

Using of Siwi Date in Production of Some New Juices

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ABSTRACT

Siwi cultivar is the most important semi-dry date cultivars in Egypt, its khalal stage has low price and marketing value as a result of its short shelf-life. So, this work aims to utilize Siwi fruits at khalal stage in production of new juices (pure or mixed with pomegranate or cinnamon), as well as evaluate these new juices chemically, sensory and microbiologically during three months of storage at room temperature. The obtained results showed that, date juice blends with pomegranate or cinnamon had higher content of polyphenols, flavonoids, anthocyanins in comparison with pure date juice, whereas pomegranate led to decrease TSS, reducing and total sugars in opposite situation with cinnamon. Also, adding pomegranate or cinnamon led to improve the microbial quality of the produced juices comparing to pure date juice. Results of sensory evaluation demonstrated that all studied date juices are accepted organoleptically. These mentioned results proposed that, Siwi date fruits at khalal stage (separately or combined with pomegranate or cinnamon) could be used in production of new, delicious and nutritional juices.

Key words: Siwi date fruits, khalal stage, pomegranate, cinnamon and juices.

INTRODUCTION

Date palm fruit (*Phoenix dactylifera* L.) could be considered as one of the most important fruits in dry and semidry areas (Chao and Krueger, 2007). Egypt is the first universal producer of date fruits, with 1590414 ton (FAO, 2019), this production represents about 18% of the universal date production. Date fruits could be categorized to three types, dry, semi-dry and soft. The most common soft types in Egypt are Samani, Zaghloul, Hayani, Amhat, Bent- Aicha,...etc , whereas those of semi -dry dates are Siwi, Al-Amri, Al-Aglani, ...etc. and those of dry dates are Ebrimi, Barakawi, Sakouti,...etc (Youssef and Ramadan,1987). Tamar stage of Siwi date is the common processed stage either pitted or none pitted, while khalal stage has low price and marketing value as a result of its low shelf-life.

Developing new food products with high sensory acceptance as well as high nutritional value is stimulated by food market (Potter and Hotchkins,1996). New juices development (using two or more kinds of fruits to obtain a juice that possessed both the used fruits nutritional values as well as a pleasant taste), has been

encouraged by the food manufactures and consumers (Carvalho et al., 2007).

The important biological properties of pomegranate (*Punica granatum* L.) juice led to increase its popularity (Hyson, 2015). The health attributes of pomegranate fruits and by-products resulted in increasing their request recently (Schwartz. et al., 2009). Juice is one of pomegranate-derived products, which characterized by its high popularity between the super juice category, and is consumed all over the world as a result of its preferable flavor, aroma and color. Pomegranate healthy active nutrients with anticarcinogenic, antioxidants and antimicrobial activities could be utilized for human by consumption pomegranate juice (Al-Maiman and Ahmad, 2002; Waley et al., 2020).

Since ancient periods, the Egyptians and the Chinese have been used Cinnamon in foods and folk medicine (Elshafie, et al., 2012). Besides, its strong antibacterial, antioxidant, antipyretic (Lu et al.,2010) and anti-inflammatory properties, which have a great role in repairing tissues (Molania, et al., 2012).

Cinnamon bark is used as one of the common spices and in tea making as well as an oriental herbal medicine for treating common colds, chronic gastrointestinal, cardiovascular and gynecological disorders (Hong, et al., 2012). In same trend, it is used also, as a remedy for cough, indigestion, sore throats, abdominal cramps, nausea, intestinal spasms, diarrhea and flatulence. Moreover, cinnamon has been showed an antifungal activity and retards food spoilage (Elahi, 2012 and Saber, 2019).

So, this work aims to maximize utilization of Siwi fruits at khalal stage in production of new juices with high nutritional values using either pomegranate or cinnamon, as well as evaluation of these new juices chemically, sensory and microbiologically.

