Journal of Home Economics
Volume 27, Number (2), 2017

http://homeEcon.menofia.edu.eg

Journal of Home Economics

ISSN 1110-2578

Usage of husk tomatoes (*Physalisperuvianalinn)* in food processing

Sara M.S. Awad
Food Science and Technolog , Agricultural Industrialization Unit, Desert Research Center, Cairo, Egypt.
E-mail: Sara.diet@yahoo.com

Abstract

The objective of this study was to evaluate jam and jelly made from husk tomatoes which addition with different juices(orange and carrot juice), all the treatment were examined for physicochemical, sensory and microbiological characteristics. Also, check the effect of storage period on the quality of husk tomato jam. The results showed that protein, fiber, ash, moisture, pH, non-reducing sugar, vitamin C and total carotenoids were decreased by increasing of storage period, while, total soluble, total acidity, reducing sugar were increased. As the storage period increased. While, microbial growth was slightly increased at storage conditions. The microbial growth in jam was under the limit up to the end of storage period. Hence, the prepared jam was safe and suitable for consumption up to 6 month. The organoleptic evaluations showed that the good qualities among all the treatments gave the best acceptability. In conclusion,the husk tomatoes jam and jelly showed a good sensory acceptability. It could be recommended that the husk tomatoes can play an important role as antioxidant and antibacterial agents in jam and their formulae.

Keywords: husk tomatoes ،jelly،jam ، orange juice ، carrots juice ، processing،Nutritional value، Vitamin C، Sensory properties.

Introduction

Husk tomatoes (*physalis. peruviana Linn., Solanaceae*) has been grown in Asian nation, Egypt, South Africa, New Zealand, Australia and Great Britain (**Mc Cain, 1993and Ramadan and Mörsel, 2003)**. Berries are shown to producevital health advantages due to their high antioxidants, vitamins, minerals and fiber **(Zhao, 2007).**

The fruits ofhusk tomatoes (*Physalisperuviana*L. family, *Solanaceae*) are also named as goldenberry, gooseberry, cape golden berry, and wintercherry fruits every where the world (**Hassanien ,2011 and Mericli,2011).** The fruit is called a 'functional food' because its bioactive compound content. Husk tomatoesis primarily valued for its fruit, which is eaten cooked or fresh fruit; processed for juice, jam, jelly and different products; sweetened with sugar as a snack; or additional to dishes, salads, desserts and cakes (**Ramadan, 2011)**. The fruit is very high in pectinand is well suited for pies and jellies (**Morton, 1987)**.Also, can be dried and it can be consumed as a very nice raisin (**Puente *et al*.,2011)**.

Consumption of husk tomatoes in fresh form is restricted due to limitedpost-harvest life because it has high enzyme activity, that promotes its speedy darkening, especially after mechanical damage throughout transport and storage(**Bravo and Dsorio, 2016)**. Thus, Husk tomatoes processing, within the form of products like jellies, would be an excellent way to increase the use of fruit. Jelly could be a noble product, extremely accepted by consumers that justify the processing of husk tomatoes, which is an exotic fine fruit, nutritionally rich with high added-value.The husk tomatoes jelly falls under the gourmet jellies category, that harmonize absolutely with fine cuisine and can be used in the preparation of refined cold, hot (meat, grilled meats) and dessert (fruit salad and ice cream) dishes. The husk tomatoes jelly is even extremely flavoured, harmonizing with fine cheeses.

Currently, is cultivated in various tropical, semitropical high hills and even temperate countries, being South American country the main producer. The fruit contains β-carotene (provitamin A), phosphorus, iron, potassium, zinc, calcium, fatty acids (linoleic, oleic, palmitic and stearic acids), vitamin C and polyphenols, the latter confer antioxidant activity (**Ocampo *et al*., 2017)**.The juice of the ripe fruit of husk tomatoes is high in pectinase, reducing priceswithin the preparation of jams and different similar preparations **(CCI, 2001)**.

The husk tomatoes has received increased interest worldwide because of its nutritional composition and therefore the presence of bioactive compounds that provide health benefits and reduce the risks of certain diseases such as cancer, malaria, asthma, hepatitis, eczema and rheumatism (**Salazar *et al.*, 2008)**. It has high dietary fibre content, and its fruit pectin acts as an intestinal regulator.

Today's consumers are very interested in the potential benefits of nutritional support for disease control or prevention through a healthy diet **(Hassanien, 2011)**. There is a growing recognition of the potential role of functional foods to help reduce health risks and improve health,especially, fruits contain several bioactive compounds associated with a strong antioxidant activity. This plays an important role in human nutrition because of free radical scavenging activities, donation of hydrogen atoms or electron, or chelate metal cations **(Balasundram *et al.*, 2006)**.

The aim of this study was to evaluate jam and jelly made from husk tomatoes which addition with different juices (orange and carrot juices), on the physicochemical characteristics, sensory acceptance and microbiological. In addition, we evaluated the influence of the information on the acceptability of the product. Check the effect of storage period on the quality of husk tomato jam.

Materials and methods

The Husk tomatoes were obtained from Valley al Natron, Alexandria way Desert, Desert Research Center-Egypt, fresh baladyorange juice, fresh carrot juice, lemon, sugar and gelatinwere purchased from the local market, Cairo. Egypt.

Preparation of husk tomatoesjam

The husk tomatoes jam was prepared according to **Sindumathi and Amutha,(2014)** where cleaned, blended and taken in an open stainless steel pan and amount of sugar was added and heated continuously under low flame. When the total soluble solids reached 60°brix, the mixture was mixed thoroughly and stirred continuously. Heating was stopped when the total soluble solids reached 67- 68°brix and the mixture was hot filled into sterilized glass jars and cooled under ambient temperature. The prepared jam was stored at room temperature until analyzed.

Husk tomatoes jam formulation where as follows

(HT):1Kg blended husk tomatoes+800 g sugar+ 10 ml of lemon juice (control treatment).

(HTO):1Kg blended husk tomatoes+800 g sugar+ 10 ml of lemon juice+200 ml orange juice.

(HTC):1Kg blended husk tomatoes+800 g sugar+ 10 ml of lemon juice+200 ml carrot juice.

Preparation of husk tomatoesjelly

Three husk tomatoes jelly formulae were prepared as follows as: One litreof the Husk tomatoes juice was blended , filtered using a muslin cloth then heated , 375 g sugar were added and 22.5 g gelatin to the extractthen heating, continued with constant stirring till the total solid substances reached 65^0 Brix and desired consistency reached.

Basic Schematic procedure

(HT): 1000 ml husk tomatoes juice + 375 g sugar + 22.5 g gelatin (control treatment).

(HTO): 500 ml husk tomatoes juice + 375 g sugar + 22.5 g gelatin + 500 ml fresh orange juice.

