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Suitability of Some Saudi Date Cultivars for Jam Making

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Abstract. The optimum processing conditions for date jam making i.e. date fruit form, fruit / sugar ratio and the effect of cultivar on the quality of the prepared date jam were studied. The storability of the prepared date jam was also conducted. The obtained results revealed that the jam prepared from Ruzeiz date paste was significantly better than those prepared from either whole or cut fruits. The most acceptable sugar / date fruit ratio was found to be 40/60. It was apparent also that Barni and Ruzeis date cultivars were more suitable than the other cultivars for jam making. The storability study results showed that storage at room temperature (25 ± 5° C) up to 32 weeks significantly affected the pH, sugar composition, color and sensory properties of the prepared date jam. However, the sensory properties of the stored date jam was still acceptable after the long storage period (32 weeks).

Introduction

The Kingdom of Saudi Arabia with over 400 different date cultivars and an annual production of more than 600000 tones [1] is the first date producing country in the world. It is estimated that less than 10 % of the Saudi dates is processed and as a result, substantial quantities of this important crop are lost annually due to lack of efficiency in the marketing operations and pest infestation. Accordingly, it is highly justified to use the surplus dates for manufacturing purposes to produce satisfactory products such as jam, jellies and candy.

Jams made from a variety of fruits are a popular food item among the local population. Jams are rich in sugars, organic acids and contain relatively good amount of some nutritionally important minerals and vitamins [2;3,p.139;4,p.431]. There are different types of imported jams available in the Saudi market, one of them being the date jam. In 1993, the imports of jams reached more than 12000 tones with a value exceeding SR 37 million [5].

Recipes and methods of jams preparation from different fruits and vegetables are well documented [4,p.431; 6,p.57;7,p.105;8,p.18;9;10].

The suitability of four Sudanese date cultivars (Barakawi, Gondela, Jawa, and Mishriq) for jam making were also studied by Nour and Ahmad [11]. It was reported that all four cultivars investigated were found suitable for jam making. For economic consideration, however, Mishriq and Jawa cultivar were preferred.

Six Saudi date cultivars (Rezeiz, Sefri, Khnazi, Khlas, Nubbut Safe and Barni) were investigated for their potential use for jam processing [12]. The results indicated that the prepared jam from the six date cultivars were generally acceptable and no significant differences were observed by the panelists.

Sawaya *et al.* [13] studied the possibility of processing three Saudi date cultivars (Khudari, Sullag and Sefri) into jam. It was reported that the color, taste and overall acceptability of the jams prepared from any of the studied date cultivars were comparable and did not differ significantly.

The possibility of processing jams from another three Saudi date cultivars (Hilali, Khsab and Omrhaim) at their two stages of maturity, Beser and Rutab, were investigated by Mustafa *et al.* [14]. Their results showed that jam prepared from Khsab dates at Beser stage was the most superior and possessed high quality attributes.

Producing a satisfactory jam from second quality dates as well as finding of the most promising Saudi date cultivars for jam making are the major objectives of this study.

Materials and Methods

Samples of nine date cultivars, at the tamar stage, representing the major date producing region in Saudi Arabia were used in this study. The Eastern region (Al-Ahsa and Al-Quatif) was represented by three date cultivars i.e Rezeiz, Khnazi and Bkerah. The Central region (Ryiadh, Kharj and Al-Qassem) was represented also by three date cultivars i.e. Khudri, Shagra and Sullag. The Southern and Al-Madena region was represented by another three date cultivars: Sefri, Kusbah and Barni. The date fruits were cleaned, pitted, packed in 1 kg plastic bags and kept refrigerated prior to further treatment and analysis.

Date paste preparation

The paste was prepared as mentioned by Yousif *et al.* [10].

Date jam preparation

Date jams were prepared as described by Yousif *et al.*[9]. In the preparation of date jams, four variables with regard to the quality of the produced jam were studied i.e. date fruit form, date fruit / sugar ratio, date cultivar and storability of the produced jam.

Effect of date fruit form(particle size) on the quality of the produced jam

Rezeiz dates were prepared and used in three forms, whole fruit, cutt dates and date paste. The Rezeiz date jam was then prepared and tested by performing sensory evaluation. The ranking preference test was used for this purpose. The three Rezeiz date jam samples after being coded were given to a panel of 10 semi trained judges at the Date Palm Research Center.

Effect of date fruit/sugar ratio on the quality of the produced jam

According to the results of the date fruit form variable, Rezeiz date paste was chosen as the best date fruit form to be used in jam making. To study the sugar / date paste ratio variable, three levels of sugar / date paste ratio were selected : 40 / 60 ; 60 / 40; and 80 / 20. The three Rezeiz jam samples were coded and evaluated as in the date form variable.

