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Research Article
Production of Juice from Zaghloul Date at Khalal Stage

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Abstract

Background and Objective: Date palm is one of the oldest fruit trees in the world. The world production of dates has increased. Date fruits contain easily digestible sugars, dietary fibers, protein, fat, ash and polyphenols. They also contain many vitamins and medicinal practices for treating various disorders. Moreover, dates exhibit antioxidant, antimutagenic and free-radical-scavenging activity. The aim of this study was: Production of juice from Zaghloul date at Khalal stage and assess the impact of acidity on compounds and physical qualities, tangible assessment, microbiological investigation and impact of storage periods. **Materials and Methods:** Juice was extracted from Zaghloul date and analyzed for chemical composition, minerals and antioxidants compounds. Physical characteristics, color values and organoleptic evaluation of juice were measured with and without different acids and their mixture additions. Microbiological evaluation and study the effect of pasteurization and potassium sorbate on chemical changes of juice during storage periods. Results from the organoleptic analysis were analyzed by using a one-way analysis of variance (ANOVA using Assistant computer programs and Least Significant Difference (LSD), statistical significance was set at $p \leq 0.05$. **Results:** Date juice was produced from Zaghloul at khalal stage. Addition of different acids increased acidity, improved sensory parameters and having color stability of date juice. Using both pasteurization and potassium sorbate reduced bacterial and increased the storage periods to 6 months. **Conclusion:** It was concluded that stable color and treating by acidity led to high quality of date juice product which having both suitability and wholesomeness.

Key words: Zaghloul juice, khalal stage, microbiological evaluation, physical characteristics and sensory parameters

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is one of the oldest fruit trees in the world, known as the tree of life[1]. The date palm has spreader world[2]. The world production of dates has increased to 7.05 million metric tons in 2008[3] and expectations are that their cultivation will continue to increase[4]. In Egypt, date palm trees are distributed where more than 27 varieties of date palm grown in Egypt[5]. All edible varieties of date pass through four distinct stages of ripening namely: Kimri, Khalal, Rutab and Tamr and all stages of date development are edible except the Kimri stage which is usually bitter and unsuitable for eating[5]. The date palm fruits are composed of a seed and fleshy pericarp which constitutes between 85 and 90% of date fruit weight[6].

Date fruits contain easily digestible sugars, mainly glucose, sucrose and fructose dietary fibers and contain small amount of protein, fat, ash and polyphenols[7,8]. They also contain vitamins like riboflavin, thiamin, biotin, folic and ascorbic acid[4] and essential minerals[9]. Date fruits also used as medicinal practices for the treatment of various disorders[10], as well as, aqueous extract of dates having antioxidant, antimutagenic, antifungal, anti-inflammatory, hepatoprotective and gastrointestinal protective, anticancer, nephroprotective and immunostimulant activities[11,12] This study will determine the antioxidant compounds like carotenoids in date juice which play as anticancer agent. Also, it contain easily digestible sugars and dietary fibers which are gastrointestinal protective.

So, the aim of the present study deals with production of date juice from Zaghloul variety date at Khalal stage and evaluate the effects of citric acid, ascorbic acid or mixture of them addition on chemical, physical, color and sensory characteristics on produced date juice.

MATERIALS AND METHODS

Chemicals and supplies: Zaghloul date at Khalal stage was obtained from the local market, summer season 2016 (6 months) and this study was carried out at Food Technology Department, National Research Centre. The date was packaged in plastic bags and stored in refrigerator at 5±1°C. Citric acid, ascorbic acid and potassium sorbet were obtained from Sigma Chemical Co.

Methods

Production of zaghloul juice: Zaghloul date juice was produced by extractor (Sanyo SJ-300E). The obtained juice sample was divided into 4 groups; each group was treated by different levels (0.5, 1.0 and 1.5%) of chemicals (citric acid, ascorbic acid and their mixtures). All date juice samples were subjected to pasteurization at 85°C for 15 min according to Egyptian organization for standardization and quality[13.] All juice samples were stored in refrigerator at 5±1°C and withdrawn (in triplicate) at 0, 2, 4, and 6 months for analysis. Samples of date juice had the highest Organoleptic scores will be select to determine the chemical changes of juice sample as affected by acids and storage periods and also measure the sensory evaluation of these samples through the same periods.

