Physiochemical Properties of Nectar Prepared From Nectarine Juice with Different Ratios of Date Syrup

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Abstract: This study aimed to produce nectar prepared with nectarine juice and partially replacement of sucrose with date syrup using five different portions T1 (100% sucrose), T2 (75% sucrose + 25% date syrup), T3 (50% sucrose + 50% date syrup), T4 (25% sucrose + 75% date syrup) and T5 (100% date syrup) in the preparation of nectar samples. Physicochemical constituents and sensory characteristics were determined for date syrup, nectarine juice and prepared nectar samples. Date syrup contained 16% moisture content, 6.8% ash, 1.98% fat, 0.83% protein and 79.70% total sugars, while the nectarine juice contained 86.8% moisture content, 0.80% ash, 0.50% fat, 0.50% protein and9.86 % total sugars. On the other hand total solids, total soluble solids, total titratable acidity and pH values were 84%, 80%, 0.18%and 6.11 in date syrup and 13.2%, 10.5%, 0.39% and 4.14% in nectarine juice, respectively. The total acidity of nectar samples decreased with increasing ratios of date syrup. On the other hand, total phenolic compounds (mg gallic acid/ 100g F.W.), purity and ash content increased gradually with increasing the partial replacement of sucrose with date syrup in nectar samples. The color parameters were evaluated with hunter lab. and sensory attributes of nectar samples, indicated that, nectar prepared from T2 (25% date syrup + 75% sucrose), T3 (50% date syrup + 50% sucrose) had the highest organoleptic score followed by T1 (100% sucrose), T4 (75% date syrup + 25% sucrose) and T5 (100% date syrup respectively.
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Key Word: Date syrup – Nectarine fruits – Siwi dates – Fruit juice - *Rosaceae* family - Nectar.

1. Introduction

In many Arabic countries (especially in Egypt) date palm (*Phoenix dactylifera L.*) plays an important social environmental and economical role because it constitutes the principal financial and food sources for oasis cultivators and it contributes to the development of subjacent cultures. Low quality date cultivation occupies about 60 % of the total plantation. These dates are poor in size and taste, unsuitable for consumption, and usually sold for animal feeding at reduced prices. The presence of high sugar content in these low quality varieties makes them suitable for industrial use, and thus a wide range of products can be produced from these dates **(Al- Farsi, 2003).**

Date syrup (locally named Dibis) is probably the most common date product. It is produced in two different ways: either at domestic or village level by extraction and boiling down of the juice, or on a semi or full industrial scale. The process consists of extraction, clarification and concentration of the date juice. Date syrup is thick- dark brown syrup. Glucose and fructose are the major sugars presented in date syrup and total sugars contents reached 88 %. Date syrup contains in addition to sugar, macro and micro elements which may play important role of considering the date syrup as rich nourishment (**Al-Khateeb, 2008 and Al- Hooti, *et al.*, 2002).**

The dates and the date syrup are used for human consumption, in bakery and ice-cream products, and for the production of caramel color, ethanol, vinegar and single cell protein. Because of the high concentration of sugars in date, it is important to develop new and more attractive uses of these sugars **(Roukas and Kotzekidou, 1997).**

Sugars, organic acids, phenolic compounds and carotenoids are natural components of many fruits and vegetables, play important roles in maintaining fruit quality and determining their nutritive value. Therefore, food analysts have been interested in the amounts of the various chemical components and the changes occurring in the edible parts of fruits, because of their impact on the shelf life, technological and nutritive quality of the food product **(Glew, et. al., 2003).**

Nectarines, like peaches, belong to *Rosaceae* family. In fact, the nectarine is a peach with recessive genes that in fuzz less fruit **(Hanaa, *et al.*, 2009). Len- Chi Wen, *et al.* (1995)** reported that, there were differences between peaches and nectarines that extend beyond the lack of fuzz. These differences include fruit size, shape, firmness, external color, aroma and flavor. Nectarine fruit, which can be yellow or white fleshed, have smooth skin, a distinctive flavor and texture, and are usually smaller. Furthermore, **Rokba (2006)** mentioned that, nectarine

produced good crops under climatic conditions of Egypt so it is adapted to warm winter of Egypt.

The present investigation aimed to substitute sugar (sucrose) with date syrup (dibis) by different ratios in nectarine juices, and to evaluate the juices by determining some physiochemical and organoleptic properties in nectarine blends.