Effect of date cultivar on the quality of the produced date jam

The same nine date cultivars mentioned before were used to study this variable. According to the results of the sugar / date paste ratio variable, the 40 / 60 sugar/date paste ratio was used in preparing the jam samples.

The prepared date jams were coded and evaluated in term of Brix and pH and sensorilly. The nine date jam samples were divided into two categories. The first group included five jam samples whereas the second group contained four jam samples. Each group with a reference sample which was an imported date jam available in the local market was evaluated using the multiple comparison difference test. The scores were calculated, tabulated and statistically analyzed. The jam of the date cv attaining the best scores was selected and used for the storability study.

Effect of storage at room temperature on the physico-chemical and sensory properties of date jam

According to the results of the date cultivar variable, Barni and Rezeiz date jams were evaluated the best. As a result, Barni and Rezeiz date pastes were used in preparing about 10 kg jam of each. The prepared jams were mixed well before being filled hot into glass jars and cooled. The jars were stored at room temperature (25±5 °C). The physico-chemical and sensory properties of the freshly as well as the stored date jam (0.0,4, 8, 16 and 32 weeks) were determined.

Methods of analysis

Moisture, ash, total soluble solids (Brix), pH, protein and minerals were determined using the standard A.O.A.C. methods[15]. Minerals were analyzed using an Perkin Elmer atomic absorption spectrophotometer model Sigma 30 (Perkin Elmer Corp.,761 Main Avenue, Norwalk, USA). Color was measured using an extraction procedure as described by Maier and Schiller [16]. The sugar monomers were determined by high pressure liquid as described by Yousif[17, p.50], using an LKB 2150 HPLC(LKB - Produkter AB, Box 305, S-161 26 Bromma, Sweden), equipped with LKB 2142 refractive index detector and a recording integrator of the model LKB 2220. An ultropac column, TSK NH2-60, 5 μm, was used for the separation of sugars using the eluent acetone/ethylacetate/water mixture in the ratio of 55/35/15 respectively. The integrator was programmed as follows: Zero:0, Att.: 7, Chart speed : 0.5, PK width: 0.5, Thrsh: 7, Ar rej: 0. The flow rate was adjusted to 1 ml/min.

The ranking preference test as well as the multiple comparison difference test as recommended by Larmond [18, p.57] were followed to detrmine the sensory properties of the prepared date jams. Ranking test (# 1 means the best and # 3 means the worst) was used where preference between samples was required, whereas multiple comparison test was used to evaluate the effect of the cultivar variable as well as the storability variable. Coded samples of date jam were given to a panel of 10 semi-trained judges from the Date Palm Research Center. An imported date jam sample was selected as the reference and was labelled R. The judges were asked to test the date jam samples and to show whether they are better than, equal to or inferior to the reference.

The scoring sheet also included the extent of difference. Numerical scores were assigned to the ratings with "no difference" equaling five, "extremely better than R" equaling one and "extremely inferior to R" equaling nine. Analysis of variance of the scores was then conducted. The scores were also rated as "excellent" for 1-2, "V.good" for 2.1-3, "good" for 3.1-4, "acceptable" for 4.1-5 and "poor" for 5.1 or more.

Data were analyzed using the "analysis of" variance procedure [19] of the statistical analysis system (SAS). Complete randomized design was used for the analysis of variance for the obtained values. Means were compared at the 0.05 level of significance using the Duncan Multiple Range Test.

Results and Discussions

Date fruit form

It is obvious from the results in Table 1 that jam prepared from date paste was given the best scores "15", followed by jam prepared from the whole fruit "19". Jam prepared from date paste was significantly different ($p \geq 0.05$) from that prepared from the cutt fruit dates "26".

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Sugar / date paste ratio

Table 1 shows the effect of using different sugar / date paste ratio on the produced date jam. It is clear from the scores listed in Table 1, that the sample which represents jam prepared using 40/60 sugar/date paste gained the best scores and was significantly different ($p \geq 0.05$) from the jam prepared using either 20/80 or 60/40 ratio.