Chemical analysis: Chemical composition of juice was determined by AOAC[14]. Total Soluble Solids (TSS %) was determined by refractometer (ATAGO, Japan). The pH was measured by digital pH-meter (HANNA, H1902 m, Germany). Non-reducing sugars were determined by difference between total sugars and reducing sugars. Total Solids (TS %) were determined by difference between moisture percent and 100°Brix/acid ratio was calculated by dividing the value of total soluble solids on the total acidity value for each sample. Total polyphenols was determined according to the Folin-Ciocalteu Procedure as mg Gallic acid equivalents kg^{-1} of sample[15]. Minerals and phosphorus contents were determined by Atomic absorption spectrophotometer and spectrophotometrically, respectively[14].

The color of different samples measured, using a spectro-colorimeter (tristimulus color machine) with CIE lab color scale (Hunter, Lab Scan XE, Reston VA.) calibrated with a white standard tile of Hunter Lab color standard (LXNO. 16379): X = 77.26, Y = 81.94 and Z = 88.14 (L = 92.71; a = -0.89; b = -0.18). Using Hunter-Scofield's equation[16]. Color difference (ΔE) was calculated from a,b and L parameters, using Hunter-Scotfield's equation[16] as follows:

$$\Delta E = (\Delta a^2+\Delta b^2+\Delta L^2)^{1/2}$$

ΔE = Color difference

where, $\Delta a = a-a^0$, $\Delta b = b-b^0$ and $\Delta L = L-L^0$, a^0 = a of control, b^0 = b of control and L^0 = L of control.

The Hue angle ($t^{-1}{}_g$ b/a) and saturation index ($\sqrt{a^2+b^2}$) were calculated.

Carotenoids compounds and lutein were extracted and determined according to the method of AOAC[14].

The provitamin A values, expressed as Rentinol Equivalents (RE), were calculated according to NAS-NRC "US National Academy of Sciences, National Research Council"[17]

for which 6 µg of β-carotene corresponds to 1 µg of Rentinol Equivalent (RE). Considering that the only provitamin A precursor carotenoid present in palm date fruit is β-carotene, the following expression was used:

$$RE = \mu g\ \beta\text{-carotene}/6$$

Microbiological analysis: A comparison between pasteurization process at 85°C for 15 min, potassium sorbate treatment at level 0.5% and their effects on total bacterial, yeast and molds counts during storage periods (2, 4 and 6) months for Zaghloul date juice samples were determined.

The total bacterial count of juice samples was carried out using nutrient agar medium[18], potato dextrose agar medium[18] was used for counting yeast and molds present in the products.

Organoleptic evaluation: Color, taste, flavor and overall acceptability were evaluated as described by Meligaard *et al.*[19]. The organoleptic scores involved 20 grades for each sensory property except 40 grades for overall acceptability for different date juice samples as effected by acids addition (citric, ascorbic and mixture of them) at levels 0.5, 1 and 1.5%. Sensory evaluation of Zaghloul juice samples as affected by acids {citric 0.5%, ascorbic 1% and mixture (1:1)0.5%} during storage periods was carried out, the organoleptic scores involved 20 grades for color, 40 grades for flavor and taste sensory properties.

Statistical analysis: The means and Standard Deviations (SD) from 3 measurements were obtained from all analytical experiments. Results from the organoleptic analysis were analyzed by using a one-way analysis of variance (ANOVA) using Assistant computer programs[20] and Least Significant Difference (LSD), statistical significance was set at $p \leq 0.05$.

RESULTS AND DISCUSSION

Chemical, minerals and antioxidants analysis: Chemical composition and minerals of Zaghloul date juice are shown in Table 1. Total solids, total acidity, pH values were 17.60, 0.22% (as citric acid) and 5.71 respectively. Juice sample had 3.41% protein and 1.99% ash. Total and reducing sugars were 13.36 and 10.51%, respectively. While, total phenols content was 2.21 (mg gallic acid/kg sample) in Zaghloul juice. The obtained results for chemical composition of Zaghloul juice were lower than[21] results for Zaghloul fruit chemical composition except contents of protein and ash which were 2.94 and 1.88%, respectively where, juice extraction process may be responsible for decreasing the other chemical constituents.