2. Materials and Methods

Materials:

1- Nectarine fruits *(Persica nucipersica*) were obtained from the Horticultural Research Inst., Agric., Res. Center, Giza, Egypt at season 2010.
2- Date fruits (*Phoenix dactylifera L.*) were obtained from Esna city at Qena region of Upper Egypt at season 2010.
3- Sucrose was purchased from local market.
4- All chemicals were purchased from El-Gomhoria Co. at Cairo, Egypt.

Methods:

Preparation of date syrup (dibis):

Siwi dates (semi dried dates) were washed with water and pressed in a double- Jacketed container at 50° C for two weeks. The collected date syrup (dibis) was cooled to room temperature, packed in plastic container, and then stored under frozen conditions until using.

Preparation of nectarine juice:

Nectarine fruits were washed and cut into two portions to get rid of kernel. Then, homogenized with a small amount of water in an electric mixer and screened through a 1.0 mm mesh screen. Each 100ml of prepared nectar contain 0.2% citric acid, 2% carboxy methyl cellulose, 0.1% sodium sorbate and adjusted the total solids to 18% by the different ratios of (date syrup to: sucrose)as presented in Table(1) . Nectars were filled in white glass bottles closed tightly, pasteurized at 85 C for 20 min. Then cooled and stored.

Table (1): The proportion of date syrup to sucrose in nectar samples

Treatment	Date syrup %	Sucrose %
T1 (Control)	0	100
T2	25	75
T3	50	50
T4	75	25
T5	100	0

Methods of analysis:

Chemical and functional properties:

The titratable acidity (results were expressed as percentage of malic acid on fresh weight basis), ash content, minerals analyses were determined according to **A.O.A.C. (2005).** While, total sugars were determined according to **Smogy (1952) and Nelson, (1974).** Total phenolics were determined colorimetric ally using Folin-ciocalteau reagent as described by **Al- Farsi, *et al.* (2005b).** The concentrations are expressed as mg of gallic acid equivalents / 100g of fresh weight.

Color values:

Color values were measured with Minolta Chroma Meter (CM- 3600d, Minolta, and Ramsey, NJ) (**Ruiz, *et al.*, 2005**). The measurements were displayed in "L", "a" and "b" values. Chroma "C" and hue angle "h" were calculated by using the following equation:

$$\text{Chroma} = \sqrt{a^2 + b^2} \qquad \text{hue} = \arctan(b/a)$$

Purity:

Percentage of purity was calculated according to the following equation as described by **Mathlouthi and Reiser (1995)**

Purity (%) = (total sugars / T.S.S.) x 100

Sensory evaluation

Sensory evaluation was carried out by ten panelists of nectar samples partial replacement of sucrose with date syrup using five different portions T1 (100% sucrose), T2 (75% sucrose + 25% date syrup), T3 (50% sucrose + 50% date syrup), T4 (25% sucrose + 75% date syrup) and T5 (100% date syrup) at using the method described by (**Reitmeier and Nonnecke 1991).**

Statistical methods

Data were statistically analyzed to facilitate comparing the least significant differences (LSD) between means of different values according to (**Snedecor and Cochran (1973)**.

3. Results and Discussion

Some physiochemical properties of date syrup (dibis) and nectarine juice

Chemical constituents of date syrup and nectarine juice are presented in Table (2). It could be noticed that, date syrup contained 16% moisture content, 6.8% ash, 1.98% fat, 0.83% protein, and 79.70% total sugars, while the nectarine juice contained 86.8% moisture content, 0.80% ash, 0.50% fat, 0.50% protein, and9.86 % total sugar. On the other hand, total solids, total soluble solids, total titratable acidity and pH values were 84%, 80%, 0.18% and 6.11 in date syrup and 13.2%, 10.5%, 0.39% and 4.14 in nectarine juice, respectively. While ascorbic acid, sodium, potassium, magnesium and calcium in date syrup were 3.2, 13.0, 202.8, 7.8,143 and 338mg/100g. However the corresponding values in nectarine juice were 9.20, 3.5, 24.2, 2.4, 11.0 and 8.0 respectively.

