EVALUATION OF JUICES PRODUCED FROM TWO VARIETIES OF SEEDLESS GRAPES

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Abstract

The extracted juice of two different seedless grapes cultivars Flame (F) and Early Superior (ES) recently imported to Egypt were used in this study. The juice of these varieties was not preferable to the Egyptian consumer, due to its high sour taste and color degradation. Therefore, studies were carried out to overcome this problem through preparing suitable blends of the two juices.

Pectic enzymes were added to the crushed berries before juice extraction in order to increase the juice yield, T.S.S, total sugars, total acidity and the coloring agents (total anthocyanin). Sensory evaluation indicated the low acceptability of each juice, hence the Flame juice was blended with the Early superior at the ratios of (3:1, 1:1, and 1:3, respectively). Results confirmed that the blend ratio 1 : 1 was the most palatable and more preferable by the panelists. Some chemical additives such as (Potassium sorbate, Calcium lactate, Ascorbic acid, Sodium meta bisulphite) were added to the blends either separately or in combination with each other in order to find their effects on the blend qualities especially during storage at 5°C for 6 months. Results indicated that the best treatment was that for the blend 1 : 1 containing 0.05% ascorbic acid plus 80 ppm sodium metabisulphite and 0.1% potassium sorbate stored at the same conditions. Besides, the interaction between the additives and the storage period showed no significant effect on the sensory properties. Correlation coefficient between sensory and chemical qualities were also studied. Economic study was carried out for the grape juice production. Moreover, pasteurization at 85°C for 5 minutes and the addition of 80 ppm sodium metabisulphite (treatment No. 5, 6 and 7) were sufficient to prevent microbial spoilage of the juice during 6 months storage at 5°C.

INTRODUCTION

Two different cultivars of seedless grape namely Flame and Early superior are recently cultivated in Egypt. The Flame variety had a high acidity, poor in total sugars and black-purple color. These properties make it undesirable for fresh consumption or drying as raisins. Early superior variety had a high total phenols and polyphenol oxidase activity which darkening the juice during processing and storage (Sims *et al.*,

1991). Although, the grape juice industry has been established in most of the developed countries; many problems remained to be solved in this industry (Sistrunk and Morris, 1984). Color is a major factor defining consumer preference of Muscadine grape juice; and the deterioration of color is influenced by time-temperature relationships during processing and storage (Flora; 1976).

Sims *et al.* (1995) mentioned that heat extraction and pasteurization as well as high storage temperature may reduce the overall qualities of muscadine grape juice. The flavor and color of grape juice both of red and white varieties are sensitive to heat. They also stated that, the sulfites treatment lowered microbial levels in grape juice. Ascorbic acid has been shown to delay browning in the presence of active polyphenol oxidase, however, with the degradation of ascorbic acid the non-enzymatic reactions dominated the browning process. On the other hand, King *et al.* (1988) indicated that sterile filtration can produce a high quality stable juice. Higher losses could be occurred in the quality of concord grape juice with high acid and phenolic contents than that with low acid and phenolic content. Also, grape maturity and the sugar/acid ratio can also affect the quality of juice. Sistrunk and Gascoigne (1983)

Leo *et al.* (1997) indicated that the use of commercial pectic enzyme is common in fruit juices processing. The technological advantages of commercial pectic enzymes are practically possess in the increase of juice yield, facilitating pressing, filtering and providing greater clarity of grape juice. Bosso (1992) detected that using of pectic enzyme preparations can affect components related to sensory qualities because it has increased the amounts of free terpenes in grape juice. Certain chemicals such as reducing and chelating agents, antioxidant and acid neutralizers have been shown to stabilize anthocyanins in pure juice and grape drinks. Many authors showed that adding some chemical additives such as $CaSo_4$, $SnCl_2$, CaCO3 and calcium lactate increased the color retention and improved the sensory properties of the muscadine grape juice (Sistrunk & Gascoigne; 1983 and Sistrunk & Morris; 1984).

This study was carried out as a trial to produce grape juice commercially from some recently imported varieties to Egypt namely Flame (F) and Early Superior (ES). The study was also extended to find the effect of certain additives and storage periods on the qualities of grape juice.

MATERIALS AND METHODS

1. Materials:-

- Two cultivars namely, Flame and Early Superior seedless grapes were obtained from a commercial orchard in Cairo-Alex desert road during season 2001. The berries were sorted to remove over and immature fruits before washing.
- Commercial pectic enzyme (Pectinex ultra SP) from Novo Nordish Ferment Ltd. Dittingen, Switzerland were used.
- All chemicals used in this study were of analytical grade usually utilized in foods.