MATERIAL AND METHODS

Plant material and sampling:

- Date palm fruits of Siwi cultivar at khalal stage were harvested from Siwa Research Station orchard in Matrouh, Egypt, during 2017 season. The obtained date fruits were selected for symmetry in size, color and free of both microbial damage and defects and as soon as fruits arrival to the laboratory (within 3 h maximum) they were used.

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- Pomegranate fruits were purchased from local market in November 2017 in Cairo, Egypt.
- Cinnamon was purchased from local market in Cairo, Egypt.
- Chemicals and Solvents: were purchased from El-Gomhoria Co. Cairo, Egypt.

Juices preparation:

Date Juice:

The selected date fruits were cleaned, washed carefully and deseeded manually, then divided into five groups each consisting of 3kg.

Date juice was produced throughout two major stages; extraction and filtration as follow:

- The extraction process: Washed and deseeded date fruits were cut into pieces and blended in electric blender with boiled water (1:1 w/w) for 6min (2min intervals) then cold immediately.
- Filtration process: the cold extracted juice was filtered through muslin cloth and kept in polyethylene bags in deep freezer (-18C) till further use.

Pomegranate juice preparation:

Purchased Pomegranate fruits were washed and cut into pieces and arils were separated. These arils were blended in electric blender with tap water (2:1 w/w) for 4min (2min intervals) for extraction of juice, then filtered through muslin cloth and kept in polyethylene bags in deep freezer (-18C) till further use.

Cinnamon preparation:

The extract of cinnamon was made as described by Safithri and Fahma (2008). A total of 10 g of cinnamon powder was put into 100 mL of distilled water (1:10), then boiled in a closed-container for 15 minutes. The sample was filtered by using Muslin cloth, and the volume of resulted filtrate was measured. The distilled

water was added to filtrate until the volume was 100 mL in total. The obtained solution was called the stock solution and then stored at -18°C till further use.

New juices formulations:

Date juice was used for production of five new juices (2 L for each) as presented in table 1.

All mentioned new date juices were pasteurized at 85°C for 10 min, then the pasteurized date juices were hot filled in cleaned and sterilized glass bottles (125 ml) and kept at room temperature for three months

Assessment of quality parameters

All previous new date juices were evaluated chemically and microbiologically at zero time, after one, two and three months, while sensory evaluation was achieved at zero time only.

Total soluble solids (TSS):

Brix values (TSS) of all studied juice blends were measured by digital refractometer (DR 6000, A. Kruss Optronic GmbH, Hamburg, Germany).

Total and reducing sugars:

Lane and Eynon method that described in AOAC, (2012), was used to determine total and reducing sugars.

Acidity:

Titrate acidity (as citric acid %) was measured as follow: 10 ml of juice sample was taken in a 250 ml beaker and 50 ml water were added into the beaker, then some drops of phenolphthalein indicator were added before titration using 0.1 N sodium hydroxide (AOAC, 2012).

pH value:

pH value was measured using a Systronic 324-combination glass electrode pH meter at 25°C.

Table 1. the formula of new Siwi date juice blends

	Date juice (%)	Pomegranate juice (%)	Cinnamon stock solution (ml)	Citric acid (%) *	Guar gum (%) *
Pure date juice	100	-	-	0.3	0.125
Date-cinnamon juice (98.75:1.25%)	98.75	-	12.5	0.3	0.125
Date-cinnamon juice (97.5:2.5%)	97.5	-	25	0.3	0.125
Date-pomegranate juice (75:25)	75	25	-	0.3	0.125
Date-pomegranate juice (50:50)	50	50	-	0.3	0.125

* Citric acid and Guar gum were added by the same ratios for 100 ml of each juice blend.

Total polyphenols:

Folin-Ciocalteu method was used to determine total polyphenol content (TPC) by recording the absorbance at 765 nm (UV-Vis spectrophotometer, Jenway, Staffordshire, UK), (Gao et al., 2000). Total phenol content was expressed as gallic acid equivalents in mg/L.