Table (2): Physiochemical properties of date syrup and nectarine juice

Components (%)	Date syrup	Nectarine juice
Moisture content	16	86.8
Ash content	6.8	0.80
Total solids on dry weight	84.0	13.2
T.S.S	80	10.5
pH values	6.11	4.14
Total acidity	0.18	0.39
Total sugars	79.70	9.86
Total proteins (as N)	0.83	0.50
Total lipids (fats)	1.98	0.50
Ascorbic acid (mg/100 g)	3.2	9.20
Sodium (mg/100 g)	13	3.5
Potassium (mg/100 g)	202.8	24.4
Iron (mg/100 g)	7.8	2.4
Magnesium (mg/100 g)	143	11.0
Calcium (mg/100 g)	338	8.0

Chemical and functional properties of nectar samples:

Analytical results pertaining to proximate composition of the tested nectars are presented in Table (3). The study revealed partial variations in ash content between T1 (100% sucrose) and the others. Acid content of fruits is important quality parameter and a key determination of fruit taste. Acids also serve as food constituents and required by the body in minute quantities. Their basic role is to main acid base balance in the body fluid systems **(Hasib, *et al.*, 2002).** The acidity was decreased with increasing ratios of date syrup in nectar samples. The variation in acid content in terms of malic acid on fresh weight basis ranged between 0.30% T1(100% sucrose) and 0.29, 0.27, 0.23, 0.21% for T2 (75% sucrose + 25% date syrup), T3 (50% sucrose + 50% date syrup), T4 (25% sucrose + 75% date syrup) and T5 (100% date syrup) respectively. On the other side, **Khalil (1995)** dimensioned that, acidity content of the data syrup was 0.17%. Total phenolic compounds (mg gallic acid/ 100g F.W.) increased gradually with increasing the partial replacement of sucrose with date syrup. The phenolics compound of nectar samples were 310.28, 331.15, 339.59, 421.65 and 456.00 for nectar samples prepared with T1 (100% sucrose), T2 (75% sucrose + 25% date syrup), T3 (50% sucrose + 50% date syrup), T4 (25% sucrose + 75% date syrup) and T5 (100% date syrup) respectively.

Purity of nectar samples were increasing with increased the partial replacement of sucrose with date syrup, the purity of nectar samples were 99.33, 99.11,98.72,99.17 and 99.06 for nectar samples with T1 (100% sucrose), T2 (75% sucrose + 25% date syrup), T3 (50% sucrose + 50% date syrup), T4 (25% sucrose + 75% date syrup) and T5 (100% date syrup) respectively. Ash content of nectar samples were gradual increasing increased the partial replacement of sucrose with date syrup, the ash content of nectar samples were 0.66, 0.77,0.91,0.95 and 1.07 for nectar samples with T1 (100% sucrose), T2 (75% sucrose + 25% date syrup), T3 (50% sucrose + 50% date syrup), T4 (25% sucrose + 75% date syrup) and T5 (100% date syrup) respectively.

Significant varietal differences existed in mineral composition of nectarine blends sample (Table3). Me and Zn elements were present in small amounts and were considered as micro elements, while Mg, Na, K, Fe and Ca levels were considerably higher and were considered as macro elements.

Table (3): Chemical and Functional properties of nectar samples

Components	Control T1	Nectar with date syrup from Siwi dates			
		75%sucrose + 25% date syrup	50% sucrose + 50% date syrup	25% sucrose + 75% date syrup	100% date syrup
		T2	T3	T4	T5
Total acidity (as % malic acid)	0.30	0.29	0.27	0.23	0.21
Total phenols (as gallic acid / 100g)	310.28	331.15	399.59	421.65	456.00
Purity (%)	99.33	99.11	98.72	99.17	99.06
Total sugars (%)	17.88	17.84	17.77	17.85	17.83
Ash (%)	0.66	0.77	0.91	0.95	1.07
Minerals (mg / 100g)					
Magnesium (Mg)	2.341	2.948	3.027	4.198	4.992
Sodium (Na)	2.301	2.377	2.475	2.529	2.648
Potassium (K)	4.238	5.252	6.594	7.313	7.793
Manganese (Mn)	0.301	0.320	0.375	0.393	0.396
Iron (Fe)	1.041	1.480	1.722	2.624	2.854
Calcium (Ca)	3.318	3.382	4.514	4.610	4.808