2. Methods:-

2.1. General characteristics:-

The grape clusters were washed and sorted into ripe and unripe grades based on visual color development of the fruit. The weight and volume of 100 berries chosen randomly were determined.

Juice yield was calculated from the weight of grape juice extracted from 100gm of grape berries.

Processing of grape juice:

Cleaned berries of each cultivar were washed, crushed in fruit blender at high speed for 5min, and potassium sorbate (0.1%) was added to the crushed grapes to prevent any microbial spoilage. The crushed grapes were divided into two lots; one of which was treated with 200 p.p.m pectinex enzyme for 4 hrs at ambient temperature (400C), and the other was used as a control. The free run juice was obtained by pressing; then clarified by setting overnight at 50C to precipitate tartarates. The obtained juices were organoleptically evaluated for each variety. Blending the juices of the two varieties were carried out by mixing at a ratio to 3:1, 1:1 and 1:3 .

The experiment was designed as a factorial with 8 treatments (for ratio 1 : 1) as shown in Table (1).

Table 1. Treatments and their additives

Treatment No.	Additives applied for the favourite blend ratio (1:1) of the tested grape juices
Control	juice+0.1% potassium sorbate (P.S)
1	juice+0.75% calcium lactate+0.1% P.S
2	juice+0.05% ascorbic acid + 0.1% P.S
3	juice+80ppm Sod. meta bisulphite+ 0.1% P.S.
4	juice+0.75% calcium lactate + 0.05% ascorbic acid + 0.1% P.S
5	juice+0.75% calcium lactate+80ppm sod. meta bisulphite+0.1% P.S.
6	juice+0.05% ascorbic acid+80ppm sod. meta bisulphate+0.1% P.S
7	juice+0.75% calcium lactate+ 0.05% ascorbic acid+ 80ppm sod. meta bisulphite+ 0.1% P.S.

The treated juices were filled into clean and dry glass containers (200ml), immersed into hot water bath at 85^{0}C for 5min, capped, cooled and stored at 5^{0}C for 0, 3 and 6 months. All treatments were run in duplicate.

2.3. Analytical methods

Total soluble solids (T.S.S.), total sugars, pH value, total acidity, anthocyanins, ascorbic acid, and phenols and carotenoids were determined before and after processing and again after chemical additives and storage periods. T.S.S., pH, Titratable acidity and Ascorbic acid were determined according to A.O.A.C. (2000). Total and reducing sugars were estimated colorimeterically according to Miller (1959).

Anthocyanins were extracted by diluting an aliquot of juice to 100ml with 95% EtOH-1.5N HCl (85: 15). Absorbance was measured at 520 and 700nm. Total anthocyanins concentration, expressed as absorbance units/ml of juice was calculated according to the following equation described by Spayd *et al.* (1984). Total anthocynins = (Abs 520 – Abs 700) x dilution factor. Calcium, Sodium, potassium and zinc were determined according to A.O.A.C (2000).

2.4. Sensory evaluation

The juices were sensory evaluated according to the method described by Sims *et al.* (1995).

2.5. Microbiological analysis:-

Total bacterial count, in the juices during storage were carried out according to Smith and Townsnd (1999).

2.6. Statistical analysis:-

The organoleptic and chemical analysis data were statistically analyzed using MSTAT-C V- 2-10 (1988). The Duncan's multiple range test was used to compare means.

RESULTS AND DISCUSSION

Selected general and chemical properties of fresh seedless grapes :

The physical and chemical properties of fresh Flame and Early superior seedless grape berries used in this study are given in Table (2).

Table 2. Physical and chemical properties of seedless grape berries.

Properties	Grape varieties	
	Flame (F)	Early superior (ES)
1. Tasted general view		
Juice color	Purple	Light yellow
Juice yield (%)	77	83
Weight of 100 berries (g)	334.8	189.2
Volume of 100 berries (cm5)	580	300
2. Chemical constituents *		
Total Soluble Solids, T.S.S %	17.60	17.80
Total sugars %	13.22	15.52
Reducing sugars %	11.88	12.31
Total phenols %	43.0	46.0
Total acidity % (tartaric acid)	1.59	0.53
Anthocyanins (mg/100g)	43.38	-
Ascorbic acid (mg/100g)	5.67	7.63
Sugar/acid ratio	8.3:1	29.3:1
pH value	3.95	4.21

* on fresh weight bases.