Total Flavonoids Content:

Flavonoids content was measured by the method described by Yoo et al., 2008. Where the absorption at 510 nm, was read. Levels of total flavonoid content (mg/L) were expressed as quercetin equivalents.

Total Anthocyanins Content:

Total anthocyanin contents were measured by a spectrophotometric pH differential protocol reported by Giusti and Wrolstad, 2001. 0.5 mL of each juice was blended with 3.5 mL of both of KCl buffer (0.025 M, pH 1) and sodium acetate buffer (0.025 M, pH 4.5). The absorbance of each mixture was read after 15 min, at 510 and 700 nm. Results are expressed as mg of cyanidin 3-glucoside equivalents/L.

Determination of total viable count (TVC):

Total viable count was achieved as described by Frazier (1976), 1ml of studied juices was added to 9 ml of ringer's solution into a sterile test tube, the sample was blended thoroughly by mixing to prepare 10 serial dilutions. Three sterile petri-dishes were inoculated by each dilution then slight layer of nutrient agar was added. The inoculated petri-dishes were gently shaken and left to harden and then incubated for 24 hours on 37°C. After incubation period the colonies number were recorded and expressed as cfu /ml. of date juice.

Yeast and mold enumeration:

Yeast and mold counts were determined using the plate counts technique on potato dextrose agar (PDA) according to procedures by A.P.H.A (1976) and Difco (1984). The plates were kept 3 days at 28 °C.

Sensory evaluation:

Sensory quality of the new date juices was evaluated by 15 panelists from the staff of Agri-Industrialization Unit, Desert Research Center. Panelists were asked to evaluate appearance, color, taste, odor, viscosity, sweetness, acidity and over all acceptability, using seven points hedonic scale with corresponding descriptive terms ranging from 7 'like extremely' to 1 'dislike extremely'.

Statistical analysis:

A completely randomized experimental design was selected to define the treatments effect. All determinations were carried out in triplicate and data

was reported as mean. Significant differences ($p < 0.05$) were calculated using Duncan multiple rang tests, followed the method reported by Steel and Torrie (1980).

RESULTS AND DISCUSSION

The Total soluble solids (TSS), reducing sugars and total sugars of the studied date juice blends at zero time and during 3 months of storage at room temperature were determined and the obtained data were presented in Table 2.

The tabulated data in Table (2), illustrated that, all studied juice blends recorded an increase in TSS by increasing the storage period, this increase reached the highest value after 3 months of storage at room temperature for each juice separately. This increment could be attributed to the transformation of some insoluble components (such protopectin) into soluble components (such pectin), Thompson and Abboodi (2003).

Also, increasing cinnamon concentration from 1.25 to 2.5% led to slight insignificant increase in TSS (from 19.2 to 19.4%), while the opposite situation was observed by increasing pomegranate concentration from 25 to 50% which led to insignificant decrease in TSS from 18.9 to 18.6%.

These findings were in accordance with those of Rani et al., 2018, who found that, TSS of Mandarin and Strawberry mixed fruit juice samples increased by increasing storage period till 90 days at room temperature.

Sugars act as natural preservative in some food products. In the same time sugars (which considered the most important fruit component) give some food products their characterized flavor.

Results in Table 2, showed that, the progress of storage period resulted in an increase in reducing sugars for all studied juice mixtures, this increase reached maximum value after 3 months of storage at room temperature for each juice sample separately. The reducing sugars increment could be attributed to transformation of sucrose to glucose and fructose (reducing sugars), as a result of storage period and temperature as well as natural acids. Shakoore et al., 2013

Also, increasing cinnamon and pomegranate ratios led to decrease reducing sugars from 13.5 to 13.2%, and from 12.5 to 12.1%, respectively.