(HTC): 500 ml husk tomatoes juice + 375 g sugar + 22.5 g gelatin + 500 ml fresh carrot juice.

Storage of the Jams

Jams were stored at room temperature until the analyses. They were analyzed immediately after prepared and after 6 months of storage.

Chemical analysis

Chemical composition of moisture content, crude protein, ether extract, ash and crude fiber content of both jam and jelly formulae was determined according to the methods described by **A.O.A.C,(2000).** Carbohydrate was calculated by differences as the following equation: Carbohydrate (%) = [(100 –(moisture + protein + fat + ash + fiber)] .Results as expressed asg/100g on dry weight basis. ThepH valueof both jam and jelly samples was measured by using digital PH meter (HANNA instrument, UK).Total acidity was determined according to **A.O.A.C,(2005).**Reducing sugars content was determined according to **Holme and Peck,(1983)**. Vitamin C was estimated according to **Brubacher *et al*., (1985)**. Consistency was measured using viscometer, V60002 (Spindle R7) 100 rpm, Spain, torque was maintained at 100%.Total carotenoids were determined according to **Lichtenthaler and Wellburn,(1985)**.

Color was measured by Chroma meter (Konica Minolta, model CR 410, Japan) calibrated with a white plate and light trap supplied by the manufacturer at CairoUniversity Research Park (CURP), Faculty of Agriculture, Cairo university. Color was expressed using the CIE L, a, and b color system **(CIE, 1976)**. A total of three spectral readings were taken for each sample. Lightness (L*) (dark to light), the redness (a*) values (reddish to greenish). The Yellowness (b*) value (yellowish to bluish) was estimated.

Sensory evaluation

Sensory evaluation (color, taste, odor, texture, overall acceptability and viscosity) of both jam and jelly were evaluated by 10 panelists Stuff Members from Desert Research Center – Egypt, according to **A.A.C.C.(2000)**.

Statistical analysis

All analyses were performed in triplicate and data reported as mean ± standard deviation (SD). Data were subjected to analysis of variance (ANOVA). All tests were conducted at the 5% significant level. **"SPSS"** Statistics,(**1998)**, version 20.

Results and Discussion:

Chemical composition of fresh husk tomatoes fruits

Chemical composition of husk tomatoes fruit showed in Table (1) that moisture content was 77.75±0.14% , crude Protein 1.05±0.07%, fat 0.23±0.06%, crude fiber 4.02±0.11% , ash content 1.09±0.07%, and total carbohydrates 16.95±0.09%, on fresh weight basis. Such results are in agreement with those obtained by**Galeb*et al*.,(2002) and USDA-(2006)**.

Table(1): Chemical composition of fresh husk tomatoes fruit.

Parameters	Chemical composition
Moisture (%)	77.75±0.14
Protein(%)	1.05±0.07
Fat (%)	0.23±0.06
Fiber(%)	4.02±0.11
Ash(%)	1.09±0.07
Total .Carbohydrat(%)	16.95±0.09
PH	3.72±0.12
Total.Acidity(g/100g)	1.19±0.07
Total.Carotenoids (µg/g)	5.7±0.6
Vitamin.C(mg/100g)	45.432±0.01
DPPH (%)"RSA"	48.135±0.91

pH of fresh husk tomatoes 3.72 was higher than citrus juices, these results are in agreement with **USDA-(2006)**.Total acidity 1.19 was close to lemon juice, this result obtained with **(Joslyn,1970),** but lower than two varieties of mango fruit juices, as mentioned by **Zeid, (1996).** Ascorbic acid level in fresh husk tomatoes fruits45.432mg/100g was higher thanin most fruits such as apple6mg /100g, peach7mg/100g, pear4mg/100g, and lower comparable with orange50mg/100g and strawberry 60mg/100g, **(Belitz,1999)**.

The fresh husk tomatoes fruits content carotenoids(5.7µg/g FW),whichlower than cantaloupe juice 7.6µml$^{-1)}$obtained by **Moustufa, (2002)**, lemon has 0.3 µml^{-1} and orange has 3.2 µml^{-1} (24)·The antioxidant activity of cape gooseberry fruits was assessed by means of a 1,1-diphenyl-2- picrylhydrazyl (DPPH) test. Fresh fruits produce a 48% decrease vs. the absorbance of DPPH radicals' control solution.

Chemical composition of husk tomatoes jam

Data in Table (2)indicated that chemical composition of protein, fat and crude fiber of preparedjam samples during storage period at room temperature for 6 months. The results showed that crude proteinwas ranged from 4.22 to 4.73, fat was ranged from 0.01 to 0.28 and crude fiber was ranged from 8.22 to 12.57after processing. During frozen storage period protein for all the treatments which gradually decreased inHT from 4.73 to 4.02 , HTO from 5.03to 4.69 and HTC from 4.75 to 4.22 respectively. The mean value at initial day for protein was recorded as 4.80 , which then decreased to 4.51 during storage .The highest mean value of 4.82 was observed in case of HT0, while the lowest mean value of 4.49 was found in case of HT and HTC .The same trend of results are in agreement with those obtained by **Kamil *et al.*,(2011) and Amruthesh,(2012).**

Table (2): Chemical composition of prepared jam samples during storage period.

Parameters	Storage periods (month)	HT	HTO	HTC	Means
Crude Protein	0	4.73	4.69	4.22	4.55 [a]
	3	4.73	5.03	4.65	4.80 [a]
	6	4.02	4.75	4.75	4.51 [a]
	Means	4.49 [a]	4.82 [a]	4.54 [a]	
Lipds	0	0.01	0.01	0.28	0.10 [a]
	3	0.04	0.00	0.29	0.11 [ab]
	6	0.00	0.01	0.19	0.07 [b]
	Means	0.02 [b]	0.01 [b]	0.25 [a]	
Crude Fiber	0	12.57	10.14	8.22	10.31 [a]
	3	14.35	11.22	5.87	10.48 [a]
	6	12.04	9.74	7.09	9.62 [a]
	Means	12.99 [a]	10.37 [a]	7.06 [b]	

(HT) is control husk tomatoes jam, (HTO) is husk tomatoes jam treatment with 200 ml orange juice, (HTC) is husk tomatoes jam treatment with 200 ml carrot juice. Mean values in the same raw / column followed by different letters are significantly different ($p \leq 0.05$).

Fiber for all the treatments which gradually decreased during storage period HT from 12.57 to 12.04 , HTO from 10.14 to 9.74 and HTC from 8.22 to 7.09 respectively. The mean value at initial day for Fiber was recorded as 10.48, which then decreased to 9.62 during storage .The highest mean value of 12.99 was observed in case of HT, while the lowest mean value of 7.06 was found in case of HTC and HTO .

