

EFFECT OF SOME TECHNOLOGICAL TREATMENTS ON RIPENING AND DRYING OF SOFT DATE (BENT AISHA VARIETY)

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Abstract

Khalal (Hard) stage of Bent Aisha date was developed to rutab (Soft) stage by freezing at -18°C or by oven drying (at 65°C). Freezing method led to the best quality in which the low molecular weight tannin contents were decreased and reducing sugars were increased. So by this treatment the consumption and marketing of Bent Aisha Date can be controlled.

Moreover to extend the shelf-life of this date (rutab) it was preserved by drying. The dried dates were of good quality (color, taste and flavor) and was preferred by the consumer. Also, Khalal stage of Bent Aisha date could be processed to acceptable jam with good taste.

INTRODUCTION

Date palm, *Phoenix dactylifera* L., belongs to family palmaceae. Date fruits are classified to three kinds i.e, dry, semi-dry and soft date.

The date production in Egypt was 631390 tons. This data was obtained from Statistical Department, Ministry of Agriculture, Egypt, (1993) from which Bent Aisha date variety (soft date) represented 5.5%.

Khalal (Hard) stage of Bent Aisha date (red stage) is unacceptable, this date is left on the tree until is changed to the rutabe (soft) stage (acceptable date).

Therefore, decreasing the ripening period through using some technological treatments and the production of the soft date in a dried form and processing of this variety in khalal stage are very important. The bad taste of Khalal date is related to its high content of tannins which is responsible for the astringent taste. Maier and Metzler (1965) found that both soluble and insoluble tannins of Deglet Noor dates,

increased during green and red stages while in the ripe stage the soluble tannins decreased by their conversion to condensed tannins. Also, Nezam El-Din, (1988) found that Samani, Zaghloul and Siwi date varieties contained 1.686, 1.925 and 1.900% of total phenols, 0.110, 0.197 and 0.311% of low molecular weight tannins and 0.721, 0.333 and 0.390% of high molecular weight tannins, respectively. By dipping the date in boiling water, the total phenols decreased to 1.425, 1.699 and 1.707%, and the low molecular weight tannins were decreased to 0.012, 0.070 and 0.105% respectively, while high molecular weight tannins increased to 0.300, 0.380 and 0.450% respectively.

The color of khalal date is yellow, pink, red, scarlet depending upon the cultivar, and the red pigment composition was found to be anthocyanin (Nezam El-Din and Ali, 1983).

By studying the chemical composition of date, Rygg (1977) found that acidity is usually decreased when the date ripen and the polyphenols constituted 3% of the dry weight. He also demonstrated that dates are considered good source of energy, since about three fourth of their dry matter are sugars. Non-reducing sugars (sucrose) in all date cultivars were found to be low in the earlier stages and increased in khalal stage then dropped in rutab stage, on the other hand, the reducing sugars increased rapidly at the end of khalal stage (Sawaya, 1986).

Therefore, this investigation aim to process and remove the astringent tast of khalal date, change it to rutab stage to be more suitable for drying, as well as, extending the shelf life through some technological treatments.

MATERIALS AND METHODS

Materials :

Bent Aisha date variety in khalal stage (red color) was obtained from Kirdasa region, Giza, Egypt. The dates were treated as follows:

1. Date treatments :

1. Dipping of khalal in boiling water for 30 min (khalal matbukh).
2. Freezing of khalal date at -18°C , after 2 days the dates were left at room temperature ($25 \pm 1^{\circ}\text{C}$) until changed to rutab stage after thawing (rutab date by freezing).
3. Khalal date was changed to rutab stage by heating in an oven at 65°C for 2 hrs (rutab date by oven).

4. Khalal date was changed to dry stage by heating in an oven at 60°C.
5. Khalal matbukh dates were dried in an oven at 65°C.
6. Khalal dates were cracked and dried in an oven at 65°C.
7. Khalal dates were cracked and dried in an oven at 85°C.

II. Khalal dates processing :

Khalal stage of Bent Aisha dates (free of pits) were used for jam processing in different forms as follows:

1. Minced khalal dates.
2. Blanched, minced khalal dates.
3. Khalal matbukh dates.
4. Whole khalal dates.

For jam processing, 0.2% citric acid and 250 gms sucrose were added to 1 kg of dates or the Raw date material.