Table 2. Total soluble solids, reducing sugars and total sugars of date juice blends during three months of storage at room temperature

TSS				
	Zero time	30 days	60 days	90 days
Date juice	18.3 ^{cC}	19.1 ^{dB}	19.1 ^{dB}	19.5 ^{cA}
Cinnamon 1.25 %	19.2 ^{abD}	19.8 ^{aC}	20.1 ^{bB}	20.3 ^{bA}
Cinnamon 2.5 %	19.4 ^{aD}	19.6 ^{bC}	20.3 ^{aB}	20.6 ^{aA}
Pomegranate 25%	18.9 ^{bD}	19.4 ^{cC}	19.8 ^{cB}	20.2 ^{bA}
Pomegranate 50 %	18.6 ^{bD}	19.3 ^{cC}	19.8 ^{cB}	20.3 ^{bA}
Reducing sugars				
Date juice	12.7 ^{eB}	13.0 ^{bB}	13.4 ^{cA}	13.6 ^{cA}
Cinnamon 1.25 %	13.5 ^{aC}	13.8 ^{aB}	14.1 ^{aA}	14.3 ^{aA}
Cinnamon 2.5 %	13.2 ^{bD}	13.5 ^{aC}	13.8 ^{bB}	14.1 ^{bA}
Pomegranate 25%	12.5 ^{cD}	12.9 ^{bcC}	13.2 ^{cB}	13.5 ^{cA}
Pomegranate 50 %	12.1 ^{dC}	12.6 ^{cB}	12.8 ^{dB}	13.2 ^{dA}
Total sugars				
Date juice	15.5 ^{bD}	15.9 ^{cC}	16.1 ^{cB}	16.4 ^{bA}
Cinnamon 1.25 %	16.1 ^{aD}	16.5 ^{aC}	16.8 ^{aB}	17.0 ^{aA}
Cinnamon 2.5 %	15.9 ^{aD}	16.2 ^{bC}	16.6 ^{bB}	17.0 ^{aA}
Pomegranate 25%	15.6 ^{bD}	15.8 ^{cC}	16.2 ^{cB}	16.5 ^{bA}
Pomegranate 50 %	15.2 ^{cD}	15.3 ^{dC}	15.7 ^{dB}	16.2 ^{cA}

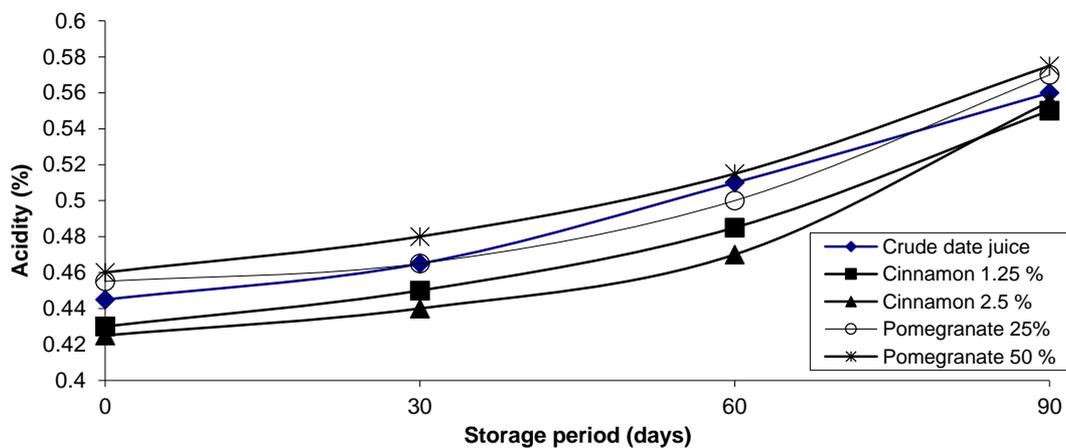
Values bearing the same superscript (capital letters) within the same row are not significantly different ($P \leq 0.05$)

Values bearing the same superscript (small letters) within the same column are not significantly different ($P \leq 0.05$)

Also, increasing cinnamon and pomegranate ratios led to insignificant reduction in total sugars for cinnamon blends, whereas significant reduction was recorded for pomegranate blends at zero time (from 15.6 to 15.2%).