Minerals content of Zaghloul date juice sample is shown in the Table 1. It contained macroelements such as sodium, potassium, calcium, phosphorus and magnesium (27.78, 1297.44, 100.17, 116.36 and 77.05) mg 100 g^{-1}, respectively. Iron, copper, zinc and manganese as microelements in Zaghloul juice were 1.99, 8.91, 1.08 and 1.25 mg 100 g^{-1}, respectively. potassium was the highest element in macroelements and iron had the same result in microelements. Results of minerals content for Zaghloul juice in this study were slightly higher than the same minerals content for Zaghloul fruit obtained by Nadir *et al.*[21] where, the variation may be to increasing ash content of Zaghloul juice in this study to 1.99%.These results are in agreement with those obtained by Al-Farsi [22], Nadir *et al.*[21] and Kulkarni *et al.*[23].

Antioxidants compounds of α, β-carotenes, lutein and provitamin A value in Zaghloul date juice sample were evaluated in Table 1. α, β-carotenes content were in date juice sample (43.70 and 20.45 µg g^{-1}) respectively. Lutein content was 69.61 µg g^{-1} and the percent's for α, β carotenes and lutein compounds were 15.29, 32.67 and 52.04%, respectively from the total carotenoids content. The present of the last compounds may be related to the color of date fruit and transferred to date juice during extraction process. These results are in agreement with those obtained by Vyawahare *et al.*[24], Abdul-Allah[25].

Physical characteristics: Effect of addition citric, ascorbic and mixture of acids levels on the physical characteristics of Zaghloul date juice is shown in Table 2. Addition of all acids and their mixture at all levels to date juice had no effect on

Table 1: Chemical composition, minerals and antioxidants contents of zaghloul date juice (.on dry weight basis)

Components	g 100 g^{-1}	Elements	mg 100 g^{-1}	Antioxidants	µg g^{-1}
Total solids	17.60±0..29	Sodium	27.78	β-carotene	20.45±0.15
Total acidity	0.22±0.11	Potassium	1297.44	α-carotene	43.70±1.12
pH	5.71±0.17	Calcium	100.17	Lutein	69.61±0.92
Protein	3.41±0.46	Phosphorus	116.36	Total carotenoids	133.76
Ash	1.99±0.18	Magnesium	77.05	Provitamin A	3.41±0.40
Total sugars	13.36±0.07	Iron	1.99		
Reducing sugars	10.51±0.41	Copper	0.91		
Non-reducing sugars	2.85	Zinc	1.08		
Total phenols (mg kg^{-1})	2.21±0.19	Manganese	1.25		

±Standard Division

Table 2: Effect of addition citric, ascorbic and mixture acids levels on the physical characteristics of zaghloul date juice

Treatments	Levels	TSS (%)	pH	Total acidity (%)	Brix acidity^{-1} ratio	TS (%)
Control		18.24±0.35	5.71±0.18	0.22±0.08	82.90	17.60±0.29
Citric acid	C1	18.41±0.51	5.53±0.48	0.23±0.02	80.04	17.72±0.73
	C2	18.45±0.62	5.29±0.43	0.24±0.09	76.87	17.81±0.17
	C3	18.48±0.45	5.13±0.30	0.26±0.06	71.07	17.90±0.52
Ascorbic acid	A1	18.39±0.70	5.60±0.46	0.27±0.05	68.11	17.86±0.81
	A2	18.46±0.14	5.38±0.52	0.29±0.07	63.65	17.94±0.64
	A3	18.40±0.48	5.22±0.41	0.32±0.04	57.50	18.06±0.31
Mixture (1:1)	M1	18.38±0.19	5.49±0.42	0.25±0.06	73.52	17.78±0.29
	M2	18.42±0.23	5.30±0.45	0.27±0.05	68.22	17.89±0.64
	M3	18.44±0.38	5.19±0.12	0.30±0.02	61.46	17.95±0.57

±Standard Division, TSS: Total Soluble Solids, TS: Total Solids, C1, C2 and C3: 0.5, 1 and1.5% citric acid, A1, A2 and A3: 05, 1 and 1.5% ascorbic acid, M1, M2 and M3: Mixture from citric acid and ascorbic acid (1:1) {05, 1 and 1.5%}

Table 3: Effect of adding levels of citric, ascorbic acids or mixture of them on zaghloul date juice color

