

EFFECT OF STORAGE ON THE PHYSICAL AND ORGANOLEPTIC PROPERTIES OF FROZEN AND CANNED POMEGRANATE JUICE

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ABSTRACT

The pomegranate grains (arils) containing the juice, are the edible part of the fruit. This current study was carried out on Egyptian ripe pomegranate fruit (Wardi, Banati and Manfaloti varieties). Pomegranate juice was extracted from the grains, filtered and preserved by two methods; packaging in polyethylene pouches and stored in freezer at -18°C for the storage period up to 4 months, and packaging in enameled cans of 400 ml capacity and pasteurized at 90°C for 15 min, then cooled immediately and stored at room temperature for days.

The effect of storage on the pH value, colour and organoleptic properties of pomegranate juice which was prepared by two methods, namely freezing and canning, were studied and the data showed that pH value increased significantly during the storage of two products. It was observed that the pH values of canned juice were lower than that of the frozen through all the storage period and for the three varieties studied.

The storage affected the color value of the pomegranate juice as measured using Lovibond was studied. The color values (yellow, and blue) increased significantly as the storage period increased; it was noticed also that the increment was higher for the canned juice samples stored at ambient temperature than those of frozen samples. However the red values were decreased as the storage period increased, for both of the frozen and canned juice. The organoleptic properties were affected by storing the juice for all treatments. The color, odor, taste and appearance values decreased remarkably as the storage period was increased. However, the storage of the canned juice showed a higher reduction in the above mentioned organoleptic properties comparing with those of the stored frozen samples.

Generally the panelists preferred the frozen Wardi juice over the other tested samples, since it got the highest quality scores in comparison with the others.

INTRODUCTION

Pomegranate is a specie originating in Iran and Afghanistan, from where it was brought to the Mediterranean countries, now it is cultivated in many countries (Kolesnikov, 1959 and Artes *et al.*, 1996). In Egypt, pomegranate are grown in many parts extending from Aswan to Alexandria (Ibrahim *et al.*, 1985).

The fresh pomegranate juice is characterized by brilliant red purple color due to anthocyanin pigments and specific aromatic taste and odor compound (Hamed, 1999).

Pomegranate juice red color can continue to increase in intensity during post harvest (Ben-Arie *et al.*, 1995 and Artes *et al.*, 1996). These results are in contrast with those of Kder and Chordas (1984), and Gil *et al.*,

(1995). They found that no changes were recorded for juice color during cold storage in air. Also by studying the stability of pomegranate juice color under thermal process conditions, it was found that the color was very stable to heat treatment (Miskin – Saymy, 1982). In addition, Yang *et al.*, (1982), stated that storage temperature was the greatest factor affecting the stability of anthocyanin pigments. These pigments were gradually destroyed with storage and the degradation increased with increasing the storage temperature.

Moreover, Ibrahim, (1992), found that, the storage of the pomegranate juice at different conditions caused a gradual destruction in the organoleptic properties for the juice stored at room and cooling temperature.

This research work has been carried out to study the sensory properties of the canned and frozen juices which were produced from the three varieties under investigation, (Wardi, Banati, Manfaloti), to determine changes in the keeping quality during storage at room temperature for canned juice and at -18°C for frozen juice.

EXPERIMENTAL PROCEDURES

Source of fruit: Three varieties of pomegranate fruit, namely; Wardi, Banati and Manfaloti, were used for the sake of comparison in this study. The pomegranate fruit were obtained from the Alexandria whole sale local market (for Wardi variety) and from Abees farm (for Banati and Manfaloti varieties) during the winter season. They were selected at their ripe stage as could be judged by color and taste. The fruits when brought to the laboratory, were washed thoroughly with water then peeled, the grains (arils) were separated by hand and packed in polyethylene pouches and then kept in freezer at -18°C until used.

Preparation of pomegranate juice:

The sample of pomegranate juice used in this study were prepared as follows:

Pomegranate grains (arils) were preheated at ...C formm to facilitate the extraction of the juice, pulped and filtered through cheese cloth.

Preliminary work was carried out to determine the preferred juice sample of pomegranate juice as judged by the panelists. Different juice samples containing 5 levels of T.S.S. (16, 18, 20, 22, 24%, respectively) were prepared at the pilot plant of Food Science and Technology department. Sugar solution of 80% concentration was used to adjust the T.S.S. of the pomegranate juice samples to the previously mentioned concentrations. The samples were subjected to taste panel tests and it was found that the juice sample containing 22% T.S.S. was the most preferable among the other samples.

