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A NEW PASTEURIZED NECTARS PREPARED FROM HUSK TOMATO AND CARROT JUICES

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ABSTRACT

The present study proposed to produce a new pasteurized blended nectars from husk tomato (*Physalis peruviana* L.) and carrot (*Daucus carota*) juice in order to determine whether it could prefer to the consumer.

Results showed that husk tomato juice contained high acidity,1.43% (pH, 3.79), high content of ascorbic acid (31.0 mg/100 ml) and total sugars (6.41%). Meanwhile, carrot juice contained high carotenoids content (6600µg/100ml). so, attention was paid to make use of the valuable constituents and quality attributes of each variety by prepared blended nectars.

Treatments comprised three pasteurized blended nectars representing (1:1), (1:2), and (2:1) (*w:w*) from husk tomato and carrot juices respectively. It could be observed that, the addition of carrot juice to husk tomato juice improved taste and over all acceptability meanwhile the addition of husk tomato juice increased ascorbic acid, total acidity and total sugars compared to carrot juice alone.

The storage at ambient temperature (25-30^{o}C) of pasteurized nectars for 3 months, decreases the total sugars, ascorbic acid as well as carotenoids. No microorganisms were detected in all samples during storage period. Highest organoleptic scores were recorded for nectars prepared from husk tomato and carrot juices in ratio (1:2) followed by nectars prepared in ratio (1:1) and (2:1) respectively.

Keywords: Physalis peruviana, carrot, natural juices, nectar, pasteurized.

INTRODUCTION

Husk tomato (*Physalis peruviana* L.) fruit belong to solanaceae family. It native to tropical and subtropical American region. Husk tomato fruit are nutritious, containing particularly high levels of niacin, carotenoids and minerals (Elsheikha*,* 2004). Husk tomato having yellow flowers with purple centers and an inflated calyx enclosed an edible yellow or orange berry used to make jam, sauces and desserts.

Fruit of the herbaceous perennial Chinese lantern *Physalis peruviana, P.pubesecens,* and *P.edulis*, resembling small cherry, surrounded by dry, bladder like calyx. Also known as golden berry, peruviana cherry and ground tomato. Dwarf cape gooseberry *(*Morton*,* 1954).

Husk tomato shows its constituents,possibly polyphenols carotenoides, which demonstrate anti-inflammatory and antioxidant properties. In foulk medicine, husk tomato has been used as a medicinal herb for cancer, malaria, asthma, hebatites, dermatitis and rheumatism (Wu*,* Sj.*,et al;* 2006*;* Franco *et al.,*2007 and Pardo*, et al.,*2008*).*

Husk tomato is one of the most promising exotic fruits, which can be used for developing interesting functional products. The pulb was yellowish or orange color with a yield 64%. The pulb and fresh juice had a light sweet and acidic taste (pH 3.7). The titratable acidity was 1.23%, polyphenols, 82 mg/ 100g and vitamin C, 32.7 mg per 100g fruit. Husk tomato fruit and its juice were rich in carotenoids (69,6 µg /g and 70 µg /ml, respectively). Juice had

high levels (in mg/ml) of minerals such as phosphorous (578), potassium(1196), zink (2.4) and boron (1). Essential amino acids as Leucin, Lysine, Isoleucine, valine and tryptophan were either higher than those recommended by FAO/WHO/UNU (1985).

Carrot (*Daucus carota* L.) is a popular vegetable and is increasing in importance, owing to the fact that its value in the diet is better understood than it was known. It is rich in β-carotene, a precursor of vitamin A, and appreciable quantities of thiamine and riboflavin (Thamposan and Kelly, 1988).