The previous results were in accordance with those obtained by Sunil et al., (2011), who found that both

reducing and total sugar contents increased during refrigerated storage of Nagpur mandarin for six months. They mentioned that, the total sugars increment could be attributed to the degradation of polysaccharides such starch, cellulose and pectin and their transformation into simple sugars.

**Fig.1. Acidity (%) of Date juice blends during three months of storage at room temperature**

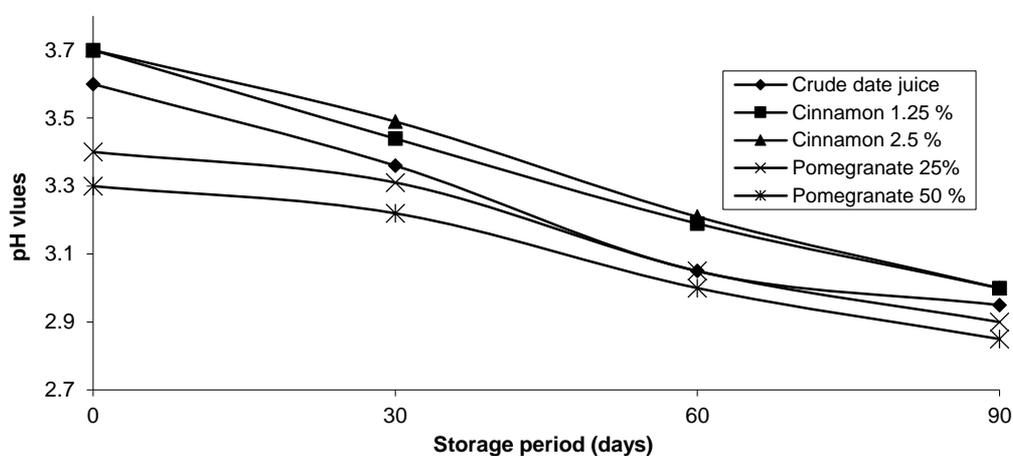


Fig.2. pH values of Date juice blends during three months of storage at room temperature

Results of Acidity (%) and pH that presented in fig. (1) and fig. (2), showed that, the highest acidity and the lowest pH value at zero time were recorded for the juice blend consisted of 50%: 50% (pomegranate juice and date juice) followed by the juice blend consisted of 25% pomegranate juice and 75 % date juice. This may be due to the organic acids that naturally present in pomegranate juice.

From the previous data, it could be noticed that, the progress of storage period the higher of acidity and the lower of pH value for all studied date juices. These findings are in complete agreement with Saeed *et al.*, (2010), who found that, there was an increase in acidity and decrease in pH during storage of mango pulp at room temperature for three months. This may be due to acids formation as a result of polysaccharides breakdown and reducing sugars oxidation or by degradation of pectic substances and uronic acid (Hussain *et al.*, 2008).

The presented data in table (3), demonstrated obviously that, blending date juice with cinnamon or pomegranate led to improve its contents of polyphenols, flavonoids and anthocyanins. This improvement increased by increasing the level of cinnamon or pomegranate, but the highest effect was recorded for 50% pomegranate juice (630, 155 and 85 mg/100 ml juice, respectively)

From the same table, it could be noticed that, extending the storage period till three months resulted in degradation of flavonoids and anthocyanins for all

studied date juice blends, while polyphenols recorded fluctuation trend, this might be due to the formation of some compounds during storage that were able to react with the Folin-Ciocalteu and then enhance the amount of this antioxidant. The common method for assessment of total polyphenol content is Folin-Ciocalteu's method; although, Folin-Ciocalteu's reagent is nonspecific, where the presence of ascorbic acid, organic acids, aromatic amines, Sulphur dioxide, reducing sugars and other components that found naturally in fruit juices, obtained unstable results Castro-López *et al.*, (2016).