From this table, it could be noticed that weight of 100 berries of Flame cultivar was higher than that of Early superior cultivar while the juice yield was lower than that of Early superior. Sugar/acid ratio, total sugars, total phenols and ascorbic acid were higher in variety (ES) compared to those of (F) variety. On the other side, Flame variety was higher in anthocyanins contents. These differences would be attributed to the variety itself, in addition to planting and weather conditions.

The effect of adding commercial pectic enzymes (pectinx ultra USP) on extraction ratio and chemical properties of fresh seedless grape juice extracted from two cultivars under study are illustrated in Table (3). Samples treated with pectic enzyme during extraction had a positive alteration in extraction ratio of juice in both F and ES. This alteration ranged between 19.5 to 16.8, respectively. Also, there was a positive alteration in the values of T.S.S., total sugars, total acidity, anthocyanins, and ascorbic acid as compared with the untreated samples. These results are in accordance with those of Struebi *et al.* (1988), who reported the successful application of macerating enzyme for apple nectar processing. These nectars possessed not only the original fruit color and flavor but also good flow properties and cloud stability over a sufficient period of time. Besides Leo *et al.* (1997) showed that the use of commercial pectic enzymes in white grape juice processing gave a more rapid flow of

juice, improved juice yields, facilitated filtering and gave greater clarity. So, the use of enzymes during extraction of juices was used in this work.

Table 3. Effect of commercial pectic enzymes* on extraction ratio and Chemical properties of fresh seedless grape juice.

Items	Untreated with enzymes		Treated with enzymes		% altration	
	F	ES	F	ES	F	ES
Extraction ratio	77	83	92.0	97	+19.5	+16.8
Total soluble solid (T.S.S.)	17.6	17.8	19.2	20.0	+9.1	+12.35
Total sugars (%)	13.22	15.52	14.97	18.11	+13.25	+16.69
Total acidity (as % tartaric acid)	1.59	0.53	1.64	0.55	+3.14	+3.77
Anthocyanins (mg/100g)	43.38	-	44.50	-	+2.58	-
Ascorbic acid (mg/100g)	5.67	7.63	6.21	8.02	+9.51	+5.11
Color index as OD						
at 420nm	-	0.510	-	0.487	-	-
at 520nm	0.675	-	0.657	-	-	-

* The applied pectic enzymes was pectinex ultra USP F=Flame cultivar ES=Early superior cultivar.

Organoleptic properties of fresh grape juices

Juices prepared from each cultivar separately (blend No. 1 and 5) and from their blends with different ratios were sensory evaluated and the results are given in Table (4). Data for each character were statistically analyzed by Duncan's multiple range test. From this table, it could be concluded that blend no 3; containing 50% F juice + 50% ES juice was more preferable for all characters compared to the other blends. Juices from either of F or ES the lowest overall acceptability F than those of other blends. The effect of blend ratios between the two varieties concerning sensory properties had highly significant differences.

Table 4. Sensory evaluation of grape juice as affected by cultivars and their mixtures.

Blend No	Blending ratio Cultivars F : ES	Sensory parameter out of (10)			(%) Overall acceptability
		Color	Flavor	Taste	
1	100 : 0	4.67 d	4.00 b	3.67 c	36.77 d
2	75 : 25	6.33 c	4.67 b	4.67 bc	56.67 bc
3	50 : 50	9.33 a	6.67 a	6.33 a	83.33 a
4	25 : 50	7.67 b	4.67	4.67 bc	66.67 b
5	0 : 100	4.33 d	4.33 b	5.00 b	46.67 cd
L.S.D		1.191	0.973	1.287	11.41
F. test		**	**	**	**

Means followed by the same letter are not significant difference.

** means highly significant difference.

Treatments and storage periods interaction

To prolong the shelf life of fresh grape juice prepared as described in Table (4), the blend No. 3 was adapted to try treatment of some additives such as potassium sorbate, calcium lactate, ascorbic acid and sodium meta bisulphite which were used separately or combined as shown in Table (1), to study the interaction between these treatments during storage on chemical and sensory properties.