Storage of Effect on the juice quality

The prepared juice was preserved by two methods.

Frozen juice: The juice was packed in polyethylene pouches and sealed after exhausting air from it, then stored in freezer at -18°C for the storage period up to 4 months.

Canned juice: The juice was packed in enameled cans of 400-ml capacity and pasteurized at 90°C for 15 min. Then cooled immediately. The cooled cans were stored at room temperature for months.

Organolyptic and physical tests for samples of frozen and canned juice were carried out at 15-day intervals for a storage period up to 4 months.

pH values and color: The (pH) values and color were evaluated for all treatments according to the method described by (Abd-El-Latif, 2000). The color of juice was determined by lovibord tintometer (model E, made by Tintometen Ltd Salistury – England), fitted with a 1.0 inch (2.54 cm) cell.

Sensory evaluation: Sensory evaluation of different properties (color, odor, taste, appearance and overall quality) of all treatments were evaluated by taste panel tests (Ranganna, 1979). The taste panel tests were carried out by ten trained panelists using composite scoring test according to Ranganna (1979).

Statistical methods: The organoleptic tests were analyzed statistically using ten replications for each treatment arranged in randomized complete block design. Analysis of variance treatment differences was performed according to Steel and Torrie (1980). The data were analyzed on the PC-computer. Statistical analysis was done by the least significant (L.S.D.), (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

According to the information given by the Egyptian ministry of Agriculture (1984), it was reported that pomegranate grains may be consumed directly with or without addition of sugar and fresh juice extract. Also, pomegranate fruit was used in many products such as juice. In this study the effect of storage on pH, color values and organoleptic properties were evaluated as follow:

pH value:

pH value was carried out for the evaluation of frozen and canned pomegranate juices during storage as shown in Table (1), (2). The data showed that there was a significant decrease in the pH value of the juice during the storage period for the three studied varieties. The pH of pomegranate juice was 3.5, 3.6 and 3.3 for Wardi, Banati and Manfaloti varieties at zero time and became 3.0, 3.0, 2.7, respectively after 105 days of storage at -18°C (Table 1).

Table (1): Effect of storage at -18°C on pH values of frozen juices for the three varieties of pomegranate

Storage Period (day)	Variety	pH Values		
		Wardi	Banati	Manfaloti
Zero			3.50	3.30
15		3.38	3.56	3.30
30		3.32	3.45	3.10
45		3.01	3.38	2.84
60		3.00	3.21	2.80
75		3.00	3.05	2.80
90		3.00	3.00	2.70
105		3.00	3.00	2.70

These results are in a coincidence with those of Rommel *et al.*, (1990), and Ibrahim (1992), they stated that pH value decreased remarkably during storage of the juice. As shown in Table (2), the pH value of canned juice was reduced slightly during the storage period for the three varieties studied and there was significant variation during storage period and among the three varieties. These results are in a good agreement with that of Ibrahim (1992). However, Abde-El-Latif (2000), reported that the pH value increased slightly during storage of ...?

Table (2): Effect of storage at room temperature on pH values of canned juices for the three varieties of pomegranate

Storage Period (day)	Variety	pH Values		
		Wardi	Banati	Manfaloti
Zero		3.50	3.60	3.30
15		3.17	3.60	3.00
30		3.03	6.40	2.90
45		3.07	3.30	2.80
60		3.00	3.28	2.80
75		3.00	3.00	2.80
90		2.80	2.90	2.80
105		3.00	3.00	2.60

Color values:

The data shown in Table (3), represent the color value of frozen pomegranate juice as determined by Lovibond during the storage period. A significant variation during the storage period and among the varieties were observed. The storage caused a remarkable increment in the yellow (Y) and blue (B) values with a noticeable decline in the red (R) value. De-Ancos *et al.*, (2000) reported that the loss of color of raspberry products during processing and storage has been attributed to many factors such as enzymatic reaction, ascorbic acid and other organic acids, sugar products, oxygen, fruit maturity, thawing time, metal ions, light and temperature; also may be affected by the actual anthocyanin concentration.