These findings were in accordance with those of Urszula *et al.*, (2017), who found that, flavonoids, underwent significant breakdown during storage of the raspberry juices and syrups. They also illustrated that, anthocyanins significantly decreased in all studied samples during five-months of storage.

Concerning the microbiological quality of the studied date juice blends, total bacterial count and mold and yeast counts were evaluated and the obtained results were presented in fig (3) and fig (4).

From the presented data, it could be observed that, either pomegranate or cinnamon treatments led to improve the microbial quality of the produced juice blends (during storage period) by reducing both of total bacterial count and mold and yeast count comparing to pure date juice. But the highest positive effect was recorded for date pomegranate juice blend (50%: 50%). These could be due to the higher content of total polyphenols and flavonoids.

Table 3. Polyphenols, Flavonoids and Anthocyanins contents (mg/100 ml) of date fruit juices during three months of storage at room temperature

Polyphenols (mg/100ml)				
	Zero time	30 days	60 days	90 days
Date juice	380 ^{dA}	365 ^{dB}	375 ^{dA}	360 ^{dB}
Cinnamon 1.25 %	480 ^{cA}	470 ^{cBC}	475 ^{cAB}	465 ^{cC}
Cinnamon 2.5 %	530 ^{bB}	535 ^{bA}	515 ^{bcD}	525 ^{bC}
Pomegranate 25%	540 ^{bB}	530 ^{bC}	550 ^{bA}	525 ^{dB}
Pomegranate 50 %	630 ^{aA}	625 ^{aA}	640 ^{aA}	620 ^{aA}
Flavonoids (mg/100ml)				
	95 ^{dA}	85 ^{dB}	80 ^{eB}	60 ^{eC}
Date juice	95 ^{dA}	85 ^{dB}	80 ^{eB}	60 ^{eC}
Cinnamon 1.25 %	115 ^{cA}	110 ^{cA}	95 ^{dB}	80 ^{dC}
Cinnamon 2.5 %	130 ^{bA}	120 ^{bB}	110 ^{bC}	95 ^{bD}
Pomegranate 25%	135 ^{bA}	120 ^{bB}	105 ^{cC}	85 ^{cD}
Pomegranate 50 %	155 ^{aA}	150 ^{aB}	135 ^{aC}	125 ^{aD}
Anthocyanins (mg/100ml)				
	25 ^{eA}	20 ^{eB}	12 ^{eC}	8 ^{dD}
Date juice	25 ^{eA}	20 ^{eB}	12 ^{eC}	8 ^{dD}
Cinnamon 1.25 %	50 ^{dA}	40 ^{dB}	35 ^{dC}	25 ^{cD}
Cinnamon 2.5 %	60 ^{cA}	55 ^{cB}	45 ^{cC}	40 ^{bD}
Pomegranate 25%	75 ^{bA}	60 ^{bB}	55 ^{bC}	42 ^{bD}
Pomegranate 50 %	85 ^{aA}	75 ^{aB}	60 ^{aC}	47 ^{aD}

Values bearing the same superscript (capital letters) within the same row are not significantly different ($P \leq 0.05$)

Values bearing the same superscript (small letters) within the same column are not significantly different ($P \leq 0.05$)