Total soluble solids, acidity and pH value of husk tomatoes jam

Data in Table (3) showed that Total soluble solids(TSS), pH value and acidity of prepared jam samples during storage period at room temperature for 6 months. The results showed that TSS was ranged from 67.4 to 67.5, pH value was ranged from 3.93 to 4.09 and acidity was ranged from 0.81 to 0.83 after processing. During storage periodTSS for all the treatments which increased gradually inHT from 67.5 to 70.8, HTO from 67.6 to 71.7 and HTC from 67.4 to 70.5 respectively. The mean value at initial day for TSS was recorded as 67.5, which then increased to 71.0 during storage .The highest mean value of 69.93 was observed in case of HTO , while the lowest mean value of 69.06 was found in case of HTC. The present findings are in accordance with obtained by **Hussain and Shakir,(2010) and Khan *et al*., (2012).**

Table(3): Total soluble solids, acidity and pH value of prepared jam samples during storage period.

Parameters	Storage periods (month)	HT	HTO	HTC	Means
Total soluble solids(tss)	0	67.5	67.6	67.4	67.5 [b]
	3	69.1	70.5	69.3	69.63 [a]
	6	70.8	71.7	70.5	71 [a]
	Means	69.13 [a]	69.93 [a]	69.06 [a]	
pH value	0	3.93	3.89	4.09	3.97 [a]
	3	3.72	3.68	3.84	3.75 [ab]
	6	3.51	3.59	3.81	3.64 [b]
	Means	3.72 [a]	3.72 [a]	3.91 [a]	
Acidity	0	0.81	0.83	0.85	0.83 [c]
	3	0.89	0.91	0.94	0.91 [b]
	6	0.99	0.99	1.01	0.99 [a]
	Means	0.89 [a]	0.91 [a]	0.93 [a]	

(HT) is control husk tomatoes jam, (HTO) is husk tomatoes jam treatment with 200 ml orange juice, (HTC) is husk tomatoes jam treatment with 200 ml carrot juice. Mean values in the same raw / column followed by different letters are significantly different ($p \leq 0.05$).

pH for all the treatments which gradually decreased during storage period HT from 3.93 to 3.51 , HTO from 3.89 to 3.59 and HTC from 4.09 to 3.81, respectively. The mean value at initial day for pH was recorded as 3.97 , which then decreased to 3.64 during storage .The highest mean value of 3.91 was observed in case of HTC, while the lowest mean value of 3.72 was found in case of HT and HTO . The same trend of results are in agreement with those mentioned by **Hussain and Shakir,(2010)and Khan *et al*.,(2012)**. The acidity for all the treatments which gradually increased during storage period HT from 0.81 to 0.99 , HTO from 0.83 to 0.99 and HTC from 0.85 to 1.01 respectively. The mean value at initial day for acidity was recorded as 0.83, which then increased to 0.99 during storage .The highest mean value of 0.93 was observed in case of HTC, while the lowest mean value of 0.89 was found in case of HT . The present finds are in accordance with obtained by **Shakir *et al*., (2007) and Khan *et al*., (2012).**The high acidity of fruit jam might be due to the hydrolysis of pectin and degradation of ascorbic acid. The increase in acidity of fruit jam also resulted due to sugar breakdown and increase in the TSS contents of the samples**(Riaz *et al*.,1999).**

Moisture and ash contents of husk tomatoes jam

Data in Table (4) illustrated that moisture and ash contents of prepared jam samples during storage period at room temperature for 6 months. The results showed that moisture was ranged from 32.41 to 33.46 and ash was ranged from 0.96 to 1.43 after processing. During storage period moisture for all the treatments which gradually decreased during storage period in HT from 32.41 to 30.77 , HTO from 33.45 to 29.94 and HTC from 33.46 to 31.39 respectively. The mean value at initial day for acidity was recorded as 33.11, which then decreased to 30.7 during storage .The highest mean value of 32.2 was observed in case of HTC, while the lowest mean value of 31.92 was found in case of HT, which is followed by HTO 31.58. The results were in agreement with **Ejiofor and Owuno,(2013) andNwosu *et al*.,(2014).**

Table(4): Moisture and ash contents of prepared jam samples during storage period.

Parameters	Storage periods (month)	HT	HTO	HTC	Means
Moisture	0	32.41	33.45	33.46	33.11 [a]
	3	32.58	31.35	31.75	31.89 [ab]
	6	30.77	29.94	31.39	30.7 [b]
	Means	31.92 [a]	31.58 [a]	32.2 [a]	
Ash	0	0.96	1.09	1.43	1.16 [a]
	3	1.03	1.07	1.25	1.12 [a]
	6	0.81	1.06	1.04	0.97 [a]
	Means	0.93 [a]	1.07 [a]	1.24 [a]	

(HT) is control husk tomatoes jam, (HTO) is husk tomatoes jam treatment with 200 ml orange juice, (HTC) is husk tomatoes jam treatment with 200 ml carrot juice. Mean values in the same raw / column followed by different letters are significantly different ($p \leq 0.05$).

The ash for all the treatments which gradually decreased during storage period HT from 0.96 to 0.81 , HTO from 1.09 to 1.06 and HTC from 1.43 to 1.04 respectively. The mean value at initial day for acidity was recorded as 1.16 , which then decreased to 0.97 during storage .The highest mean value of 1.24 was observed in case of HTC, which is followed by T_2 1.07, while the lowest mean value of 0.93 was found in case of HT. The same trend of results are in agreement with those noticed by **Arkoub-Djermoune *et al*., (2015)** and (**Mohd Naeem *et al*.,(2015).**The variation in ash content is due to variation in inorganic compounds especially calcium ion present in pectinpresent in the different fruits. Mineral components show great changes during cooking

operations, because of their solubility in water. Cooking might improve mineral bioavailability by increasing solubility due to cell wall disruption, protein denaturation and release of organic acids, which is found in the work of generally, low ash content indicates that is not a rich source of minerals.

Reducing and non-reducing sugar of husk tomatoes jam

Data in Table (5) indicated that reducing and non- reducing sugar of prepared jam samples during storage period at room temperature for 6 months. The results showed reducing sugar was ranged from 48.26 to 52.96 and non- reducing sugar was ranged from 41.6 to 46.05 after processing. During storage period reducing sugar for all the treatments which gradually increased in HT from 48.26 to 85.74, HTO from 53.88 to 86.77 and HTC from 52.96 to 85.51, respectively. The mean value at initial day for acidity was recorded as 51.7, which then increased to 86.01 during storage .The highest mean value of 73.11 was observed in case of HTC, while the lowest mean value of 71.1 was found in case of HT, which is followed by HTO72.8.The same trend of results are in agreement with those mentioned by **Noure*t al*.,(2011) and Ahmmed *et al*.,(2015).**The raise in the reducing sugar is caused by the conversion of sucrose to glucose and fructose, due to temperature and acidic condition(**Jawaheer *et al*.,2003 andAhmmed *et al*.,2015).**

Table(5): Reducing and non-.reducing sugar of prepared jam samples during storage period.