Treatments	Levels	L*	a*	b*	a/b	Saturation	Hue	ΔE**
Control	0	56.00	5.63	24.17	0.23	24.82	76.89	
Citric acid	C1	62.81	7.13	28.21	0.25	29.10	75.82	8.06
	C2	63.54	8.25	31.73	0.26	32.78	75.43	10.99
	C3	65.73	9.59	33.50	0.29	34.85	74.03	14.05
Ascorbic acid	A1	59.63	6.20	26.30	0.24	27.02	76.74	4.25
	A2	61.28	7.51	29.84	0.25	30.77	75.87	7.97
	A3	63.14	8.72	31.65	0.28	32.83	74.60	10.79
Mixture (1:1)	M1	61.17	6.59	27.13	0.24	27.92	76.35	6.03
	M2	62.36	7.75	30.67	0.25	31.63	75.82	9.34
	M3	64.29	9.10	32.49	0.28	33.74	74.36	12.25

L*: Lightness, a*: Redness, b*: Yellowness, **Color difference, C1, C2 and C3: 0.5, 1 and 1.5% citric acid, A1, A2 and A3: 05, 1 and 1.5% ascorbic acid, M1, M2 and M3: Mixture from citric acid and ascorbic acid (1:1) {05, 1 and 1.5%}

TSS % and TS % and their values were varied from18.39-18.48% and from 17.72-18.06%, respectively. It was noticed that, values of total acidity were increased as a result of organic acids added at all levels compared to control, where, their values were inversely proportional with pH values. Brix. acidity^{-1} ratios were lowered in all acidified juice samples in this investigation. These results are in agreement with Yu and Rupasinghe[26], Da Costa *et al.*[27]. They found that, no noticed effect was observed on TSS % or TS % values when ascorbic or citric acids added to orange and carrot juices while, some little increasing and decreasing was present for total acidity ratio and pH values respectively in these juices.

Color of juice: Effect of adding levels of citric, ascorbic acids or mixture of them on Zaghloul date juice color is given in Table 3. All color parameters of date juice except hue were increased as the level of different acids added increased. Color values of juice samples contained all levels of added citric acid were higher than that found in control juice sample and other juice samples contained other acids. The highest values of lightness (L), redness (a), Yellowness (b), (a/b) and saturation was present in juice sample treated with 1.5% citric acid which were 65.73, 9.59, 33.50, 0.29 and 34.85 respectively while, juice samples contained ascorbic acid at all addition levels had the lowest values for all color parameters except hue. The increasing rate from color results of control sample was ranged between 6.48-17.38, 10.12-70.34, 8.81-38.60, 4.35-26.09 and 8.86-40.41% for L, a, b, a/b and saturation respectively. As a general observation, the increasing color values of all acidified juice samples may be due to the effect of these acids on some physical characteristics of date juice like total acidity and pH. Also, the color of zaghloul date juice was due to the presence of anthocyanins pigments. Ascorbic acid 0.5% juice sample had the lowest E (4.25) and the highest value for the same parameter was present in citric 1.5% juice sample (14.05). These results are in agreement with Da Costa *et al.*[27], Khalil[28], Sakr *et al.*[29].

Sensory evaluation: The organoleptic properties of different Zaghloul date juice samples as shown in Table 4. From the results shown in this Table 4, it could be observed that, addition of citric, ascorbic acids and their mixtures at all addition levels improved all values of determined organoleptic properties for all different date juice samples compared with control and the highest total score for all organoleptic properties values was present in juice sample contained 1% ascorbic acid (96), for this reason, it was selected the last juice sample for pasteurization, potassium sorbate treatments and microbiological examination.

Table 4: Organoleptic evaluation of zaghloul date juice as affected by acids addition

Sensory parameter	Control	Citric acid			Ascorbic acid			Mixture			LSD
		C1	C2	C3	A1	A2	A3	M1	M2	M3	0.05
Color (20)	14.7^{c}	19^{a}	18.5^{b}	18.2^{b}	18.5^{b}	119.2^{a}	18^{b}	19.2^{a}	18.6^{b}	17.3^{c}	1.29
Flavor (20)	15.6^{c}	18.7^{a}	18.4^{b}	18.1^{b}	18.3^{b}	19.5^{a}	17.7^{bc}	19^{a}	18.5^{b}	18^{b}	0.98
Taste (20)	14.2^{c}	19.2^{a}	18.7^{a}	18.4^{ab}	18.4^{ab}	119.3^{a}	17.9^{b}	19.5^{a}	18.1^{b}	17.1^{b}	1.33
Acceptability (40)	31.0^{c}	38.2^{a}	37.6^{a}	36.4^{b}	37.4^{a}	38^{a}	36.2^{b}	37.2^{a}	36.4^{b}	35.8^{b}	1.80
Total (100)	75.5	95.1	93.2	91.1	92.6	96.	89.8	94.9	91.6	88.2	