Table (5) shows the effect of some additives and storage period on chemical quality attributes of the investigated grape juice. From this Table, it could be noticed that calcium lactate, sodium metabisulphite and their combination (treatments 1, 3 and 5) had no significant difference on total sugars content after processing. Meanwhile; there was a highly significant difference in total sugars content between all treatments during storage. The decrease in total sugars content during storage may be due to the browning reactions and/or to slight fermentation. Statistical analysis showed the effect of storage period (A), treatments (B) and interaction between AB on total sugars were highly significant.

A slight decrease in total acidity as tartaric acid and slight increase in pH values were also noticed in Table (5) during the storage periods. The interaction between treatments and storage periods and their effect on total acidity and pH values had a high significant effects.

As shown in Table (5); the addition of 50mg ascorbic acid to the juice stabilized the anthocyanins contents (treatment No 2). And so prevented anthocyanins against oxidation. Meanwhile, sodium meta bisulphite alone had an adverse effect on anthocyanins content (treatment No 3). But when combined with ascorbic acid (treatment No 6) a similar effect was noticed on anthocyanins content compared to juices treated with calcium lactate (treatment No 4) and control. During storage period, anthocyanins content decreased gradually and treatment No. 6 showed a high value of anthocyanin content at 6 months storage period (0.59mg/100g). From these results, it could be noticed that anthocyanin content were affected greatly during storage and the additives had different effects depending on the type of additive and the interaction occurring between additives. With respect to ascorbic acid, it could be noticed that; treatment No. (2 and 6) enriched with ascorbic acid had a maximum ascorbic acid content after processing (14.33 and 13.59mg/100g) and lost more than 40% of its initial content at 6 months storage at 5°C, but still containing a marked value (6.51 and 7.50mg/100g). These results are in accordance with those found by El-Manawaty (1971). F-test showed a highly significant difference as the effect of treatments, storage periods and interaction between them on ascorbic acid content of

the rested grape juices. Also, data in Table (5) show that different additives, storage period and their interaction had a high significant effect on color index, and ascorbic acid plus sodium metabisulhpite was the best treatment. This may be due to that ascorbic acid played a very important role in protection of real pigments (anthocyanin) as it lowered the pH value leading to stability of that pigments. As regards sodium metabisulphite may captured aldehydes groups of reducing sugars preventing the reaction between these groups and amines groups (Millard reaction). This would help in keeping good color of the final products. Similar results were obtained by Spayd *et al.* (1984).

Table 5. Effect of some additives and storage periods on chemical quality attributes of grape juice

Treatment no.	Chemical quality attributes					
	Total sugars %	Total acidity %	pH value	Anthocyanins (mg/100g)	Ascorbic acid (mg/100g)	Color index (OD 520nm)
	After processing					
Control	15.92 a	0.573	4.21	0.78 b	6.73 f	0.585 n
1	15.47 b	1.173	3.09	0.74 c	6.75 f	0.600 m
2	14.05 ef	0.793	3.31	0.83 a	14.33 a	0.583 o
3	15.55 b	0.588	4.33	0.59 h	6.79 f	0.656 gh
4	14.80 d	0.790	4.83	0.77 b	10.53 f	0.591 n
5	15.49 b	0.881	3.71	0.67 e	6.73 f	0.628 k
6	14.75 d	0.690	3.82	0.77 b	13.59 a	0.620 l
7	15.15 c	0.639	3.08	0.68 e	10.92 b	0.641 j
	After 3 month storage					
Control	13.66 gh	0.556	4.20	0.63 g	5.33 h	0.646 Ig
1	13.00 i	0.944	3.58	0.46 m	3.86 j	0.673 f
2	12.50 i	0.687	3.42	0.65 f	10.77 b	0.686 de
3	14.72 d	0.497	4.48	0.37 p	5.35 g	0.686 d
4	12.70 i	0.776	3.50	0.55 j	7.31 e	0.680 e
5	13.85 fg	0.712	4.04	0.41 o	3.83 j	0.680 e
6	14.15 e	0.672	3.83	0.70 d	9.29 c	0.626 k
7	13.64 h	0.609	4.50	0.58 I	8.45 d	0.652 h
	After 6 month storage					
Control	12.70 J	0.528	4.27	0.47 l	3.84 j	0.841 a
1	11.15 m	0.742	4.45	0.34 o	1.76 l	0.691 d
2	11.95 k	0.584	3.67	0.51 k	6.51 f	0.706 b
3	12.56 j	0.472	4.65	0.24 s	5.04 h	0.691 d
4	11.53 l	0.662	4.06	0.43 n	3.45 i	0.698 c
5	11.85 k	0.607	4.55	0.30 r	1.88 k	0.691 d
6	13.80 gh	0.647	3.85	0.59 hi	7.50 e	0.632 k
7	12.51 J	0.601	4.15	0.46 lm	6.65 h	0.661 g
L.S.D	0.21	0.036	0.04	0.013	6.14	0.007
F-test						
Storage period A	**	**	**	**	**	**
Treatments B	**	**	**	**	**	**
AxB	**	**	**	**	**	**

Means followed by the same letter are not significant difference.