Parameters	Storage periods (month)	HT	HTO	HTC	Means
Reducing sugar	0	48.26	53.88	52.96	51.7 [b]
	3	79.26	77.83	80.85	79.31[a]
	6	85.74	86.77	85.51	86.01[a]
	Means	71.1[a]	72.8 [a]	73.11[a]	
Non- Reducing sugar	0	46.05	40.74	41.6	42.8 [a]
	3	15.01	16.07	13.15	14.7 [b]
	6	7.95	7.57	8.54	8.02 [c]
	Means	23.00 [a]	21.5 [a]	21.1[a]	

(HT) is control husk tomatoes jam, (HTO) is husk tomatoes jam treatment with 200 ml orange juice, (HTC) is husk tomatoes jam treatment with 200 ml carrot juice. Mean values in the same raw / column followed by different letters are significantly different ($p \leq 0.05$).

The non-reducing sugar for all the treatments which gradually decreased during storage period HT from 46.05 to 7.95 , HTO from 40.74 to 7.57 and HTC from 41.6 to 8.54 respectively. The mean value

at initial day for acidity was recorded as 42.8 , which then decreased to 8.02 during storage .The highest mean value of 23.00 was observed in case of HT and 21.5HTO, while the lowest mean value of 21.1 was found in case of HTC .The present results are in close contract with the findings a decline in the non- reducing sugars by **Ehsan *et al*.,(2003) and Khan *et al*.,(2012).**

Antioxidant contents of husk tomatoes jam

Data in Table (6) illustrated that antioxidant contents(ascorbic acid and total carotenoids) of prepared jam samples during storage period at room temperature for 6 months. The results showed that ascorbic acid was ranged from 6.82 to 11.21 and total carotenoids was ranged from 5.64 to 9.74 after processing. During storage period ascorbic acid for all the treatments which gradually decreased in HT from 6.82 to 4.44 , HTO from 11.21 to 5.33 and HTC from 8.13 to 4.23 respectively. The mean value at initial day for acidity was recorded as 8.72 , which then decreased to 4.66 during storage .The highest mean value of 7.61 was observed in case of HTO, while the lowest mean value of 5.9 was found in case of HTC, followed by HT 5.47. Similar trend of decline in ascorbic acid content of fruit jam was observed by **Veltman *et al*., (2000) and Gimenez *et al*., (2001)**. The loss of ascorbic acid content is because of light in the storage environment of the product. Ascorbic acid is the most important nutrient that represents the quality characteristics of the product, which is substantially affected due to oxidation during processing and storage**.**

Table(6): Antioxidant contents of prepared jam samples during storage period.

Antioxidants	Storage periods (month)	HT	HTO	HTC	Means
Ascorbic acid	0	6.82	11.21	8.13	8.72 [a]
	3	5.15	6.29	5.34	5.59 [ab]
	6	4.44	5.33	4.23	4.66 [b]
	Means	5.47 [a]	7.61 [a]	5.9 [a]	
Carotenoids	0	9.74	5.64	7.4	7.59 [a]
	3	3.92	4.23	4.28	4.14 [b]
	6	2.17	2.53	4.16	2.95 [b]
	Means	5.28 [a]	4.13 [a]	5.28 [a]	

(HT) is control husk tomatoes jam, (HTO) is husk tomatoes jam treatment with 200 ml orange juice, (HTC) is husk tomatoes jam treatment with 200 ml carrot juice. Mean values in the same raw / column followed by different letters are significantly different ($p \leq 0.05$).

The total carotenoidsfor all the treatments which gradually decreased during storage period HT from 9.74 to 2.17 , HTO from 5.64 to 2.53 and HTC from 7.4 to 4.16 respectively. The mean value at initial day for acidity was recorded as 7.59 , which then decreased to 2.95 during storage .The highest mean value of 5.28 was observed in case of HT and HTC , while the lowest mean value of 4.13 was found in case of HTO. The findings are in accordance with obtained by **Nicoli *et al*., (1999) and Giufrida *et al*.,(2013).**

Color of husk tomatoes jam

Data in Table (7) showed that Color measurments content of prepared jam samples during storage period at room temperature for 6 months. The results showed that *L** was ranged from 42.39 to 47.24, a* was ranged from 5.71 to 7.85 and b* was ranged from 9.52 to 15.29 after processing. During storage period the value of the *L** parameter fluctuated over the period of the jams' storage, directly after processing, the *L** parameter determining color brightness fluctuated from, which gradually decreased during storage period HT from 42.39 to 31.06 , HTO from 44.94 to 27.72 and HTC from 47.24 to 30.77 respectively. The mean value at initial day for *L** was recorded as 44.86 , which then decreased to 29.85 during storage .The highest mean value of 38.4 was observed in case of HTC, while the lowest mean value of 35.17 was found in case of HT and 33.79 HTO. During jam storage, a gradual decrease in the L^* parameter was observed resulting in the products' darkening. After a 6month storage period. Similar trends were observed by **Wicklund *et al*., (2005).**

Changes in the color of anthocyanin-rich jams are not only caused by Maillard's reaction. They mainly result from transformations of anthocyanins, which, in addition to browning, also increase the yellow coloration, which was confirmed by **Scibisz*et al*.,(2011)**. On the other ´hand, Maillard's reaction and the products of nonenzymatic browning occurring during storage have the greatest effect on the color of jams with low anthocyanin content(**Rada *et al*.,2004)**.

Table (7): Color measurments of prepared jam samples during storage period.

Parameters	Storage periods (month)	HT	HTO	HTC	Means
L*	0	42.39	44.94	47.24	44.86 [a]
	3	32.07	28.70	37.19	32.65 [b]
	6	31.06	27.72	30.77	29.85 [b]
	Means	35.17 [a]	33.79 [a]	38.4 [a]	
a*	0	6.23	5.71	7.85	6.6 [a]
	3	7.29	6.29	7.99	7.2 [a]
	6	7.56	7.04	9.20	7.9 [a]
	Means	7.03 [ab]	6.35 [b]	8.35 [a]	
b*	0	11.20	9.52	15.29	12.0 [b]
	3	13.13	11.43	18.42	14.33 [ab]
	6	18.74	18.26	22.48	19.83 [a]
	Means	14.36 [a]	13.07 [a]	18.73 [a]	

(HT) is control husk tomatoes jam, (HTO) is husk tomatoes jam treatment with 200 ml orange juice, (HTC) is husk tomatoes jam treatment with 200 ml carrot juice. Mean values in the same raw / column followed by different letters are significantly different ($p \leq 0.05$).