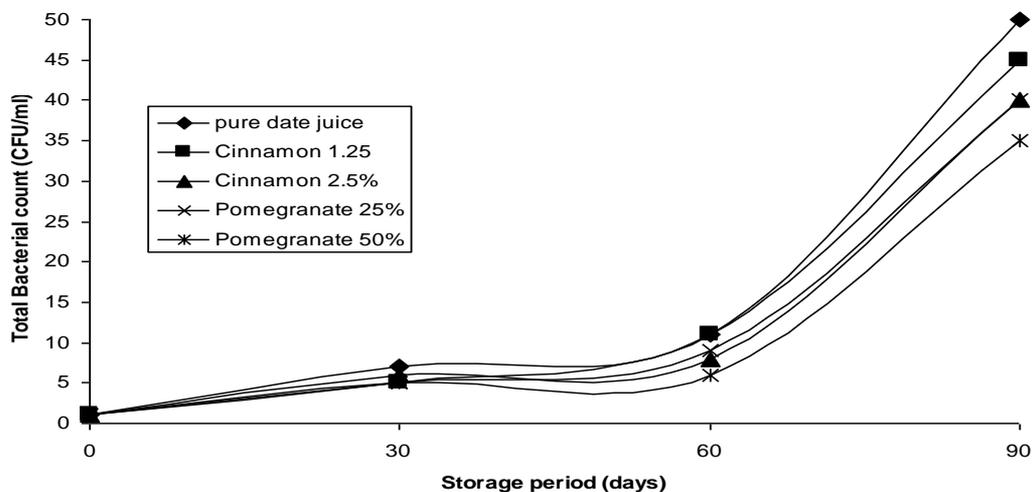


Fig.3. Total Bacterial count (cfu/ml)*10² of Date juice blends during three months of storage at room temperature

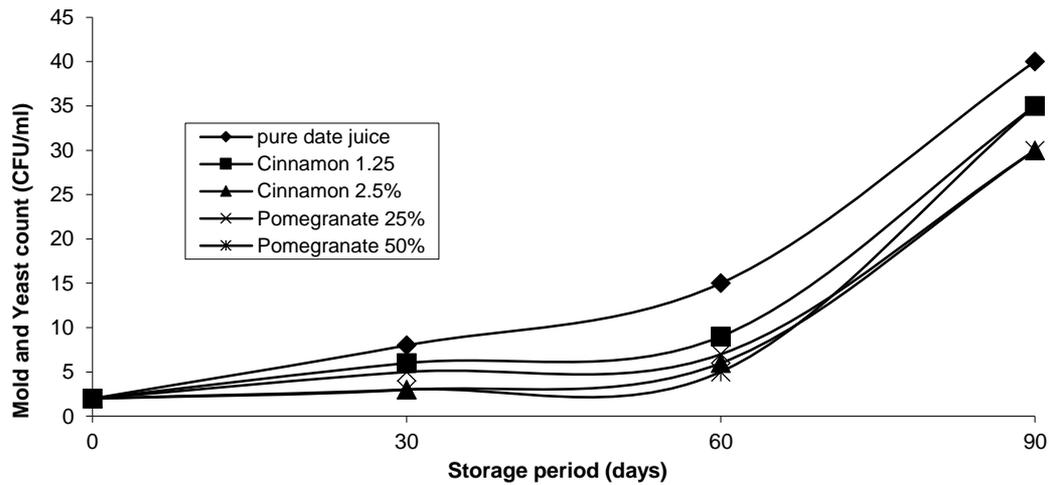


Fig. 4. Mold and Yeast count (cfu/ml)*102 of date juice blends during three months of storage at room temperature

Also, the mentioned data, indicated that, all studied date juice blends had acceptable microbial quality where, total aerobic bacterial counts were used as indicators of quality and counts $>10^4$ cfu/ml can provide useful information about the general quality and remaining shelf life of the cooked food in question. Where the upper acceptable limit of total aerobic counts is 10^4 cfu/ml (Center for Food Safety, 2014).

Sensory evaluation of date juice blends was carried out and the results were tabulated in table (4). The mentioned data in table (4), illustrated that, all studied samples were sensorial accepted (there was no value below 4). The previous data showed obviously that, all

studied blends led to improve the appearance, color, sweetness and acidity comparing with pure date juice sample which recorded the lowest values (5.28, 5.13, 5.07 and 4.68, respectively). While the lowest values of taste, odor, viscosity and over all acceptability were recorded for date pomegranate blend (50%:50%). On the other hand, the highest scores of appearances, color, taste, viscosity and over all acceptability (6.02, 5.88, 5.63, 5.39 and 5.84, respectively) were recorded for date cinnamon blend (98.75:1.25%), while the highest scores of odor and sweetness (5.73 and 5.57, respectively) were recorded for date cinnamon blend (97.5:2.5%).