*Mean with the same letters in the same row is not significantly different, C1, C2 and C3: 0.5, 1 and 1.5% citric acid, A1, A2 and A3: 05, 1 and 1.5% ascorbic acid, M1, M2 and M3: Mixture from citric acid and ascorbic acid (1:1) {05, 1 and 1.5%}

Table 5: Microbiological of zaghloul date juice (log_{10} CFU mL^{-1})

Samples	Bacterial counts (Months)				Yeast and mold counts (Months)			
	0	2	4	6	0	2	4	6
Control	2.26	2.46	2.84	3.11	1.54	1.87	2.10	2.24
Pasteurized	0.30	0.47	0.47	0.47	ND*	0.30	0.47	0.47
P. sorbate	0.47	0.47	0.47	0.47	ND*	ND*	0.30	0.30

*ND: Not determined, All data in this table are average of two determinations. All processed date juice samples in this table were samples of date juice+ascorbic acid at level 1% which selected from the best results of organoleptic properties evaluation

The results indicated that, regarding to color, no significant differences were found between date juice samples contained 0.5 and 1% levels of different acids and their mixture used in this study. There was no significant differences for taste between juice samples treated with 0.5, 1% citric acid, 1% ascorbic acid and 0.5% mixture of citric and ascorbic acids (1:1). Between juice samples which had 1, 1.5% citric acid, 0.5% ascorbic acid and 1, 1.5% mixture of citric and ascorbic acids (1:1), no significant differences were found for flavor.

In regard to overall acceptability, the addition of citric acid alone to Zaghloul juice samples caused significant differences between levels 0.5, 1% and level 1.5%. the same results were obtained as ascorbic acid added alone at the last same addition levels where, addition mixture of citric and ascorbic acids (1:1) at levels 1 and 1.5% caused a significant differences between their samples and juice sample contained 0.5% of the same acids mixture. From these organoleptic properties results, the highest scores were 95.10, 96 and 94.90 for Zaghloul juice samples contained 0.5% citric acid, 1% ascorbic acid and 0.5% mixture of their acids, these samples were selected to evaluate the chemical changes of Zaghloul juice as affected by acids and storage periods and also measure the sensory evaluation of these samples through the same periods.

Quality examination of juice: International Quality Institutes evaluate food quality through quality criteria. Quality of juice products is generally assessed by sensory evaluation. The suitability of the product is assessed by chemical analysis and food wholesome is assessed by bacteriological analysis.

The results of the microbiological examination of prepared different Zaghloul date juice samples as shown in Table 5. From these results, the total counts of bacteria, yeast and mold were increased generally in Zaghloul date juice sample (control) at zero time which was increased gradually during the months of the storage period. Total bacterial counts were ranged from 2.26-3.11 log_{10} CFU mL^{-1}, total yeast and mold counts were ranged from 1.54-2.24 log_{10} CFU mL^{-1} for control date juice sample through the storage period.

Pasteurization process caused a reduction in total counts of bacteria (0.30 log_{10} CFU mL^{-1}) at zero storage period (6 months) and little increasing was observed in the same counts to 0.47 log_{10} CFU mL^{-1} during all the storage period. Yeast and mold counts not detected for date juice in zero storage period and were 0.30 log_{10} CFU mL^{-1} at the second month of the storage period. The same trend for the last results was noticed for the yeast and mold counts (0.47 and 0.47 log_{10} CFU mL^{-1}) during the 4th and 6th months respectively of the same storage period. Potassium sorbate treatment for Zaghloul date juice tend to the same results for total bacterial counts during all the storage period (0.47 log_{10} CFU mL^{-1}) similar to observed in results of pasteurized date juice. Not detect any counts of yeast and mold for date juice treated with potassium sorbate during zero and the 2nd months of the storage period but it was 0.30 log_{10} CFU mL^{-1} at the 4th and 6th months of the same period.