Carrots had the highest content of carotene compared to several raw fruits and vegetables (Simon,1990). In general, carrot contains 6.9 to 15.8 mg carotenoids per 100 g (Heinonen, 1990). It has been reported that β carotene constitutes a large portion (60–80%) of carotenoids in carrots, followed by α-carotene (10–40%), lutein (1–5%), and the other minor carotenoids (0.1–1%) (Baloch, *et al.,* 1977; Bushway and Wilson, 1982; Heinonen, 1990; Munsch and Simard, 1983; Seifert and Buttery, 1978.

The carrot is an important root vegetable and is often used for juice production (Yoon, *et al.,* 2005). Carrot juice had a high nutritional value as it is an important source of carotene, and carrot juice is preferably used as a natural source of pro-vitamin A in the carotenoids drinks (Demir, *et al.,* 2004; Yoon *et al.,* 2005). In many countries, a steady increase of carrot juice consumption has been reported (*Schieber, et al., 2001).* The consumption of carrot juice concentrate (CJC) is increasing very fast in China, which reached 0.38, 0.43 and 0.53 million tons with 40Brix in the year of 2001, 2002 and 2003, respectively (Wang and Chen, 2003; Wang, *et al.,* 2004). It was known that many juices darken during thermal processing and storage (Wang *et al.,* 2006).

According to Simon (1990) vitamin A was the most common dietary deficiency in the world. Vitamin A is derived from carotene, which are abundantly available in vegetables and fruits. So food-based strategies have been regarded as important measures for combating vitamin A deficiency (VAD) in many countries, especially in an agriculture-based country (Udomkesmalee,1992). Among the carotenoids, β-carotene theoretically possesses 100% vitamin A activity while α-carotene possesses between 53% (Bushway and Wilson, *1982)* and 50% (Heinonen, 1990). β-carotene provides 80% of vitamin A ,value measured as retinol equivalents (Chen, *et al.,*1995; Chou *and* Breene, *1972*). Besides, being a remedy for VAD, the carotenoid pigments also serve as effective antioxidants that quench free radicals provide protection against oxidative damages to cells, multitude of degenerative diseases and also stimulate immune function (Ames, 1983; Anon, 2005a; Craig, 1999; Hudson, *1990*).

Carrot juices are preferably used as a natural source of pro-vitamin A in the production of alpha-tocopherol beta-carotene drinks (ATBC-drinks) leading to superior physical and chemical stability (Carle, 1999; Marx, *et al.,* 2000). Carrot juice is one of the most popular vegetable juices (Marx, *et al.,* 2003), and it is preferably used as a natural source of pro-vitamin A in the carotenoid drinks (Yoon, *et al.,* 2005). In many countries, a steady increase of carrot juice consumption has been reported. From 1995 to 1999, German

carrot juice production increased by 69% (Schieber*, et al.,* 2001*).* The consumption of carrot juice is increasing very fast in China (Wang *et al.*, 2006). Since carrot juice is a low-acid food of approximately pH 6.0, it has a higher risk of bacterial contamination than other acidic foods *(*Park*, et al.,* 2002). Hence, it requires severe heat treatment (105 to 121°C) for protection from spoilage (Kim and Gerber*,* 1988*;* Chen*, et al.,*1995*).*

The quality and shelf life of fruit juice depend upon a range of internal parameters related to the product and several external factors, packaging being one of them, *(*Mannheim *et al.,*1987).

Additionally, no attention has been paid to the utilization of husk tomato fruit in food industries, and there is little available data in the literature regarding its nutritional properties and industrial utilization. So this work aims to produce new pasteurized nectars prepared from husk tomato and carrot juice with high quality and rich in carotenoids specially β-carotene and providing useful information for storage properties and industrial application of husk tomato. Also the effect of pasteurization and storage at ambient temperature (25-30^{o}C) for 3 months on the chemical composition, microbial evaluation and organoleptic characteristics of blended juice were investigated.

MATERIALS AND METHODS

Materials:

Ripe husk tomato (*Physalis peruviana* L.), fruits were obtained from local market from Ismailia governorate, Egypt during April 2009. Samples were carefully selected according to the degree of ripeness which observed by berries colour (brilliant orange). The berries were peel back the husk and rins it, then sorting, washed, crushed and blended to obtain juice.