** means highly significant difference.

Sensory evaluation of seedless grape juice as affected by different additives and storage periods are shown in Table (6). It could be demonstrated that no significant differences were found in color acceptability between treatment No. 6 (treated by ascorbic acid plus sodium meta bisulphite) and treatments No. 1, 2, 4, 7 and the control after processing immediately. While, during storage for 6 months at 5°C, the differences observed in color acceptability were more evident and continued having desirable color acceptability. The interaction between storage periods and treatments had no significant difference in the acceptability of color. It could be concluded that treatment No. 6 had highly color acceptance after 6 months storage.

Table 6. Effect of some additives and storage periods on sensory evaluation of grape juice

Treatment no.	Sensory parameters out of (10)			
	Color acceptability	Flavor	Taste	% overall acceptability
	After processing			
Control	8.5 ab	6.5 cd	6.5 bf	85.0 b
1	8.5 ab	7.0 bc	5.5 de	85.0 b
2	8.0 ab	8.0 a	5.5 de	75.0 cd
3	5.5 f	4.5 gh	6.5 bc	65.0 ef
4	8.0 ab	7.5 ab	5.5 de	75.0 cd
5	7.0 c	6.0 de	6.0 cd	75.0 cd
6	9.0 a	7.5 ab	8.0 a	95.0 a
7	8.0 ab	7.0 bc	7.0 ab	85.0 b
	After 3 months storage			
Control	7.5 bc	5.5 ef	6.5 bc	70.0 de
1	7.5 bc	6.5 cd	5.5 de	75.0 cd
2	6.5 d	6.0 de	4.0 g	55.0 gh
3	3.5 h	5.0 fg	5.5 de	55.0 gh
4	6.5 d	6.0 de	5.0 ef	65.0 ef
5	5.5 f	5.5 ef	5.0 de	65.0 ef
6	8.5 ab	7.5 ab	7.5 ab	85.0 b
7	7.5 bc	7.0 bc	6.0 cd	75.0 cd
	After 6 months storage			
Control	5.5 f	4.5 gh	5.5 de	60.0 fg
1	6.5 d	4.5 gh	4.5 fg	60.0 fg
2	6.0 e	5.5 ef	4.0 g	50.0 h
3	3.0 i	3.5 I	4.5 fg	50.0 gh
4	6.0 e	5.0 gh	4.5 fg	55.0 gh
5	4.5 g	4.0 hi	4.5 fg	80.0 bc
6	8.0 ab	7.5 ab	7.0 ab	70.0 de
7	7.0 c	6.0 de	5.5 de	78.8 a
L.S.D	1.12	0.98	1.27	7.88
F-test				
Storage period A	**	**	**	**
Treatments B	**	**	**	**
AxB	N.S	N.S	N.S	N.S

Means followed by the same letter are not significant difference.

** means highly significant difference. – N.S. means not significant difference.

After processing treatment No. 2 had the highest value of flavor followed by treatment No. 4 and 6. This indicates that different additives can affect flavor of the investigated grape juices. Changes in flavor during storage were observed where treatment No. 6 recorded the highest value of flavor; so, storage period had a negative effect on the flavor as well as interaction between treatments and storage had no significant difference. With respect to taste; there was a highly significant difference between all treatment after processing and during the storage period. Treatment No. 6 recorded a higher score in taste than the other treatments. The same observation was noticed in the overall acceptability whereas treatment No. 6 was more favourite than other treatments after and during storage till 6 months (at 5°C). Generally, it was found that the additives and storage period had a significant effect on sensory properties of grape juice and the interaction between treatments and storage had no significant difference.

Table (7) shows the effect of different additives and storage period on total bacterial count of seedless grape juice. The results indicate that the control sample was insufficient to maintain the grape juice against increasing of total viable count bacteria (till 6 months storage at 5°C); a contrast with treatments (3, 5, 6 and 7) occurred when sodium meta bisulphite were used. These results were coincide with those obtained by Sims *et al.* (1995) who reported that sulfite lowered microbial levels in grape juices.