The reduction rate for total bacterial counts during the storage periods for date juice were ranged between 80.89-86.72% and between 79.20-84.89% for pasteurization

Table 6: Chemical changes of zaghloul juice as affected by acids and storage periods

Parameters	Storage periods (Months)	Treatments			
		Control	Citric acid C1	Ascorbic acid A2	Mixture M1 (1:1)
TS %	0	17.60±0.58	17.74±58	17..80±0.58	17.78±0.58
	2	17.55±0.58	17.72±0.15	17.80±0.15	17.78±0.15
	4	17.52±0.47	17.72±0.17	17.80±0.17	17.78±0.17
	6	17.50±0.61	17.70±0.54	17.78±0.54	17.76±0.54
Acidity ratio (%)	0	0..22±0.11	0.23±0.13	0.27±0.13	0.25±0.13
	2	0.22±0.13	0.23±0.12	0.27±0.13	0.25±0.13
	4	0.21±0.13	0.23±0.11	0.27±0.18	0.25±0.18
	6	0.20±0.13	0.24±0.11	0.26±0.12	0.24±0.11
pH	0	5.71±0.18	5.53±0.30	5.46±0.30	5.49±0.30
	2	5.71±0.22	5.53±0.19	5.46±0.23	5.49±0.18
	4	5.73±0.21	5.53±0.20	5.46±0.25	5.49±0.20
	6	5.75±0.24	5.51±0.22	5.45±0.23	5.47±0.23
Protein (%)	0	3.41±0.46	3.38±0.36	3.39±0.36	3.40±0.35
	2	3.40±.0.40	3.38±0.34	3.38±0.31	3.39±0.31
	4	3.38±0.32	3.36±0.32	3.38±0.36	3.37±0.38
	6	3.38±0.35	3.35±0.33	3.37±0.37	3.36±0.34
Red. sugar (%)	0	10.51±0..41	10.53±0.36	10.59±0.40	10.56±0.36
	2	10.53±0.38	10.55±0.35	10.59±0.38	10.57±0.35
	4	10.53±0.32	10.56±0.33	10.60±0.34	10.59±0.33
	6	10.56±0.34	10.57±0.38	10.62±0.36	10.60±0.31

Values represent the mean of triplicates±Standard Deviation. Mean with the same letters in the same row is not significantly different

process and potassium sorbate treatments respectively while, the same result for total yeast and mold counts through the storage periods for the same date juice were ranged from 77.62-83.96% and from 85.71-86.61% for the last treatments respectively. Fruit juice can be spoiled due to moulds, *lactobacillus, leuconostoc* and thermophilic *bacillus* are common spoilage microorganisms of orange juice[30,31] revealed, that the most common method used in food preservation being very effective against enzymes and microorganisms is Thermal treatment. These results are in agreement with those obtained with Gomez-Lopez *et al.*[31], Nguyen and Mittal [32], Mosqueda-Melgar *et al.*[33].

Effect of acids and storage periods on juice chemical changes: Chemical changes in zaghloul date juice that affected by acids and storage periods are presented in Table 6. The results showed that, addition of different acids such as 0.5% citric acid, 1% ascorbic acid and \0.5% mixture of their acids (1:1) to zaghloul date juice sample caused a little increasing in TS % values during the storage periods which were higher than their present in control sample and observed that, there was a little reduction in values of TS% as the storage periods increased and the highest values was found in zaghloul date juice contained 1% ascorbic acid which were 17.80, 17.80, 17.80 and 17.78% at 0, 2, 4 and 6 months, respectively during the storage periods. The same trend of the last results was observed in total acidity % values (as citric acid) where 1% ascorbic acid added trend to increased values of total acidity % to little increasing from the results of the control sample during the storage periods.

Results in the same table indicated that, pH values of zaghloul date juice samples were inversely proportional with acids added to them which it reduced from their values for control sample and pH values levels were more lower in date juice samples treated with 1% ascorbic acid than the samples contained other acids used in this investigation with noticed that, there was a reduction in pH values as the storage periods increased. These results are in agreement with those reported by Yu and Rupasinghe[26], Da Costa *et al.*[27]. They revealed that, no great changes present in values of TS%, values of total acidity ratio were increased and the pH values was decreased as the addition of different organic acids such as ascorbic and citric acids to orange and carrot juices.

Protein values present in the same table were reduced by very little reduction rate as any acid added at the same storage periods compared to their values of the control sample. There was no great change in values of reducing sugars % where, it caused a very little increasing when any kind of acids added at the same storage periods and observed the same trend for results was present as increasing the storage periods. These results are in agreement with those obtained by Da Costa *et al.*[27].