Carrot (*Daucus carota*) was obtained from local market from Ismailia. Carrot were washed, trimmed and chopped lightly.

The juice was obtained from the chopped carrot heated in water at 90° C. The carrot was mixed with water in the ratio 1:1 *(w/w)* to facilitate the extraction of the juice.

The juice of husk tomato fruits and carrot was used to prepare five different blended nectars as the following:

1-husk tomato juice alone
2-Carrot juice alone
3-husk tomato and carrot blend (1:1) (*w/w)*
4-husk tomato and carrot blend (1:2) (*w/w)*
5- husk tomato and carrot blend (2:1) (*w/w)*

Each of the blended treatment was adjusted to 18% total soluble solids using sucrose solution (50%). All prepared nectars were filled in white glass bottles, closed tightly, pasteurized at 85°C for 15 minutes. Then cooled suddenly in cold water bath. Processed nectars were stored at ambient temperature (25-30^{o}C) for 3 months.

Methods:

Moisture content, total soluble solids, free amino nitrogen, total acidity and pH value were determined according to methods described in the A.O.A.C (2000).

Colour index was determined colormetrically at 420 nm according to the methods described by Ranganna *(*1979). Ascorbic acid was determined by 2.6 di chlorophenolindophenol as described by A.O.A.C. (2000). Total carotenoids were determined spectrophotometrically (in diethyl ether) at wavelength 440 nm as mentioned in the methods of Beadle and *Zscheile (*1942). Total and reducing sugars content were determined colormetrically according to the methods of Bernfeld*, (*1955*)* and Miller*, (*1959)..

Total plate count, moulds & yeast, coliform group and spore former bacteria were determined according to Oxoid *(*1992).

Sensory evaluations were carried out by 10 trained panelists to evaluate the quality of the final product according to the method of Larmond*, (*1970).Ten panelists were asked for their decision concerning the organoleptic attributes using a scale from 1 to 10. The score 6 was considered as the limit of acceptability.

Statistical analysis for data obtained were subjected to analysis of variance according to SPSS*, (*1997). Significant differences among individual means were analyzed by Duncan's multiple range test *(*Duncan*,*1955).

RESULTS AND DISCUSSION

The chemical composition of fresh juices and prepared nectars from husk tomato and carrot juice were evaluated and presented in Table (1). Results revealed that, husk tomato juice contained 1.43% total acidity (as citric acid), 31.0 mg/ 100ml ascorbic acid and Total sugars 6.41%. These values were higher compared to that in carrot juice. Meanwhile, carotenoids content of carrot juice was 6600 µg/ 100ml compared with 3843 µg/ 100ml for husk tomato juice. Furthermore, the color index and free amino nitrogen content in the prepared husk tomato nectar was 0.22 and 2.78 mg/ 100ml respectively.

Table (1): Chemical composition of fresh juices and nectar prepared from husk tomato and carrot juice

Treatment	Husk tomato		Carrot		**1:1		**1:2		**2:1	
Chemical composition	**Juice**	**nectar**	***Juice**	**Nectar**	**Juice**	**nectar**	**Juice**	**nectar**	**Juice**	**nectar**
Total soluble solids (T.S.S.) %	12.2	18.0	4.3	18.0	8.1	18.0	6.9	18.0	9.2	18.0
Total acidity (as citric acid) %	1.43	1.22	0.032	0.030	053	0.50	0.335	0.31	0.79	0.74
pH value	3.79	3.81	5096	6.01	4.06	4.12	4.08	4.65	3.96	4.99
Ascorbic acid (mg/100ml)	31.0	29.8	3.5	2.75	19.00	13.30	16.50	15.12	20.8	19.20
Free amino nitrogen mg/100ml)	2.8	2.78	1.21	1.19	2.52	2.49	2.24	2.20	2.80	2.77
Total sugars %	6.41	12.35	2.01	12.21	4.54	12.30	3.38	12.19	4.86	12.38
Reducing sugars %	3.61	10.32	1.1	10.03	2.55	10.22	1.82	10.18	2.82	10.28
Non reducing sugars %	2.80	2.03	.91	2.18	1.99	2.08	1.56	2.01	2.04	2.10
Carotenoids (µg/100ml)	3843	3340	6600	6120	5072	4200	5840	5080	4550	4150
Color index (O.D. at 420 nm)	0.216	0.220	0.270	0.270	0.250	0.252	0.230	0.235	0.255	0.258