Table (8) shows the nutritional value of grape juice stored at 5°C after 6 months. It could be observed that the favourite treatment grape juice contained 13.8% carbohydrate, 0.42% protein and 7.49mg/100g ascorbic acid. (Hodges (1980) revealed that the absolute minimum requirement of vitamin C per day to prevent scurvy was about 100mg), while a deficient in fat and fiber were detected. This juice had minerals such as Ca, Na, K and Zn which play an important role in metabolism inside the human body (Briggs and Calloway, 1984).

Table 7. Effect of different (additives) and storage periods on total bacterial count of seedless grape juices.

Treatments No.	Total viable count (CFU × 10^2/ml)		
	After processing	After 3 months	After 6 months
Control	5.2	16.5	38.2
1	4.1	15.7	23.5
2	4.3	12.0	16.3
3	2.7	1.5	0.5
4	4.0	7.5	24.0
5	N.D	0.7	N.D
6	N.D	N.D	N.D
7	N.D	N.D	N.D

N.D = Not detected

Table 8. Nutritional value of grape juice after 6 months storage at 5°C.

Items	Value (g/100ml)
Total sugars	13.80
Ascorbic acid (mg/100g)	7.49
Minerals (mg/100g)	-
Ca	22.6
Na	3.0
K	158.0
Zn	0.04

CONCLUSIONS

Seedless grapes juice from varieties Flame and Early Superior with a good color acceptance, flavor, taste and overall acceptability could be produced by mixing the juice of the two cultivars at the ratio 1:1. Adding 0.05% ascorbic acid, 80 ppm sodium meta bisulphite and 0.1% potassium sorbate to the juice and storing at a refrigeration (5°C) led to increase the shelf life of this juice. Further research would be needed to determine what treatments or combination of treatments would be most effective to maximize overall acceptability of blended juice during commercial storage and marketing.

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تقييم عصير العنب المصنع من ثمار صنفين عديمى البذور

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تمت الدراسة علي صنفين من أصناف العنب اللابذرية الحديثة الزراعة في مصر وهما (Flame & Early superior) والتي لا يستهلكها المستهلك المصري بكثرة وذلك للمذاق الحامضى والتلوين ولذلك تمت الدراسة للتغلب علي هذه المشكلة بإجراء الخلط بين الصنف الحامضى وصنف Early superior لعمل أتزان في الطعم واللون ولزيادة معدل استخلاص العصير ثم بإضافة بعض الإنزيمات البكتينية حيث أثبتت النتائج أن إضافة هذه الإنزيمات قبل الاستخلاص أدي إلي زيادة ملحوظة في نسبة العصير الناتج وكذلك زيادة في كل من المواد الصلبة الذائبة الكلية والسكريات الكلية والحموضة الكلية ومحتوي العصير من صبغة الأنثوسيانين .

وبأجراء التحكيم الحسي للعصير الناتج من كلا الصنفين علي حدة تبين عدم قبوله لدى المحكمين ولذا تم خلط عصير الصنف Flame مع عصير الصنف Early superior بنسبة ٣ : ١، ١ : ١ ، ١ : ٣ حجمياً على الترتيب وأظهر التحكيم الحسي أن الخلط بنسبة ١ : ١ كانت الأكثر تفضيلا لدي المستهلكين.

أظهرت نتائج البحث أيضاً أن البسترة مع استخدام سوربات البوتاسيوم ٠,١% وإضافة ميتا كبريتيت الصوديوم (٨٠ جزء في المليون) كانت كافية لمنع الزيادة الميكروبية للعصير (المعاملة ٥ ، ٦ ، ٧) وذلك بعد مرور ٦ أشهر تخزين علي درجة ٥م. كذلك أظهرت نتائج التقييم الحسي والكيماوي والميكروبيولوجي أن المعاملة رقم ٦ التي تحتوي علي (نسبة خلط ١ : ١ من كلا الصنفين) ٠,٠٥% حمض أسكوربيك + ٨٠ جزء في المليون ميتا كبريتيت الصوديوم + ٠,١% سوربات بوتاسيوم كانت أفضل المعاملات بعد مرور ٦ أشهر تخزين علي درجة ٥م. وتم حساب التكلفة الإقتصادية للعصير الناتج وأظهرت الدراسة أن إنتاج العصير مُجدى اقتصادياً.