The value of the $a*$ parameter fluctuated over the period of the jams' storage , which gradually increased during storage period HT from 6.23 to 7.56 , HTO from 5.71 to 7.04 and HTC from 7.85 to 9.20 respectively. The mean value at initial day for *a** was recorded as 6.6 , which then increased to 7.9 during storage .The highest mean value of 8.35 was observed in case of HTC and 7.03 HT , while the lowest mean value of 6.35 was found in case of HTO. After 6 of storage, the increase in the proportion of red color was generally slight. Also, (**Wojdylo *et al*., 2008 andAbdel-Hady *et al*.,2014)**recorded changes in the $a*$ parameter during the storage of strawberry jams, depending on the additives applied. The values of the $b*$ parameter, which were within the range of yellow coloration , which gradually increased during storage period HT from 11.20 to 18.74 , HTO from 9.52 to 18.26 and HTC from 15.29 to 22.48 respectively. The mean value at initial day for *a** was recorded as 12.0 , which then increased to 19.83 during storage .The highest mean value of 18.73 was observed in case of HTC, while the lowest mean value of 13.07 was found in case of HTO and 14.36 HT. Which is a natural consequence of the color of these ingredients. Throughout the storage period, the proportion of yellow color increased. These results are in accordance with **Rababah *et al*.,(2014)**, who examined cherry

jams, also found a larger increase in the $b*$ parameter in the products stored at (room) higher temperatures.

Total bacterial counts of Husk Tomatoes jam

Table(8): Total bacterial countsof prepared husk tomatoes jam samples duringstorage period (cfu/g).

Storage periods (month)	HT	HTO	HTC
Zero time	90	< 0.1	< 0.1
3	< 0.4	< 0.1	< 0.1
6	< 0.4	< 0.1	< 0.1

(HT) is control husk tomatoes jam, (HTO) is husk tomatoes jam treatment with 200 ml orange juice, (HTC) is husk tomatoes jam treatment with 200 ml carrot juice.

Data in Total (8) showed thattotal bacterial countsof prepared husk tomato jam samples during storage period. The obtained results showed that total bacterial counts was ranged from < 0.1 to 90 (cfu/g) at zero time. During storage period, total bacterial counts was decreased as the prolonged storage time proceeded. This decrease in microbial growth may be due to the effect of increasing of sugar concentration and acidity which possess as preservative properties. These trend of results are in agreement with those noticed by **Gaikwad, (2016) and Kumar and Deen, (2017).**It is worthy to mention that all prepared samples are in the permissible limit as recommended by **Ranganna, (2010)** who reported that total bacterial counts of jelly should not exceeded to 10^3cfu/g. In addition, all prepared husk tomato jam were safe for human consumption.

Sensory evaluation of husk tomatoes jam

Data in Table (9) illustrated that organoleptic evaluation of Color, Taste, Texture and Overall acceptability of prepared jam samples during storage period for 6 months, were highly acceptablescore after processing at room temperature by the panelist color score ranged from 8.6 to 6.3, taste 8.8 to5.3, texture8.7 to 6.5 and overall acceptability 8.4 to 6.4. These results are in agreement with those obtained by **Suutarinen *et al*., (2000)** and **Hussain and Shakir, (2010).**

Table(9): Sensory evaluation of prepared jam samples during storage period.

Parameters	Storage periods (month)	HT	HTO	HTC	Means
Color	0	8.6	8.4	8.1	8.4 [a]
	3	7.4	7.1	6.3	6.9 [b]
	6	6.3	6.1	5.2	5.9 [b]
	Means	7.4 [a]	7.2 [a]	6.5 [a]	
Taste	0	8.8	8.3	7.8	8.3 [a]
	3	7.7	7.2	6.4	7.1 [a]
	6	5.3	5.1	4.5	4.9 [b]
	Means	7.3 [a]	6.9 [a]	6.2 [a]	
Texture	0	8.7	8.7	8.1	8.5 [a]
	3	7.6	7.5	7.1	7.4 [b]
	6	6.5	6.4	6.1	6.3 [c]
	Means	7.6 [a]	7.5 [a]	7.1 [a]	
Overall acceptability	0	8.4	7.1	6.7	7.4 [a]
	3	7.5	6.4	5.9	6.6 [a]
	6	6.4	5.3	5.1	5.6 [a]
	Means	7.4 [a]	6.3 [a]	5.9 [a]	

(HT) is control husk tomatoes jam, (HTO) is husk tomatoes jam treatment with 200 ml orange juice, (HTC) is husk tomatoes jam treatment with 200 ml carrot juice. Mean values in the same raw / column followed by different letters are significantly different ($p \leq 0.05$).

Antioxidant contents of husk tomatoes jelly

The average values of different juices formulations used in jelly are shown in Table (10). The Total carotenoids values ranged from 5.55 to 17.56,respectively, which carrot juice the higher one, since the total phenolic wasranged from 0.05 to 0.17, respectively. Also, vitamin C values ranged from 13.43 to 18.69, which orange juice the higher one. Vitamin E was ranged from 1.54 to 5.29, which husk tomato juice5.29 the higher one.

Table(10): Antioxidant contents of prepared jelly from husk tomato, orange and carrot juices.

Parameters	Husk tomato juice	Orange juice	Carrot juice
Total.Carotenoids (µ/g)	5.7 ± 0.8	5.55±0.13	17.56±0.13
Total. Phenolic (mg/g)	0.05±0.01	0.16±0.01	0.17±0.00
Vitamin.C (mg/100g)	13.43±0.02	18.69±0.01	15.10±0.51
Vitamin.E (µ/100ml)	5.29 ±0.70	2.36±0.01	1.54±0.01

Chemical composition of husk tomatoes jelly

The average values and the average test of the physicochemical properties evaluated for the husk tomatoes jelly with different juices formulations are shown in Table (11). The moisture values of the HTO jelly and HTC jellylower than HT jellytreatment. Ash content levels between 1.24 HTO jelly and 2.28 HT jelly, suggestion a higher mineral content in this jelly. The fruit of *P. peruviana* L. contains Phosphorus, Iron, Potassium and Zinc **(Rodríguez *et al*., 2007)**.The fiber values was ranged from 8.32 to 12.21, respectively, which HTO jellythe higher one. since the reducing sugar was ranged from 21.85to 32.55, respectively, which HTO jelly the higher one.

Table(11): Chemical composition of prepared husk tomato jelly samples.