Color values

The Hunter color parameters L, a and b have been widely used to describe color changes during processing of nectarine juices. The color variables have been related to the type and quantities of some components presented in foods **(Sass-Kiss, *et al*., 2005).** Color values of control juice and modified nectar samples are reported in Table (4). Lightness factors, "L" for the control samples T1 (100% sucrose) was 32.19, while the nectar prepared with date syrup were ranged from 37.65, 38.18, 36.99 and 27.13 for nectar prepared with T2 (75% sucrose + 25% date syrup), T3 (50% sucrose + 50% date syrup), T4 (25% sucrose + 75% date syrup) and T5 (100% date syrup), respectively. The "a" value, which represents the green-red spectrum with a range from -60 (green) to +60 (red), was 6.027 in T5, while it was lower in T1 (100% sucrose),T3 (50% sucrose + 50% date syrup) and T4 (25% sucrose + 75% date syrup), it was 1.740, 1.137 and 2.237, respectively. The "b" values which represents the blue-yellow spectrum with a range from -60 (blue) to +60 (yellow), were found to be considerably higher in T2(75% sucrose + 25% date syrup) and T3(50% sucrose + 50% date syrup), it was 31.55 and 32.39, respectively. The "c" (chroma) value, which changes from 0 (dull) to 60 (vivid), in general, was higher in T2(75% sucrose + 25% date syrup) and T5(100% date syrup). Hue angle (h°) is expressed in degrees: 0° (red), 90° (yellow), 180° (green) and 270° (blue). The "h°" values were higher in T2 (75% sucrose + 25% date syrup), it was 6.020. In general, these results indicate that, the use of data syrup (dibis) by 50% instead of sucrose T3 were the best data.

Table (4): Hunter color of nectar samples with different ratios of date syrup and sucrose

Components	Nectar with sucrose (100%) (Control) T1	Nectar with date syrup from Siwi dates			
		75% sucrose +25% Date syrup	50% sucrose +50% date syrup	25% sucrose+ 75% Date syrup	100% date syrup
		T2	T3	T4	T5
L	32.190^{F}	37.650^{b}	38.187^{a}	36.997^{c}	27.313^{h}
a	1.740^{Fg}	3.373^{d}	1.137^{h}	2.237^{e}	6.027^{a}
b	24.317^{F}	31.550^{b}	32.390^{a}	30.950^{c}	23.513^{g}
C (chroma)	24.357^{F}	31.733^{b}	32.410^{a}	31.030^{c}	24.277^{f}
Hue (h°)	4.000^{de}	6.020^{c}	1.847^{F}	4.090^{d}	15.280^{a}

* Value with different letters in the same column is significantly different at $p< 0.05$.

Sensory Evaluation:-

The organoleptic evaluation of food products is of primary importance, since it reflects the consumer preference for a respective food product. Accordingly, it is necessary to run a test for the sensory aspects of the food before marketing to avoid any possible hazards that could happen in the market. The color, taste, odor and the overall acceptability of consumers to respective food material, will give a combined criteria for the organoleptic parameters.

Color, taste, odor and overall acceptability of nectar prepared from nectarine juice and different ratios of date syrup and sucrose are illustrated in table (5). It could be observed that, blended nectar prepared from T2 (75% sucrose + 25% date syrup) and T3 (50% sucrose + 50% date syrup) had superior color, taste, odor and the overall acceptability than the other tested samples. These samples came in the first order in comparison with other prepared nectars; however, the samples prepared from T1 (100% sucrose) came in the second order followed by T4 (75% date syrup + 25% sucrose) and T5 (100% date syrup) respectively.

The prepared nectar with (100% date syrup) recorded unacceptability color, taste and over all acceptability

Table (5): Sensory evaluation of nectar prepared by different ratios of date syrup

Treatment	Color	Taste	Odor	Overall acceptability
T1 (control)	**7 .00^{b}**	**.20^{ab}**	**7.40^{ab}**	**8.10^{ab}**
T2	8.50^{a}	7.90^{a}	7.40^{ab}	8.50^{a}
T3	8.60^{a}	7.80^{a}	7.50^{ab}	8.60^{a}
T4	6.30^{c}	6.20^{c}	6.30^{c}	6.20^{c}
T5	4.50^{e}	3.30^{f}	4.20^{e}	4.20^{e}

* Value with different letters in the same column is significantly different at $p< 0.05$.

Economical Aspects:-

Economical studies of date syrup production from Siwi date were of importance. The production rate of date syrup from Siwi date fruits was 0.56 Kg. Each 100 kilo gram Siwi date produced 56 Kg date syrup.

The price of one Kg Siwi date fruits accounted for 1.5 L.E. The economical costs of producing one Kg date syrup from Siwi date was 2.68 L.E. Therefore, it is preferable to produce this sort of product on a large scale.

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