Table (3): Effect of storage at -18°C on the color of frozen juices for the three studied varieties

Storage Period (day)	Variety	Wardi			Banati			Manfaloti		
		Y.	R.	B.	Y.	R.	B.	Y.	R.	B.
Zero		0.20	7.00	2.90	0.70	2.50	2.10	4.00	7.00	3.50
15		0.20	10.00	3.00	0.10	1.90	2.00	4.30	7.40	5.00
30		0.30	10.00	3.20	1.30	1.10	2.00	1.10	1.90	5.30
45		10.00	20.90	5.00	10.00	7.60	3.00	10.40	10.10	5.20
60		23.00	10.00	7.70	24.10	6.90	9.50	21.10	5.20	10.10
75		20.00	9.00	7.70	22.00	6.50	9.30	21.00	4.90	10.00
90		20.00	8.50	8.00	22.00	6.00	9.50	20.00	5.00	10.00
105		20.00	9.00	8.00	20.00	5.00	9.50	20.00	5.00	10.50

Storage the canned pomegranate juice of the three studied varieties at room temperature affected significantly the color values of the samples (Table 4). Yellow (Y) and blue (B) values increased significantly with the increase of storage periods, while the red (R) values were lower after storage period, especially at 60 – 105 days of storage. Soliman (1996) reported a reduction in the color scores of.....? with increasing the storage time, and the reduction was higher in the samples stored at ambient temperature than those under refrigeration condition.

Table (4): Effect of storage at room temperature on the color of canned juices for the three studied varieties

Storage Period (day)	Wardi			Banati			Manfaloti		
	Y.	R.	B.	Y.	R.	B.	Y.	R.	B.
Zero	0.20	7.00	2.90	0.70	2.50	2.10	4.00	7.00	3.50
15	2.00	9.00	3.80	0.20	0.90	2.70	0.50	9.00	6.20
30	1.00	10.90	4.00	1.90	1.10	3.00	1.00	4.90	6.00
45	10.80	10.90	6.90	10.00	5.90	3.00	20.00	10.00	7.90
60	21.10	4.90	7.90	20.00	3.90	9.10	33.00	4.90	10.32
75	20.00	5.00	8.10	22.00	4.00	9.50	21.00	4.60	10.50
90	20.00	5.00	8.50	21.00	5.00	10.10	20.00	4.50	10.60
105	20.00	5.00	9.00	20.00	5.00	10.50	20.00	6.00	11.00

Organoleptic properties:

Pomegranate juice were subjected to an organoleptic test performed by 10 members. The results of the sensory evaluation of Wardi, Banati and Manfaloti pomegranate juice (frozen and canned) were shown in Figs. 1, 2, 3, 4, 5 and 6. It can be noticed that the storage affected the organoleptic attributes for all treatments and there were significant variations among storage periods and the three studied varieties. Storage of frozen pomegranate juice up to 30 days had no effect on the color values, while continuing storage (up to 105 days) caused slight reduction in the color score.

The same result was observed for the appearance and overall values, irreversibly, the odor was severely decreased as the storage period increased up to 45 days; then increasing the storage period to 115 days caused no effect on odor values. Storage of canned Wardi pomegranate juice results in a noticeable decrease for color value up to 15 days, after 30 days of storage, the juice, color value was lowered remarkably till the end of the storage period. Same trend was observed for the odor, taste, appearance and overall values of stored canned juice.

As shown in Fig (3), storage of the frozen Banati juice up to 15 days had no effect on the color values, while a noticeable decline in the color value was occurred during the rest of the storage period. Similarly, the odor, appearance and overall quality showed the same trend as color.

Fig (4), show the effect of the storage on the organoleptic attributes of canned Banati pomegranate juice. Color value decreased remarkably as the storage period increased, while both of odor, taste and overall of the juice

showed a noticeable decline as storage period increased up to 15 days, then very slight reduction occurred to the same values as the storage period increased up to 60 days. Abd-El-Latif (2000), reported a slight decrease in organoleptic attributes for frozen pomegranate grains during storage period at -18°C .