Parameters	HT jelly	HTO jelly	HTC jelly
Moisture (%)			
Ash (%)	59.81±0.02	57.87± 0.01	57.75± 0.02
Protein (%)	2.28±0.00	1.24± 0.02	1.58± 0.00
Fat (%)	8.61±0.08	8.49± 0.01	7.43± 0.01
Fiber (%)	0.04±0.04	0.05± 0.01	0.01± 0.00
T.Carbohydrat(%)	9.39±0.02	12.21± 0.02	8.32± 0.02
PH	89.07±0.09	90.23 ± 0.02	90.99± 0.02
T.Acidity(g/100g)	4.13 ±0.06	4.1±0.05	4.51± 0.08
Reducing	0.002±0.00	0.02± 0.00	0.004± 0.00
sugar(g/100g)	27.19±0.13	32.55 ± 0.14	21.85± 0.14

(HT jelly) is husk tomatoes juice(100%) jelly, (HTO jelly) is husk tomatoes juice(50%)+orange juice(50%) jelly, (HTC jelly) is husk tomatoes juice(50%)+ carrot juice(50%) jelly. Mean values in the same raw / column followed by different letters significantly different ($p \leq 0.05$).

The pH values ranged from 4.1 to 4.51, since the acidity ranged from 0.002 to 0.02 g citric acid/100 g. Through the average Table (11) it can be seen that HTC jelly and HT jelly husk tomatoes jelly stood out due to the higher pH 4.51 and 4.13, respectively and consequently lower acidity 0.0021 and 0.0044 g citric acid/100 g, respectively.

Antioxidant contents of husk tomatoes jelly

Data in Table (12) indicated that total carotenoids show that values ranged from 2.11 to 3.56, which HTC jelly3.56 and HT jelly3.24, respectively , higher than HTO jelly 2.11.Total phenolic was ranged from 0.02 to 0.07, respectively, which HTO jelly 0.07 higher one. Also, vitamin. C values was ranged from 5.45 to 7.44, which HT jelly 7.44 and HTO jelly 7.13, respectively, higher than HTC jelly5.45 mg/100g.Vitamin. E values was ranged from 0.092 to 1.698, which HTO jelly 1.69 higher one.

Table(12): Antioxidant contents of prepared husk tomato jelly samples.

Parameters	HT jelly	HTO jelly	HTC jelly
Total.Carotenoids(µ/g)	3.24 ± 0.39	2.11 ± 0.25	3.56 ± 0.35
Total. phenolic(mg/g)	0.03± 0.00	0.07± 0.01	0.02± 0.01
Vitamin.C(mg/100g)	7.44± 0.02	7.13 ± 0.02	5.45 ± 0.01
Vitamin.E(mg/100ml)	0.09 ±0.01	1.69 ± 0.02	0.19 ± 0.02

(HT jelly) is husk tomatoes juice(100%) jelly, (HTO jelly) is husk tomatoes juice(50%)+orange juice(50%) jelly, (HTC jelly) is husk tomatoes juice(50%)+ carrot juice(50%) jelly.

Color of the husk tomatoes jelly

Data in Table (13) showed that Color measurments of prepared husk tomatoes jelly samples. The results showed that Jellies elaborated with the husk tomatoes and different juices characterized by have the highest L* and b*, and then characterized by being the lighter and more yellowish formulations. Jelly made with the HTC jelly characterized by higher a* values, resulting in its red-purplish color and jelly made with the HTO jelly presented the lowest value of a*, presenting as more greenish. It can be verified that the jelly retained the typical coloring of the fruit in fresh form. The darkening displayed, as indicated by the parameter L*, was due to concentration and the reactions that occur during

heating, such as the Maillardreaction. This could be attributed toenzymatic or non-enzymatic browning (Maillard reactions) (**Monsalve *et al*., 1994)** . In fact, the presence of a higher amount of reducing sugarsafter inversion of sucrose during cooking,and/or higher pH, could contribute to thesebrowning reactions.

Table (13): Color measurments of prepared husk tomatoes jelly samples.

	L*	a*	b*
HT jelly	42.25 ^{c} ± 0.71	10.38 ^{b} ± 0.30	32.63 ^{b} ± 1.08
HTO jelly	48.94 ^{a} ± 0.46	9.93 ^{b} ±0.78	36.63 ^{a} ± 0.71
HTC jelly	45.60 ^{b} ± 0.20	15.02 ^{a} ± 0.11	29.65 ^{c} ± 0.26

(HT jelly) is husk tomatoes juice(100%) jelly, (HTO jelly) is husk tomatoes juice(50%)+orange juice(50%) jelly, (HTC jelly) is husk tomatoes juice(50%)+ carrot juice(50%) jelly. Mean values in the same raw / column followed by different letters are significantly different ($p \leq 0.05$).

Sensory evaluation of husk tomatoes jelly

Data in Table (14) showed that organoleptic evaluation of Color, Taste, Texture and Overall acceptability of prepared jelly samples were highly acceptable score after processing by the panelist, color score ranged from 8.5 to 8.1, taste 8.7 to 7.5, odor 8.2 to 7.9, texture 7.6 to 8.5 and overall acceptability 8.3 to 8.1, respectively.

Table (14): Sensory evaluation of prepared husk tomatoes jelly from different juices.

	Color	Taste	Odor	Texture	Overall acceptability
HT jelly	8.5 ^{a} ±0.53	8.67 ^{ab} ±0.6	8.2 ^{a} ±0.29	7.6 ^{a} ±0.57	8.3 ^{b} ±0.48
HTO jelly	8.6 ^{a} ±0.66	8.8 ^{a} ± 0.35	8.1 ^{a} ±0.85	8.7 ^{a} ±0.52	8.6 ^{a} ±0.31
HTC jelly	8.1 ^{a} ±0.12	7.5 ^{b} ± 0.5	7.9 ^{a} ±0.15	8.5 ^{a} ±0.45	8.1 ^{c}±0.25

(HT jelly) is husk tomatoes juice(100%) jelly, (HTO jelly) is husk tomatoes juice(50%)+orange juice(50%) jelly, (HTC jelly) is husk tomatoes juice(50%)+ carrot juice(50%) jelly. Mean values in the same raw / column followed by different letters are significantly different ($p \leq 0.05$).

Inconclusion, data of the present study confirmed that the antioxidant activities of husk tomatoes fruits. Suchproperties principally attributed to its content different bioactive compounds. Therefore, we recommended to use husk tomato powder in our daily dishes and beverages.

References:

A.A.C.C. (2000): Approved Methods of the American Association of Cereal Chemists. St Paul. American Association of Cereal Chemists, MN.

Abdel-Hady, M. M.;Gamila, Y. A. and Afaf, M. A. (2014): "Color stability of strawberry jam fortified by purple carrot puree," Egyptian Journal of Agricultural Research, 92(1):323– 336.

Ahmed, L.; Islam, M.N. and Islam, M.S.(2015): A Quantitative estimation of the amount of sugar in fruits jam available in Bangladesh. Science Journal of Analytical Chemistry 3(5): 52-55.

