New L.S.D. at P = 0.05 for:	1988 season 1989 season	Treatments 0.48 0.61	Storage interval 0.79 0.95	nterval 9 5	Interaction 1.55 1.73	ŧ	

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.

Changes in fruit juice total sugars percentage of Balady guava as affected by some post harvest treatments during cold storage at "10°C" in 1988 and 1989 seasons. Table (45):

		Total sugars % estimated at one week interval	% estimate	d at one wee	k interval		3
Treatments	Initial*	1	ime of stor 2	Time of storage in weeks	4	2	Mean
			1988 season	eason			
1- Control	6,3	6.8	7.1	7.6	8,9	8.5	7.5A
2- Borax + Boric acid 4, 2% mix.	6.3	6.7	7.0	7.3	8,9	8.9	7.5A
3- Marm water "45°C"	6,3	6.9	7.4	7.9	0.6	8.7	7.7A
4- Paraffination	6.3	9.9	8.9	7.2	7.9	8.2	7.1B
Mean	6.3d	6.7cd	7.0c	7.5b	8.6a	8.5a	0.0
			1989 scason	nosec			
1- Control	6.1	7.3	7.8	8.5	8.6	10.0	8.2AB
2- Borax + Boric acid 4, 2% mix.	6.1	7.5	7.9	8.7	6.6	10.2	8.3AB
3- Warm water "45°C"	6,1	7.8	8.1	8.9	10.7	10.3	8.6A
4- Paraffination	6.1	7.0	7.3	8,3	0.6	9.1	7.88
Hean	<b>6.1</b> d	7.4c	7.7c	8.6b	9 <b>.</b> 8a	9.9a	0.0
New L.S.D. at P = 0.05 for:	1988 season	Treatments 0.35	Storage interval	nterval O	Interaction 0.95		
		3	•	•	77.1		

Storage was started on November 19 and 29th in 1988 and 1989 seasons, respectively.