It can be noticed from Fig (5) that, there was a slight decline for the odor, taste, appearance and overall scores for the frozen Manfaloti pomegranate juice as the storage period increased up to 30 days, but after that the values were lowered remarkably till the end of the storage period. However, storage of the juice up to 30 days had no effect on the color values then the color value decreased at the rest of the storage period. The taste value for the canned pomegranate juice (Fig 6), changed very slightly as storage period increased to 45 days, but it was rejected after 75 days of storage. The color, taste, appearance and overall values showed a remarkable decline during the storage of the canned juice. Generally, the panalists preferred the frozen and canned Wardi juice over the other samples.

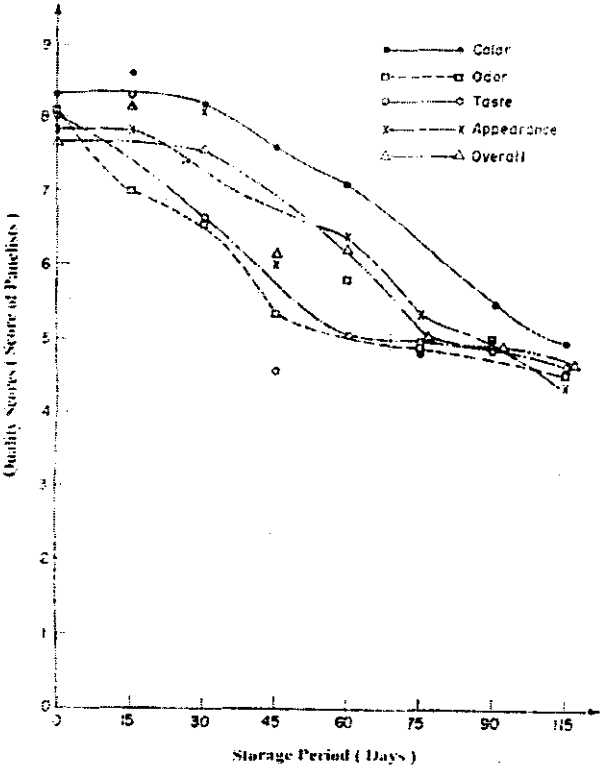


Fig. (1): Effect of Storage on Organoleptic Attributes of Frozen Pomegranate Juice (Wardi)