Amruthesh, C. (2012): Studies on the fortification of tomato (*Solanumlycopersicum* L.) ketchup and its storage. M. Sc. Thesis. UHS, Bagalkot.

A.O.A.C.(2000): Association of Official Analytical Chemistry. Official Methods of Analysis. 18th Ed. Washington DC.

A.O.A.C.(2005): Official Method of Analysis. Association of Analytical Chemistry. Washington D.C.91(1): 112-122.

Arkoub-Djermone, L.;Boulekbache –Makhlouf, L.;Zeghichi-Hamri, S.;Bellili, S. andBoukhalfa, FandMadani.(2015): Influence of thermal processing on the physicochemical propreties and the antioxidant activity on of a solanaceae vegetable: eggplant. Journal of Food Quality,10: 181 – 191. 10.

Balasundram, N.;Sundram, K.and Samman, S.(2006): Phenolic compounds in plants and agri-industrial by-products: Antioxidant activity, occurrence, and potential uses. J. Food Chemistry 99:191-203.

Belitz, H. D. and Grosch, W. (1999): Food Chemistry.Springer, Berlin.

Bravo, K.;andDsorio, E. (2016): Characterization of polyphenol oxidase from Cape gooseberry (*Physalisperuviana*L.) fruit. J. Food Chemistry, 197(1):185-190.

Brubacher, G.; Muller-Muolt, W.and Southgate, D.A. (1985): Methods for the determination of vitamin in food. Elsevier Applied Science Publishers, London.

CIE (Commission International de Clairage), (1976): Official recommendations on uniform color spaces. Color difference equations and metric color terms, Suppl. No. 2. CIE Publication No. 15 Colourimetry, Paris, France.

Ehsan, E.B.;Naeem, Z.P.;Javid, A. and Nazir, A .(2003): Development, standardization and storage studies on grape fruit apple marmalade. Pak. J. Food Sci. 13: 11-15.

Eke-Ejiofor, J.and Owuno, F. (2013): The physico-chemical and sensory properties of jackfruit (artocarpusheterophilus) jam. International Journal of Nutrition and Food Sciences 2(3): 149-152.

Gaikwad, S.U.(2016): Studies on Preparation of Sapota (*Manilkaraachras* (Mill.) fosberg): beetroot (beta vulgaris) blended jelly. M.Sc. Thesis, Dr. BalasahebSawantKonkanKrishiVidyapeeth, Dapoli Maharashtra, India.

Galeb, A.D.;Wrolstad, R.E. and Mcdaniel, M.R. (2002): Compo-sition and quality of clarified cantaloupe juice concentrate. J. Food. Proc. Pres. 26(1): 39–56.

Gimenez, J.; Kajda, P.;Margomenou, L.; Piggott, J.R. andZabetakis, I.(2001):A study on the colour and sensory attributes of high-hydrostatic-pressure jams as compared with traditional jams. J. Sci. Food .Agric. 81: 1228-1234.

Giuffrida, D.; Torre, G.; Dugo, P. and Dugo. G. (2013): Determination of the carotenoid profile in peach fruits, juice and jam. Fruits, 68 : 39 – 44.

Hassanien, M.F.(2011): Physalisperuviana: A rich source of bioactive phytochemicals for functional foods and pharmaceutical. Food Reviews International 27(3):259-273.

Holme, D.J. and Peck, H. (1983): Analytical Biochemistry. 1st ed., PP. 305, London group limited, England.

Hussain, I. and Shakir, I. (2010): Chemical and organoleptic characteristics of jam prepared from indigenous varities of apricot and apple. World J. Dairy Food Sci. 5: 73-78.

Jawaheer, B.;Goburdhun, D. andRuggoo, A .(2003): Effect of processing and storage of guava into jam and juice on the ascorbic acid content. J. Plant Food Human Nutri 58: 1-12.

Joslyn, M. A. (1970): Methods in Food Analysis, ^{2}nd Ed., Berkeley, California, 845.

Kamil, M.M.; Gamal, F. and Mohamed, Shaheen, M.S. (2011): Fourier transformer infrared spectroscopy for quality assurance of tomato products. J. American Sci., 7(6): 206-216.

Khan, R.U.;Afridi, S.R.;Ilyas, M.;Sohail, M. andAbid, H .(2012): Development of strawberry jam and its quality evaluation during storage. Pak. J.Biochem Mol. Biol. 45: 23-25.

Kumar, A. and Deen, B. (2017): Studies on preparation and storage of jelly from wood apple (*Limoniaacidissima* L.) fruits. Journal of Pharmacognosy and Phytochemistry.; 6(6):224-229.

Lichtenthaler , H. K. and Wellburn, A. R.(1985): Determination of total carotenoids and chlorophylls a and b of leaf extracts in different solvents . J. Biol. Soc. Trans. 11.591- 592.

Mc Cain, R. (1993): Goldenberry, passionfruitand white sapote: potential fruits for cool subtropical areas. In: Janick, J., Simon, J.E. (Eds.), New Crops. John Wiley &ons Inc., New York, pp. 479–486.

Mericli, F. (2011): "Bilimselacidanaltincilekmeyveleri (*Physalisperuviana*)," Fitomed, vol. 20, pp. 18–22.

MohdNaeem, M.N.;MohdFairulnizal, M.N.;Norhayati, M.K.;Zaiton, A.;Norliza, A.H.;Wan Syuriahti, W.Z.;MohdAzerulazree, J.;Aswir, A.R. and Rusidah, S.(2015): The nutritional composition of fruit jams in the Malaysian market. Journal of the Saudi Society of Agricultural Sciences, 1 : 8-17.

Monsalve-Gonzalez, A.; Barbosa-Canovas, G.V.; Cavalieri, R.P.; McEvily, A.J. and Iyengar, R. (1994): Inhibition of enzymatic browning in apple products by 4-hexylresorcinol, Food Technolgy. 4: 110–118.

Morton, J.F.(1987): Cape gooseberry. In Fruits of Warm Climates; Morton, J.F., Ed.; Creative Resource Systems Inc.: Winterville, NC:430–434.

Moustufa, B.M.(2002): Chemical and technological studies on some vegetables and fruits juices, Ph.D. These Fac. Agric.Moshtohor, Benha Univ. Egypt.

Nicoli, M. C.;Anese, M. and Parpinel, M.(1999): Influence of processing on the antioxidant properties of fruit and vegetables. Trends in Food Science and Technology 10: 94-100.

Nour, A.A.; Khalid, K.S.and Osman, G.A.(2011): Suitability of some Sudanese mango varieties for jam making. American Journal of Industrial Research, 2: 17-23.