Table 4. Sensory Evaluation of fresh date fruit juices

	Appearance	Color	Taste	Odor	Viscosity	Sweetness	Acidity	Over all acceptability
Pure Date juice	5.28 ^d	5.13 ^e	5.18 ^c	5.24 ^c	5.18 ^{ab}	5.07 ^c	4.68 ^c	5.44 ^b
Cinnamon 1.25 %	6.02 ^a	5.88 ^a	5.63 ^a	5.68 ^a	5.39 ^a	5.47 ^{ab}	4.75 ^c	5.84 ^a
Cinnamon 2.5 %	5.39 ^{cd}	5.44 ^c	5.57 ^a	5.73 ^a	5.15 ^{ab}	5.57 ^a	4.89 ^b	5.78 ^a
Pomegranate 25%	5.71 ^b	5.57 ^b	5.34 ^b	5.50 ^b	5.05 ^b	5.18 ^c	5.28 ^a	5.50 ^b
Pomegranate 50 %	5.52 ^c	5.33 ^d	4.86 ^d	5.13 ^c	4.94 ^b	5.38 ^b	5.31 ^a	5.36 ^b

Values bearing the same superscript within the same column are not significantly different ($P \leq 0.05$)

CONCLUSION

Using Siwi fruits at khalal stage in production of new juices (mixed with pomegranate or cinnamon), led to produce date juice blends with higher content of polyphenols, flavonoids, anthocyanins in comparison with pure date juice, whereas pomegranate led to decrease TSS, Reducing and total sugars in opposite situation with cinnamon. Also, adding pomegranate or cinnamon resulted in improving the microbial quality of the produced juices comparing to pure date juice. Sensory evaluation demonstrated that all studied date juices were accepted organoleptically. From the mentioned results it could be concluded that, Siwi date fruits at khalal stage (separately or combined with pomegranate or cinnamon) could be used in production of new, delicious and nutritional juices.

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الملخص العربي

استخدام التمر السيوي في إنتاج بعض العصائر الجديدة

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المواد الصلبة الذائبة الكلية والسكريات المختزلة والكلية وذلك على عكس القرفة . كذلك فإن إضافة الرمان أو القرفة أدى إلى تحسين الجودة الميكروبية للعصائر الناتجة مقارنة بعصير البلح الخالص. ولقد أوضحت نتائج التقييم الحسي أن كل العصائر تحت الدراسة كانت مقبولة حسيًا. ولقد أظهرت النتائج المشار إليها أن ثمار التمر السيوي في مرحلة الخلال (سواء منفردة أو مخلوطة مع الرمان أو القرفة) يمكن استخدامها في إنتاج عصائر جديدة ولذيذة ومغذية.

الكلمات المفتاحية: ثمار التمر السيوي، مرحلة الخلال، الرمان، القرفة، العصائر.

يعتبر صنف التمر السيوي أهم صنف في التمور النصف جافة في مصر، وفي مرحلة الخلال تكون ثماره منخفضة السعر والقيمة التسويقية كنتيجة لقصر عمرها . لذلك فإن هذا العمل يهدف إلى الإستفادة من ثمار السيوي في مرحلة الخلال في إنتاج عصائر جديدة (منفردة أو مخلوطة مع الرمان أو القرفة) إلى جانب تقييم هذه العصائر الجديدة كيميائياً وحسياً وميكروبيولوجياً خلال ثلاث شهور من التخزين على درجة حرارة الغرفة. ولقد أظهرت النتائج أن مخاليط عصير البلح مع الرمان أو القرفة كانت أعلى في محتواها من البولي فينولات والفلافونيدات والأنثوسيانين مقارنة مع عصير البلح الخالص، بينما أدت إضافة الرمان إلى انخفاض كلا من