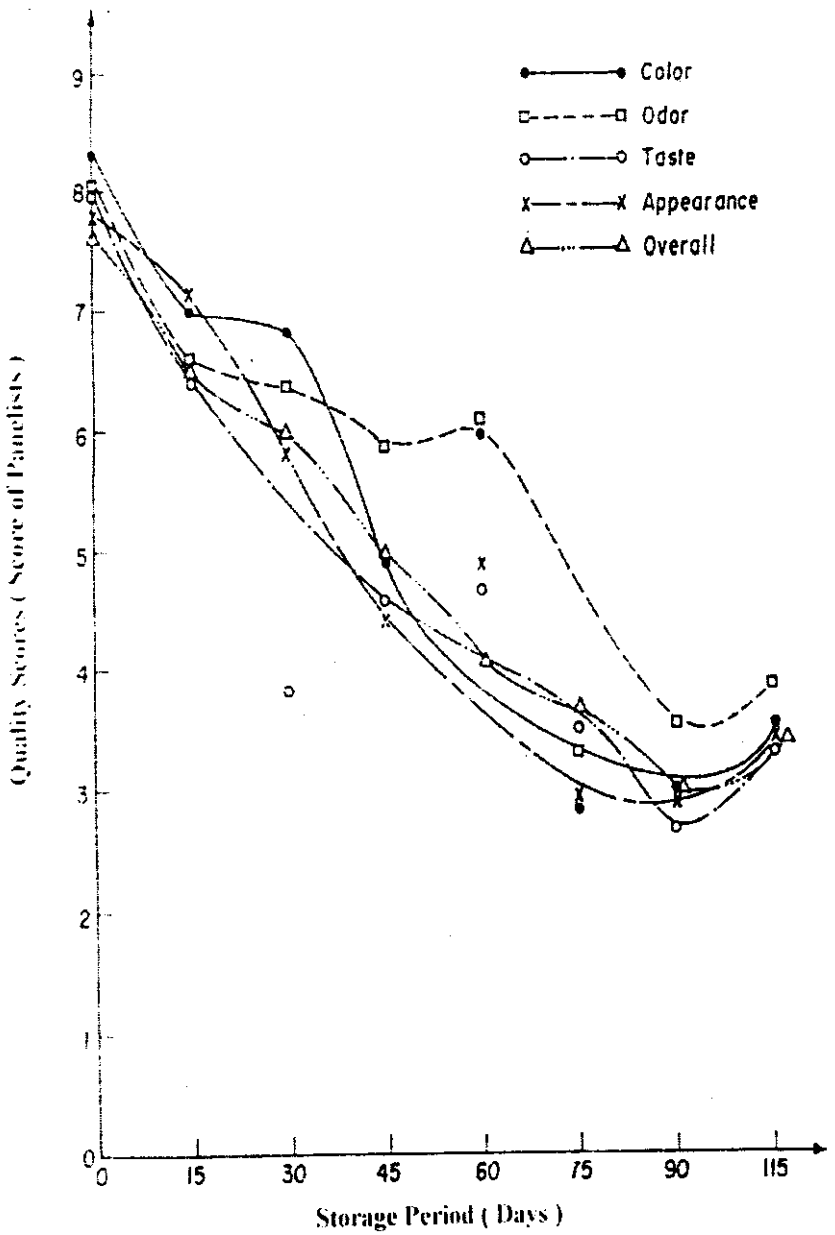


Fig. (2): Effect of Storage on Organoleptic Attributes of Canned Pomegranate Juice (Wardi)

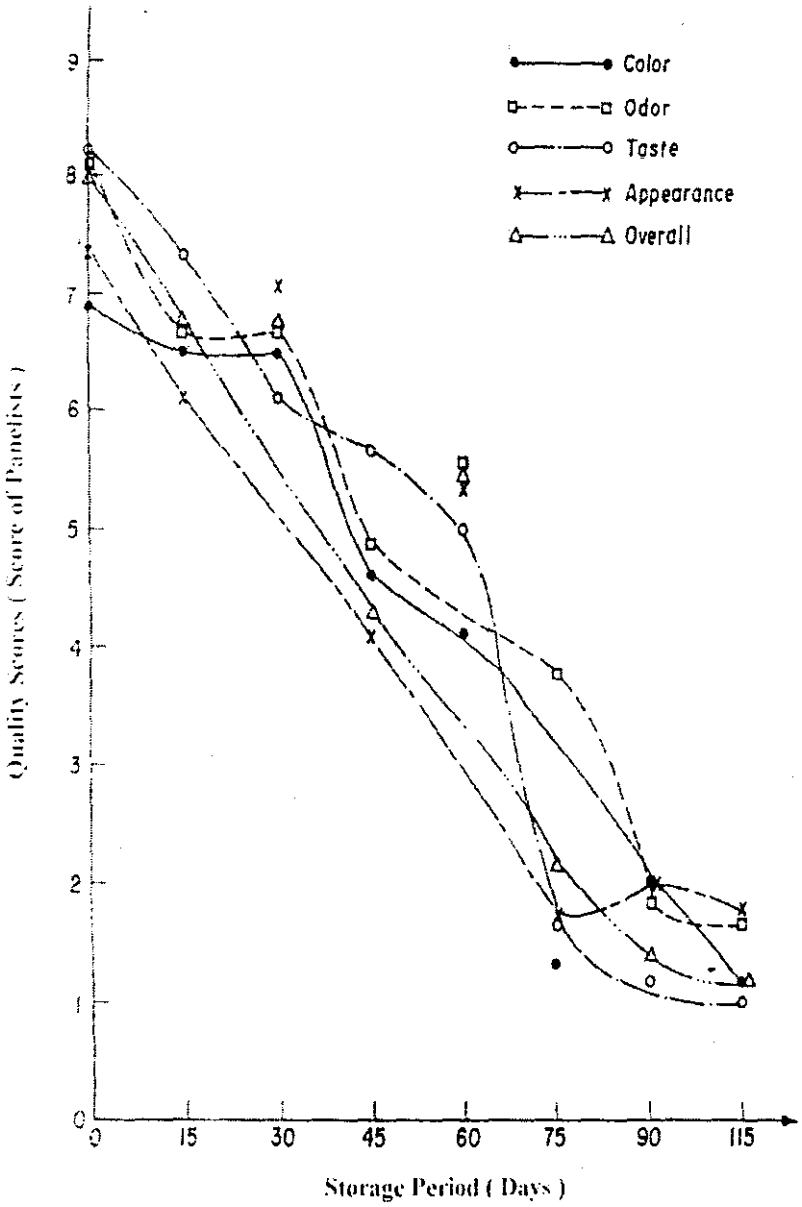


Fig. (3): Effect of Storage on Organoleptic Attributes of Frozen Pomegranate Juice (Banati)