Table 1. Effect of processing and quality variables on the sensory evaluation mean scores of the prepared date jams

Fruit form (Rezeiz dates)											
	Panalists mean scores*										
	1	2	3	4	5	6	7	8	9	10	Total
Whole	2	2	2	2	3	2	1	1	2	2	19b**
Cutt	3	3	3	3	2	3	3	2	1	3	26a
Paste	1	1	1	1	1	1	2	3	3	1	15c
Sugar/date paste ratio (Rezeiz dates)											
60/40	3	1	1	1	2	2	3	3	2	3	21b**
40/60	2	2	2	2	1	1	1	1	1	1	14c
20/80	1	3	3	3	3	3	2	2	3	2	25a

Effect of date cultivar	**Barni**	**Rezeiz**	**Sullaj**	**Kusbah**	**Sefri**	**Shagra**	**Khudri**	**Khnazi**	**Bkerah**	**Imported jam**
Brix***	72.7	72.2a	66.6	65.3d	72.5	65.3d	66.4c	65.3d	65.4d	71.8b
PH***	4 02	4.01b	4.01	4.05b	3.91	4.07b	4.14a	3.82d	3.88c	3.29e
Sensory** evaluation scores (Total)	57b	50.0c	55b	48c	65a	67a	66a	49c	47c	.....

* Means of three determinations

** Totals having the same letters are not significantly different ($p \geq 0.05$)

*** Means having the same letters in the same row are not significantly different ($p \geq 0.05$)

Effect of date cultivar

The Brix and pH values for date jams prepared from nine date cultivars are presented in Table 1. The Brix values for the prepared date jams ranged between 65.3 for jam prepared from Khnazi dates and 72.7 for jam prepared from Barni dates. pH values for the prepared date jam ranged between 3.8 for Khnazi date jam and 4.1 for Khudri date jam. Significant differences ($p \geq 0.05$)were observed in the Brix and pH values of date jam. A close similarity could be observed between the pH and Brix values for Khudari and Sullaj date jams prepared by Sawaya *et al.* [13] and those prepared in this study. However, higher pH values for jams prepared from Rezeiz, Barni and Sefri dates (4.00-4.50) were reported by Mustafa *et al.* [12].

chemical properties as well as their storability were determined and the obtained values were presented in Tables 2 and 3.

Table2. Chemical, physical and sensory properties of fresh date jam

Composition		Value means		
		Barni date jam	Rezeiz date jam	Imported date jam
Moisture	%	33.5a	34.6a	.....
PH		4.09a	4.01a	3.67b
Ash	%	1.18b	1.25a	.....
Brix	%	67.4a	66.2c	66.6b
Protein	%	0.63a	0.65a	.....
Color(mg pigment/g dry matter		2.33a	2.80a	.....
Total sugar	%	51.10c	51.20b	52.20a
Sucrose	%	13.70b	14.70a	0.0c
Fructose	%	18.70b	18.20c	26.0a
Glucose	%	18.70b	18.60c	29.20a
Sensory evaluation(mean scores)		3.0a	2.83b	Reference
K	(mg/100g)	426a	391b	372c
Ca	(mg/100g)	54c	90b	150a
Mg	(mg/100g)	54b	54b	74a
Na	(mg/100g)	60c	30b	72a
Zn	(mg/100g)	20a	20a	20a

* Means having the same letters in the same row are not significantly different ($p \geq 0.05$)

Physico-chemical properties of fresh Barni and Rezeiz date jams

A close similarity could be observed in the characteristics of the Barni and Rezeiz jams in the freshly prepared stage (Table2). Only a minor difference could be quoted in the color (pigment concentration) of the two date jams where Rezeiz date jam was slightly darker than Barni jam. It is also clear from Table 2 that the pH and Brix values of the prepared date jams conform with the Saudi standards for jam manufacturing [20]. It appears also from the same results that the pH of the imported date jam is significantly ($p \geq 0.05$) different (lower) from that of the date jam prepared in this study. A great variation could also be noticed between the sugar composition of the imported and that of the prepared date jam. Sucrose was not detected in the imported date jam, while it ranged between 13.7 and 14.7 in the prepared date jams. On the contrast of the sugar results, a close similarity could be seen in the mineral composition of the prepared date jam and that of the imported one.

Results in Table 2 further reveal that the prepared date jam was better and more acceptable than the imported date jam and gained a mean score of 2.83 to 3.0 when compared with the latter, which is equivalent to "very good".

Storability of date jam

t is evident from the storability study results (Table3) that storage at room temperature (25 ± 5°C) up to 32 weeks had no effect on the moisture and Brix values of the date jam. On the other hand, the pH, sugar composition and sensory properties of Barni and Rezeiz date jams were significantly affected by storage time. A significant decrease (from 4.09 to 3.77 for Barni jam) was noticed in the pH values of the date jam. Total sugars were not affected by the storage conditions up to 16 weeks but tended to decrease as a function of increasing storage time up to 32 weeks. Furthermore, storage time affected significantly the mono and disaccharide content of the date jam. Sucrose decreased and glucose and fructose increased as a function of storage time. These results, however, might be explained on the basis of sucrose inversion due relatively to the high storage temperature (25 ±5°C) and acidic environment (pH 3.7 - 3.8).