*** diluted carrot / juice with water at ratio (1/1)**

**** husk tomato / carrot blend ratio (w/w)**

These results are in agreement with those found by *(*El- Sheikha *et al.,*2008; Sanad, 1991 and Mattuk *et al.,*1996*).*

Results in Table (2) showed that the effect of processing and storage at ambient temperature (25- 30^{O}C) for 3 months on some chemical composition of the pasteurized nectars prepared from husk tomato and carrot juices. It could be included that, there was decreased of pH values during storage period. The pH values decreased conversely to total titratable acidity. Ascorbic acid content sharply decreased, it may be due to the effect of heat treatment of pasteurization, and oxidation these results are in agreement with those found by Gerschenson and Rojas (1997). The free amino nitrogen content also decreased slightly.

Table (2): Effect of storage at ambient temperature (25- 30^{O}C) for 3 months on the total acidity, pH, ascorbic acid and free amino nitrogen of husk tomato and carrot pasteurized nectar

Treatment / Period/ month	Husk tomato	*Carrot	**1:1	**1:2	**2:1
Total acidity					
0	1.20	0.03	0.50	0.30	0.74
1	1.28	0.10	0.64	0.44	0.92
2	1.42	0.28	0.82	0.61	1.50
3	1.68	0.46	1.10	0.90	1.64
pH value					
0	3.81	6.01	4.11	4.66	4.99
1	3.80	5.94	4.06	4.64	4.92
2	3.75	5.89	4.01	4.60	4.89
3	3.70	5.82	3.96	4.58	4.82
Ascorbic acid					
0	18.60	1.75	10.5	8.5	11.10
1	17.35	1.31	9.70	8.1	10.75
2	16.45	1.11	8.95	7.44	10.30
3	15.52	0.92	8.31	6.30	9.80
Free amino nitrogen					
0	5.60	2.80	3.90	3.20	4.10
1	5.58	2.52	3.08	2.80	3.80
2	5.20	2.24	2.80	2.40	3.20
3	4.80	2.00	2.40	2.20	2.80

*** diluted carrot / juice with water at ratio (1/1)**
**** husk tomato / carrot blend ratio (w/w)**

Data given in Table 3 show the effect of processing and storage at ambient temperature for 3 months on total sugars, reducing sugars, carotenoids and color index of husk tomato and carrot pasteurized nectars. Total and reducing sugars were decreased. These decreased in sugars and free amino nitrogen may be due to the Millard reaction, this also in agreement with those reported by Tressler and Joslyn (1961).

Carotenoids constitute is the major coloring substances in juices. The results were decreased in carotenoids after processing of husk tomato and carrot nectars, the percentage of carotenoids decreases were 18.81% and 7.45% respectively. This decrement reached to 25.05% and 10.0% of the

initial amount of carotenoids after 3 months of storage. It could be explained by oxidation reactions that developed during storage and also by Millard reactions this results in agreement with those reported by Nicoli *et al* ., (1999)Singleton *et al*.,(1961)reported that the total carotenoids content is un changed and these changes which occur during processing could be attributed to the isomerization, they added also that the decrease could be occurred due to the leaching of pigments in the planching soultion