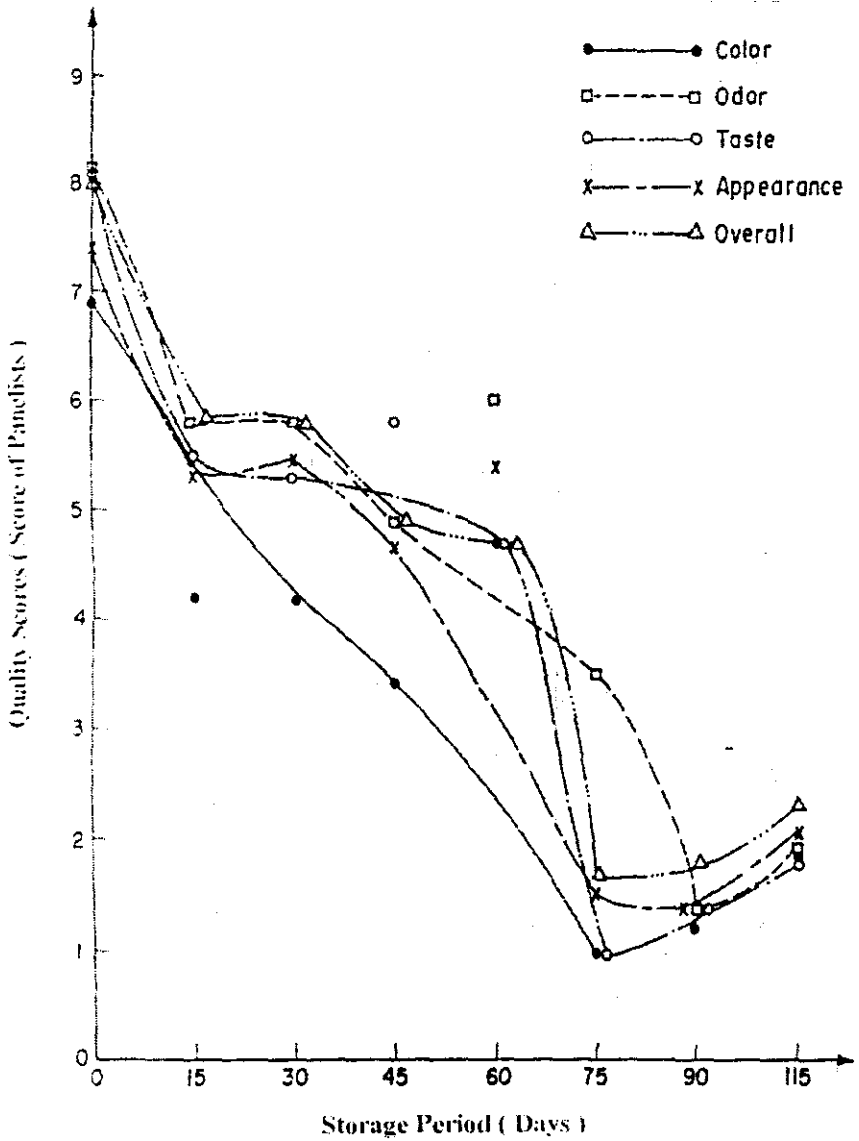


Fig. (4): Effect of Storage on Organoleptic Attributes of Canned Pomegranate Juice (Banati)