Table.3. Effect of storage on the physico-chemical and sensory properties of date jam

Composition		Storage period(wk)				
	Date jam	0.0	4	8	16	32
Moisture %	Barni	33.5a	32.7b	33.1ab	32.2c	33.2ab
	Rezeiz	34.6a	34.7a	34.2c	33.7d	34.4b
pH	Barni	4.09a	3.78c	3.67d	3.77c	3.91b
	Rezeiz	4.01a	3.71a	3.56a	3.65a	3.79a
Brix %	Barni	67.4b	69.2a	66.5b	67.3b	67.3b
	Rezeiz	66.2ab	67.2a	65.2bc	64.5c	65.2bc
Color	Barni	2.33a	1.90b	1.95b	1.90b	1.85b
(mg pigment/g dry matter)	Rezeiz	2.80a	2.70b	2.64c	2.51c	2.49c
Total sugar %	Barni	51.1b	51.8a	50.8c	51.0c	44.4d
	Rezeiz	51.0b	50.1b	50.1b	53.2a	44.1c
Sucrose %	Barni	12.6a	11.8b	10.0c	10.0c	6.5d
	Rezeiz	14.7a	13.4b	11.8c	8.8d	8.7d
Fructose	Barni	18.8b	19.5a	19.7a	20.0a	17.4c
	Rezeiz	18.1c	18.9b	19.2b	21.2a	17.1d
Glucose	Barni	20.2c	20.7bc	21.3a	21.0ab	20.5bc
	Rezeiz	18.3c	18.0c	19.4b	23.3a	18.3c
Sensory evaluation	Barni	3.0cd	3.25c	2.92d	4.17b	4.60a
(Mean scores)	Rezeiz	2.83d	3.25c	3.08c	3.67b	4.0a

* Means having the same letters in the same row are not significantly different ($p \geq 0.05$)

It is apparent from the storability study results (Table3) that the color values of the stored date jams were not consistent. Visual examination revealed that this parameter was highly affected by storage time since the darkness intensity was markedly increased as a function of storage time. This means that the absorptivity readings which were dependent on methanol extractable pigments failed to reflect the change in color. These

results, however, indicated that the followed procedure was not efficient for measuring color in stored date jams.

As far as the sensory properties of the stored date jams are concerned, the results revealed that this parameter was moderately affected. The mean sensory evaluation scores for Barni jam increased from 3 at the fresh stage to 4.6 after 32 weeks storage time, whereas that of the Rezeiz jam increased from 2.8 to 4.0. This means that the fresh date jams were evaluated "very good" (2.8 - 3.0) when compared with the imported date jam while after 32 weeks storage time, they were evaluated "good". These results indicated that the date jams were still acceptable after 32 weeks storage time at room temperature.

Conclusion

Date jam development study on laboratory scale highlighted the possibility of processing the surplus dates into date jam. The developed date jam was evaluated and proved to be of good quality and was rated as superior to the similar imported jam. the jam prepared from date paste was significantly better than those prepared from either whole or cut fruits. The most acceptable sugar / date fruit ratio was found to be 40/60. It was apparent also that Barni and Ruzeis date cultivars were more suitable than the other cultivars for jam making. The storability study revealed that the laboratory scale developed jam was of good shelf life and can be kept for at least 24 weeks at room temperature without affecting its good quality attributes.

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ملاءمة بعض أصناف التمور السعودية لصناعة المربيات

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ملخص البحث. تم في هذه الدراسة التعرف على الظروف المثلى لتصنيع مربيات التمور، وشمل ذلك شكل الثمرة ونسبة السكر إلى التمور، وكذلك تأثير صنف التمور على جودة المربى المصنعة. كما تم التعرف على صلاحية مربيات التمور المصنعة للخزن. أشارت النتائج المتحصل عليها إلى أن المربيات المصنعة من عجينة تمور الرزيز كانت ذات صفات جودة أفضل من تلك المصنعة من الثمار الكاملة أو المقطعة، وكانت النسبة المثلى من السكر إلى التمور ٦٠/٤٠. كما أشارت النتائج إلى أن تمور البرني والرزيز كانت أكثر ملاءمة من أصناف التمور الأخرى قيد الدراسة لتصنيع المربيات.

دلت نتائج الدراسة الخزنية على أن خزن مربيات التمور على درجة (٢٥ ± ٥°س) ولمدة ٣٢ أسبوعا أثر معنويا على كل من الرقم الهيدروجيني والمحتوى السكري واللون، وكذلك الصفات الحسية لتلك المربيات. إلا أن الخصائص الحسية للمربيات ما زالت مقبولة حتى بعد فترة الخزن الطويلة (٣٢ أسبوعا).