Nwosu, J.N.;Udeozor, L.O.;Ogueke, C.C.;Onuegbu, N.;Omeire, G.C. and Egbueri, I.S. (2014): Extraction and Utilization of Pectin from Purple Star-Apple (Chrysophyllumcainito) and African Star-Apple (*Chrysophyllumdelevoyi*) in Jam Production. Austin Journal of Nutrition and Food Science 1(1): 1003 - 1009.

Ocampo, Y.;Caro, D.; Rivera, D.and Franco, L.(2017): Safety of sucrose esters from Physalis peruviana L.in a 28-day repeated-dose study in mice. Biomed Pharmacother, 90, 850–862.

Puente, L.A.; Pinto-Muñoz, C. A.; Castro, E. S.and Cortés, M.(2011): Physalisperuviana Linnaeus, the multiple properties of a highly functional fruit: A review. Food Res. Int., 44(7):1733–1740.

Rababah, T. M.; Datt, M. Al-U'.and Al-Mahasneh, M.(2014):"Effect of Jam processing and storage on phytochemicals and physio- chemical properties of cherry at different temperatures," Journal of Food Processing and Preservation, 38, (1): 247–254.

Rada-Mendoza, M.; Sanz, M. L.; Olano, A. and Villamiel, M.(2004):"Formation of hydroxyl methylfurfural and furosine during the storage of jams and fruit-based infant foods". J. Food Chemistry, 85, (4): 605–609.

Ramadan, M. and Mörsel, J.(2003): Oil goldenberry (*Physalisperuviana*L.). Journal of Agricultural and Food Chemistry,*51*(4):969−974.

Ramadan, M.F.(2011): Bioactive phytochemicals, nutritional value, and functional properties of Cape gooseberry (P. *peruviana*): an overview. J. Food Research International, 44: 1830–1836.

Ranganna, S. (2010): Handbook of Analysis and Quality Control for Fruit and Vegetable Products, (Tata McGraw–Hill Education Pvt. Ltd.), New Delhi.

Riaz, M. N.; Mohyuddin, G. and Al-Haq, M. I. (1999): Physical, chemical and sensory characteristics of jams made from fresh and frozen strawberries. Pakistan. J. Arid. Agric. 2: 51-60.

Rodriguez,S. and Rodriguez, E. (2007): Eteco de la ingesta de *physalisperuviana* (aguaymanto) sobre la glicemia postprandial en adultosjovenes . RevistaMedicaVallejiana, 4 (1): 43-52.

Salazar, M.; Jones, J.; Chaves, B. and Cooman, A. (2008): A model for the potential production and dry matter distribution of Cape gooseberry (*P. peruviana* L.). ScientiaHorticulturae, 115, 142–148.

Scibisz, I.; Gasik, A.; Mitek, M. and Cendrowski, A. (2011):"Effect of storage conditions on colour of jams made from colourful fruits,"˙Zywno´s´c. Nauka. Technologia. Jako´s´c, 18 (1): 99–111.

Shakir, I.; Durrani, Y.; Hussain, I.; Qazi, I. M. and Zeb, A. (2007): Physicochemical analysis of apple and pear mixed fruit jam prepared from varieties grown in Azad Jammu and Kashmir. Int. J. Food Safety 9: 22-24.

Sindumathi, G. and G.S. Amutha, (2014): Processing and quality evaluation of coconut based jam. IOSR-J. of Env. Sci., Toxicol. and Food Technol., 8 (1):10-14.

SPSS, (1998): Statistical Package for Social Science, Computer Software, Ver. 20, SPSS Company. London, UK.

Suutarinen, J.; Heiska, K.; Moss, P. and Autio, K. (2000): The effects of calcium chloride and sucrose pre-freezing treatments on the structure of strawberry tissues. LensmittelWissensachaft und Technologie, 33: 89-102.

USDA. (2006): National Nutrient Database for Standard Reference, NDB No.11954. The US Department of Agriculture, Washington DC.

Veltman, R. H. ; Kho, R. M. ; Van, A.C.; Sanders, M. G. and Oosterhaven, J . (2000): Ascorbic acid and tissue browning in pears under controlled atmosphere conditions. Post Harvest Biol. Tech. 19: 129-137.

Wicklund, T. ; Rosenfeld, H. J. and Martinsen, B. K. (2005): "Antioxidant capacity and colour of strawberry jam as influenced by cultivar and storage conditions," LWT - Food Science and Technology, 38(4): 387–391.

Wojdyło, A. ; Oszmia´nski, J. and Bober, I. (2008): "The effect of addition of chokeberry, flowering quince fruits and rhubarb juice to strawberry jams on their polyphenol content, antioxidant activity and colour," European Food Research and Technology, 227(4): 1043–1051.

Zeid, M. H. (1996): Technological studies on some fruit and vegetable products. Ph.D. Thesis, Faculty of Agriculture, Zagazig University, Egypt.

Zhao, Y. (2007): Berry Fruit, Value-Added Products for Health Promotion; CRC Press: New York.

Journal of Home Economics, Volume 27, Number (2), 2017

استخدام ثمار الحرنكش في التصنيع الغذائي

سارة محمد صلاح عواد سالم

مركز بحوث الصحراء – قسم الانتاج النباتي– وحدة التصنيع الزراعي– القاهرة – مصر

الملخص العربى:

يهدف هذا البحث الي تقييم المربي و الجيلي المصنع من ثمار الحرنكش المضاف اليه عصائر مختلفة مثل عصير البرتقال الغني بفيتامين (ج) و عصير الجزر الغني بالكاروتينات وكان لهم خصائص لونية و حسية مثالية بالاضافة لبعض الخصائص الفيزيائية و الكيميائية و درجة التقبل العام للمنتجات المصنعة. كذلك التحقق من تأثير فترة التخزين علي جودة المربي ، فكانت جميع عينات المربي مرتفعة اثناء فترة التخزين .فأظهرت النتائج أن البروتينات ،الرماد، درجة الرطوبة، درجة الحموضة، السكريات الغير مختزلة، فيتامين سي والكاروتينات الكلية انخفضت بطول زيادة فترة التخزين، و تقليل نمو الميكروبات في المربي سجلت الحد حتي نهاية العمر الافتراضي. و بالتالي كانت المربي آمنة و مناسبة للاستهلاك حتي ٦ شهور. أظهر التقييم الحسي أن الصفات الجيدة بين جميع المعاملات أعطت افضل درجات القبول. و يمكن تلخيص بأن مربي و جيليثمار الحرنكش منتجات جيدة و يوصي باستخدامها لما لها من اهمية لمواد الاكسدة و خالية من الميكروبات.

الكلمات الافتتاحية: ثمار الحرنكش - مربي- جيلي - عصير برتقال -عصير جزر -التصنيع - القيمة الغذائية- فيتامين سي- التقييم الحسي.