Table (3): Effect of storage at ambient temperature (25- 30^{O}C) for 3 months on the total sugars, reducing sugars, carotenoids and color index of husk tomato and carrot pasteurized nectar

Treatment / Period/ month	Husk tomato	*Carrot	**1:1	**1:2	**2:1
Total sugars					
0	12.35	12.21	12.30	12.19	12.38
1	12.07	12.12	12.08	12.00	12.10
2	11.45	11.87	11.67	11.52	11.74
3	11.00	11.68	11.34	11.34	11.22
Reducing sugars					
0	10.32	10.03	10.22	10.18	10.28
1	10.02	9.94	10.00	9.92	10.00
2	9.88	9.55	9.78	9.66	9.65
3	9.64	9.34	9.50	9.42	9.35
Carotenoids					
0	3120	6108	4180	5055	4122
1	3030	6099	4090	5049	4050
2	2960	6011	4020	4979	3970
3	2880	5941	3950	3899	3890
Color index					
0	0.225	0.271	0.255	0.236	0.258
1	0.290	0.345	0.281	0.266	0.280
2	0.330	0.470	0.310	0.290	0.330
3	0.545	0.611	0.480	0.341	0.477

*** diluted carrot / juice with water at ratio**
**** husk tomato / carrot blend ratio (w/w)**

The color index of all samples of the pasteurized nectars was slightly increased during storage period. This increasing may be attributed to browning reactions. These findings are in accordance with those found by (Speers *et al.,*1987; Aguilera *et al.,*1987*;* Avil and Silva*,* 1990*).* El- Sheikha *(*2004). Reported that the increasing of the juice optical density is usually an index for undesirable changes in its quality and safety. The darkening may be due to non- enzymatic browning reactions, as cited by Buglione and Lozano (2002).

Microbial counts (total bacterial count, moulds & yeasts and spore former bacterial count) and coliform group of pasteurized blended nectars were studied and the obtained results were given in Table (4). The total bacterial counts were 47 × 10^{-1}, 8× 10^{-1}, 25× 10^{-1}, 19× 10^{-1} and 38× 10^{-1} CFU/ g in husk tomato, carrot, 1:1, 1:2 and 2:1 nectars respectively. While these values were 158× 10^{-1}, 3× 10^{-1}, 65× 10^{-1}, 59× 10^{-1} and 93× 10^{-1} for

moulds & yeasts. All samples were free from spore former bacterial count and coliform group. These results revealed the effect of following sanitation during processing and may also due to the anti-microbial effect of husk tomato juice against some serious pathogenic microbes. The anti-microbial activity of methanolic extracts of juice was significant against *E. coli* O157:H7 and *Bacillus subtilus*, complete against *Fusarium solani* and had no effect against *Candida albicans (*El-Sheikha *et al.,* 2008*).*

Table (4): Effect of storage at ambient temperature (25- 30^{O}C) for 3 months on total bacterial count, moulds & yeasts and spore former bacterial count of pasteurized nectar

Treatment / Period/ month	Husk tomato	*Carrot	**1:1	**1:2	**2:1
Total bacterial count					
0***	47×10^{-1}	8×10^{-1}	25×10^{-1}	19×10^{-1}	38×10^{-1}
1	Not detected	Not detected	Not detected	Not detected	Not detected
2	Not detected	Not detected	Not detected	Not detected	Not detected
3	Not detected	Not detected	Not detected	Not detected	Not detected
Moulds & Yeasts					
0***	158×10^{-1}	3×10^{-1}	65×10^{-1}	59×10^{-1}	93×10^{-1}
1	Not detected	Not detected	Not detected	Not detected	Not detected
2	Not detected	Not detected	Not detected	Not detected	Not detected
3	Not detected	Not detected	Not detected	Not detected	Not detected
Spore former bacterial count					
0***	Not detected	Not detected	Not detected	Not detected	Not detected
1	Not detected	Not detected	Not detected	Not detected	Not detected
2	Not detected	Not detected	Not detected	Not detected	Not detected
3	Not detected	Not detected	Not detected	Not detected	Not detected
Coli form group					
0***	Not detected	Not detected	Not detected	Not detected	Not detected
1	Not detected	Not detected	Not detected	Not detected	Not detected
2	Not detected	Not detected	Not detected	Not detected	Not detected
3	Not detected	Not detected	Not detected	Not detected	Not detected