Sensory evaluation of zaghloul juice samples as affected by acids during storage periods: Sensory evaluation changes in Zaghloul date juice samples that affected by acids and storage

Table 7: Sensory evaluation of zaghloul juice samples as affected by acids during storage periods

Sensory parameters	Storage periods (month)	Control	Citric acid C1	Ascorbic acid A2	Mixture M1(1:1)	LSD 0.05
Color (20)	0	14.7^{c}	19^{ab}	19.2^{a}	19.2^{a}	0.21
	2	0^{c}	19^{ab}	19.2^{a}	19^{ab}	0.24
	4	0^{c}	18.8^{b}	19.2^{a}	19^{ab}	0.29
	6	0^{c}	18.8^{b}	19.2^{a}	19^{ab}	0.28
Flavor(40)	0	28.4^{c}	37.4^{bc}	39^{a}	38^{b}	0.91
	2	0^{c}	37.4^{bc}	39^{a}	38^{b}	0.93
	4	0^{c}	37.2^{bc}	39^{a}	38^{b}	0.92
	6	0^{c}	37.2^{bc}	39^{a}	38^{b}	0.94
Taste (40)	0	31.2^{c}	38.4^{ab}	39^{a}	38.2^{b}	0.75
	2	0^{c}	38.4^{ab}	39^{a}	38.2^{b}	0.80
	4	0^{c}	38.4^{ab}	39^{a}	38.2^{b}	0.78
	6	0^{c}	38.2^{ab}	39^{a}	38^{b}	0.92
Total (100)	0	74.3	94.8	97.2	95.4	
	2	0	94.8	97.2	95.2	
	4	0	94.4	97.2	95.2	
	6	0	94.2	97.2	95	

Values represent the mean of triplicates. Mean with the same letters in the same row is not significantly different ($p \leq 0.05$)

periods are presented in Table 7. Zaghloul juice quality includes all attributes that influence a product's value to the consumer. Sensory evaluation scores of control sample decreased significantly ($p \leq 0.05$) as the storage period advanced in comparison with acid juice samples that does not change appreciably. Addition of all acids to Zaghloul date juice samples increased all values of sensory parameters during storage periods compared to control. It was observed from results that, color, flavor and taste values for juice sample contained 1% ascorbic acid were higher than that of their values present in other juice samples contained 0.5% citric acid and 0.5% mixture (1:1) of citric and ascorbic acids also, the highest values of total score (97.2) was occurred in acidified juice sample with 1% ascorbic acid during the storage periods. Generally, there were significant differences $p \leq 0.05$ between all acids treatments of date juice samples and control sample for all determined sensory parameters except juice samples contained 0.5% citric acid for flavor characteristic. There was no significant differences regarding color between juice samples contained 0.5%. Citric acid and the other samples in this research except the control sample during 0 and 2 months of storage periods. The same observation was found for color property between juice samples treated with 0.5% mixture (1:1) of citric and ascorbic acids and the other juice samples contained only 0.5% citric acid and 1% ascorbic acid only during the storage periods. (4 and 6 months).

On the other hand data presented in the same table showed that, between juice samples contained 1% ascorbic acid and juice samples contained other acids (citric acid and mixture of citric and ascorbic acids) for flavor, there was no significant differences between them through the same storage periods. Moreover, no significant differences were detected regarding the taste between juice samples contained 0.5% citric acid and other samples treated with other acids used in this study for all storage periods. Accordingly, the juice samples exhibited higher sensory quality through the storage period, and a longer shelf life as well. These results are in agreement with those obtained by Da Costa *et al.*[34]. They evaluate the effect of oligofructose (prebiotic) or ascorbic acid supplementation on the viability of *Lactobacillus paracasei* ssp. *paracasei* probiotic culture, physicochemical characteristics and acceptance of orange juice during cold storage (4°C for 28 days). Juices with probiotic culture, ascorbic acid and/or oligofructose supplementation showed physicochemical characteristics, acceptance and storage stability similar to the pure juices.

CONCLUSION

Zaghloul Date juice was extracted from Zaghloul variety. Addition of different acids decreased pH and Birx/acidity ratio values. All color values of different date juices increased by acids used. 1% ascorbic acid improved the total score of organoleptic properties. A reduction in total bacterial, yeast and molds counts by pasteurization and potassium sorbate.

SIGNIFICANCE STATEMENT

The product of this study will suitable for Sports and patients with osteoporosis and pallor for long stretches of up to 6 months. Various acids addition will prevent juice oxidation and no change in color. It had no effect on physical characteristics and improved the sensory attributes of juice.

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