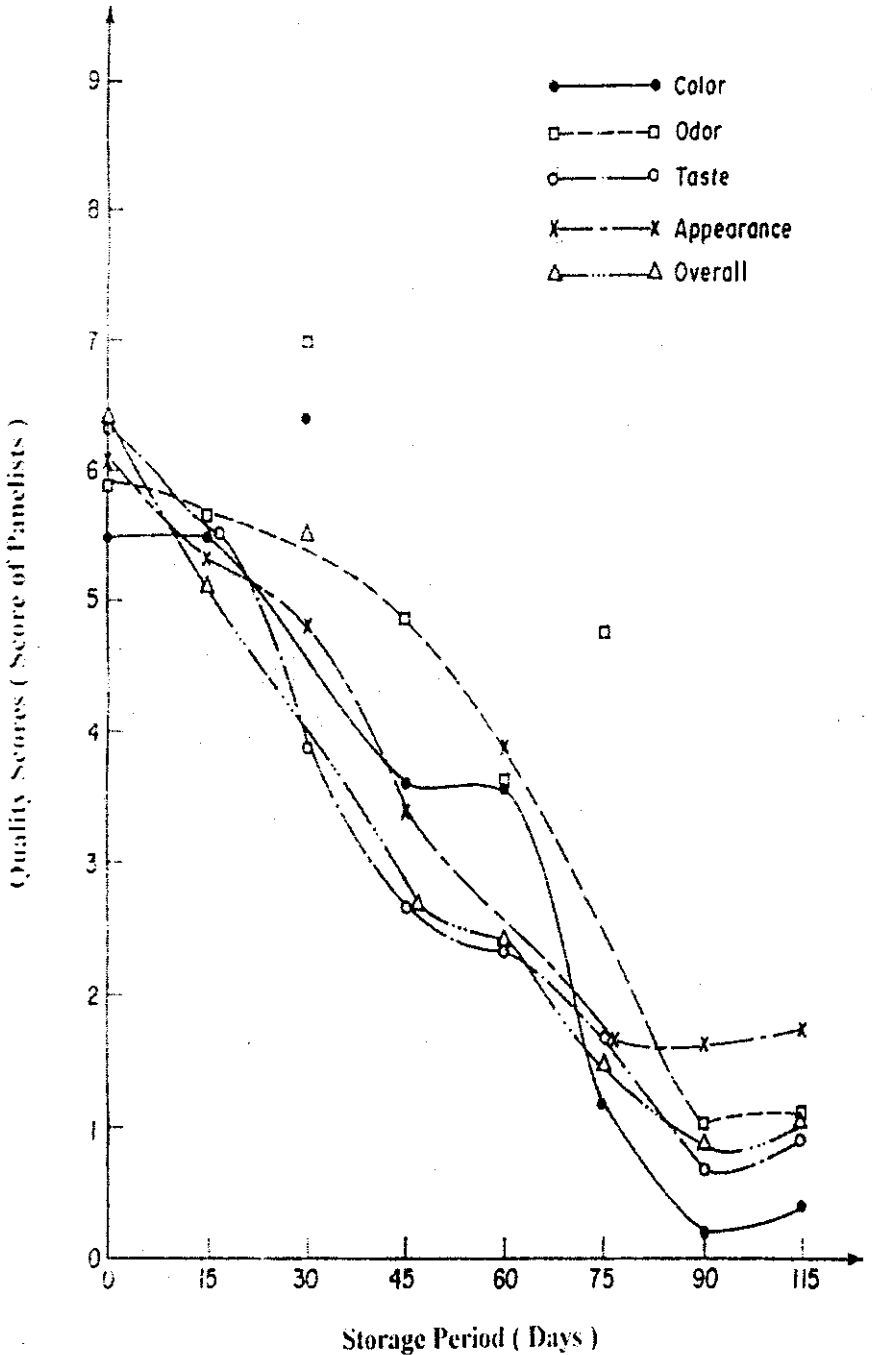


Fig. (5): Effect of Storage on Organoleptic Attributes of Frozen Pomegranate Juice (Manfaloti)