*** diluted carrot / juice with water at ratio (1/1)**
**** husk tomato / carrot blend ratio (w/w)**
***** freshly prepared nectars before pasteurising**

Data in Table (5) show the organoleptic evaluation of pasteurized nectar prepared from husk tomato and carrot juice. Results revealed that, there are no significant differences in taste between the samples (husk tomato, 1:1 and 2:1) respectively and the best treatment was, (1:2). Data also show that the treatment, (1:2) had a higher score for odor characteristic and there are no significant differences between the samples, (husk tomato, carrot, 1:1 and 2:1). The significantly, (≤ 0.05) lowest score of color was given for samples,(husk tomato and 2:1) respectively and the best color quality was samples, 1:2, which also showed the higher overall acceptability significantly.

Finally, it could be concluded that, it is possible to produce pasteurized nectar from husk tomato and carrot juice at the ratio (1:2) (w/w). These blended have high nutritional value and preferred by consumer

In a row, means followed by the same superscript letters are not significantly different at 5% level

Table (5): Organolepticevaluation of pasteurized nectar prepared from husk tomato and carrot juice

Attribute	Treatment				
	Husk tomato	carrot	1:1	1:2	2:1
Taste	7.0 ^{bc}	5.0 ^{a}	7.0 ^{bc}	7.4 ^{c}	6.5 ^{b}
Odor	6.0 ^{b}	5.6 ^{b}	6.3 ^{b}	7.9 ^{a}	6.0 ^{b}
Color	7.0 ^{a}	8.0 ^{b}	7.7 ^{b}	9.0 ^{c}	7.0 ^{a}
Overall acceptability	7.0 ^{b}	6.2 ^{a}	7.1 ^{b}	8.9 ^{c}	5.9 ^{a}

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المشروب المبسترالمحضر من عصائر الحرنكش والجزر

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يهدف هذا البحث الى انتاج مشروبات جديدة مبسترة محضرة من مخاليط عصائر الحرنكش والجزر لتحديد افضلها لدى المستهلك وقد اوضحت نتائج هذا البحث ارتفاع محتوى عصير الحرنكش من كل من الحموضة الكلية والسكريات الكلية مقارنة بلب الجزر بينما يحتوى عصير الجزر على نسبة عالية من الكاروتينات مما دفعنا للاستفادة من مكونات وعناصر الجودة لكل منهما وانتاج مخاليط منهما بالنسب التالية: (١:١) و (٢ :١) و(١ : ٢) (و/ و) من عصير الحرنكش والجزر على التوالى وكذلك مشروبات مبسترة من كل منهما على حدة وقد اظهرت نتائج هذا البحث ان اضافة عصير الجزر لعصير الحرنكش ادى لتحسين كل من الطعم والقابلية العامة وكذلك وجد ان اضافة عصير الحرنكش ادى لزيادة محتوى فيتامين ج والحموضة الكلية وكذلك السكريات الكلية مقارنة بعصبر الجزر بمفرده. وقد ادى التخزين على درجة حرارة الغرفة **(٢٥ - ٣٠ °م)** لمدة ٣ شهور لانخفاض المحتوى من السكريات الكلية وفيتامين ج وكذلك الكاروتينات لكل العينات. كما اعطيت اعلى درجات للتقييم الحسى للمشروب المحضر من خلط عصير الحرنكش والجزر بنسبة ٢:١ واتبعه كل من ١:١ ثم ١:٢ (و/ و) على التوالى .

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