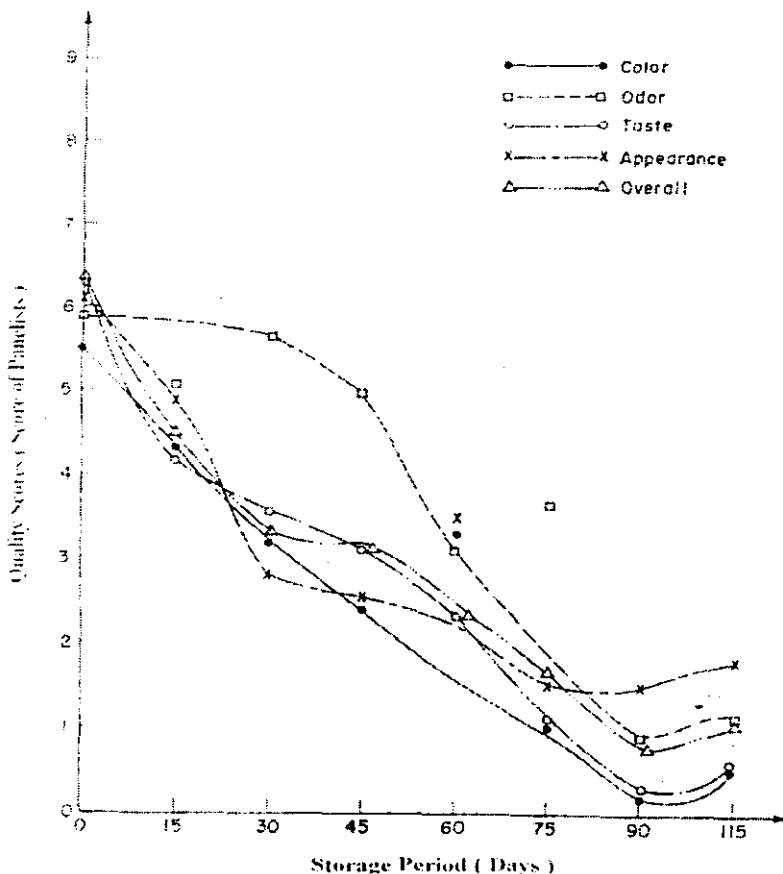


Fig. (6): Effect of Storage on Organoleptic Attributes of Canned Pomegranate Juice (Manfaloti)

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تأثير التخزين على الخواص الفيزيائية والعضوية الحسية لعصير الرمان المجمد والمعلب

ليلى عبد الهادي شكيب ، ناهد محمد الشيمي ، شادي حسين ، السيد محمد أبو طور
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تعتبر حبوب الرمان المحتوية للعصير هي الجزء المأكول من الثمرة . وقد أجريت هذه الدراسة على ثمار الرمان المصرية الناضجة من الأنواع (الوردي - البناتي - المنطوطي). وقد تم استخلاص العصير من الحبوب ثم الترشيح ورفع نسبة المواد الصلبة الكلية إلى 22% باستخدام سكر وز 80% ، والحفظ بإحدى الطريقتين : التعبئة في أكياس بولي إيثيلين والتخزين على درجة - 18م لفترات تخزين تصل إلى 4 أشهر . أيضا التعبئة في عبوات معدنية سعة 400 مل والتعقيم على 90م لمدة 15 دقيقة ثم التبريد المفاجئ والتخزين على درجة حرارة الغرفة لمدة تصل إلى 4 أشهر . وبدراسة تأثير التخزين على الخصائص الفيزيائية وكذلك الخواص العضوية الحسية لعصير الرمان والمصنع بطريقتي التجفيد والتعليب ، قد دلت النتائج على انخفاض قيم رقم الحموضة للعصير أثناء التخزين وكان الانخفاض في قيم الحموضة أكبر في حالة العصير المعلب أكبر من تلك الخاصة بالعصير المجمد وذلك أثناء فترة التخزين لأصناف الدراسة الثلاثة .

أيضا بدراسة تأثير التخزين على قيم اللون (أصفر - أحمر - أزرق) مقياسة بجهاز اللوفيبوند ، وجد أن قيم كل من الأصفر والأزرق قد زادت بدرجة معنوية بزيادة فترة التخزين وكان معدل الزيادة في قيم اللونين الأصفر والأزرق للعصير المعلب والمفrozen على درجة حرارة الغرفة أعلى من معدل الزيادة بالنسبة لنفس القيم في العصير المجمد والمفrozen على -18م بينما أدت فترة التخزين إلى انخفاض قيم اللون الأحمر لكلا من العصور المجمد والمعلب .

وبتقدير الخواص العضوية الحسية للعصير لوحظ أن زيادة فترة التخزين قد أدت إلى انخفاض ملحوظ لسي قيم اللون والرائحة والطعم والمظهر العام . وقد أظهر العصور المعلب انخفاض واضح في قيم الخواص العضوية الحسية مع زيادة فترة التخزين مقارنة بالعصير المجمد . وقد لوحظ عامة أن عينات عصير صنف الوردي المجمد والمعلب كانت أكثر العينات تحميلا من قبل المحكمين مقارنة بالعمليات الأخرى .