Methods:

Chemical Analysis:

Moisture content was determined at 65°C under vacuum as described by AOAC (1975).

Acidity (measured as citric acid) and the pH values were determined according to the AOAC (1990).

Reducing and non-reducing sugars were extracted by 80% ethanol and total sugars were hydrolysed by HCl (1N), then determined according to Somogi (1952) and Nelson (1974) using arsenomolybdate reagent and Somogi copper reagent.

Free amino acids were determined according to Fahd (1972) using isoleucine for the standard curve.

Total phenols were determined by Folin-Denis reagent as described by Swain and Hillis (1959).

Anthocyanidin was determined by using the Butanol-HCl method as described by Bate-Smith (1977).

Low and high molecular weight tannins were separated as described by Czochanska *et al*, (1979) and measured by Folin-Denis method as described by Swain

and Hillis (1959).

Organoleptic evaluation :

Data of 14 panelists for sensory evaluation (color, taste, and flavor) were subjected to analysis of variance (completely randomized design) according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Bent Aisha date as one of the Egyptian soft date varieties is consumed in rutab stage. It can be gathered in khalal stage to be kept until it is changed to rutab date which is suitable for eating. So any treatment of such date that enhance its ripening, prolongs its shelf-life, or even its utilization in processing of jam is needed.

Khalal stage of Bent Aisha dates were treated to produce khalal matbukh, rutab by freezing and by heating, dried khalal date, dried khalal matbukh, dried cracked date at 65°C, dried cracked date at 85°C, jam of minced khalal date, jam of blanched and minced khalal date, jam of minced khalal matbukh and jam of whole khalal dates.

Moisture content of khalal dates was found to decrease by changing from rutab to dry stage in different ratios according to the method used.

Total acidity of khalal date (0.33%) was decreased to 0.20 and 0.30% after changing to rutab stage by freezing and rutab stage by heating in an oven at 65°C, respectively, but the pH values increased from 5.6 in fresh khalal date to 6.8 and 5.7 in rutab stage by freezing and by heating respectively (Table 1). These results are in agreement with the finding of Rygg (1977).

Drying of Bent Aisha date showed an increase in total acidity and a decrease in pH values of all treatments when compared to rutab stage.

Total acidity of jam products was lower than that of fresh, rutab and dried dates, which may be due to the increasing of jam total solids when sucrose was added for processing. Also the heating during jam preparation led to formation of sugar mono-ester and the reaction between amino acids and sugars (Maillard reaction) and lowering the acidity (Ingles and Reynolds, 1958).

The pH values of jam treatments were lower than those found for all stages of dates which may be related to the addition of citric acid during jam preparation but

this effect did not appear in acidity due to the marked increase of total solids by the addition of sugars.

Table 1. Moisture, total acidity and pH values of Bent Aisha date and its jam products.

	Moisture %	Total acidity* %	pH value
Fresh khalal date	59.00	0.33	5.64
khalal matbukh date	58.00	0.38	5.00
Rutab date (by freezing)	50.40	0.20	6.80
Rutab date (by oven)	43.70	0.30	5.72
Dried khalal date	14.10	0.37	5.14
Dried khalal matbukh	11.00	0.35	5.35
Dried cracked date (at 65C)	10.00	0.32	5.62
Dried cracked date (at 85C)	8.00	0.34	5.40
Jam of minced khalal date	20.50	0.21	5.01
Jam of minced and blanched khalal date	27.90	0.24	4.91
Jam of minced khalal matbukh date	20.30	0.18	5.00
Jam of khalal date	17.10	0.22	4.90

* Total acidity was measured on dry weight basis

Reducing and total sugars :

From Table 2 it can be seen that reducing sugars increased from 61.40% in khalal dates to 84.50 and 80.75% in the rutab stage by freezing and by oven, respectively. Then it decreased by drying to 60.20, 77.00 and 50.40% for dried khalal date, dried cracked date at 65°C and dried cracked date at 85°C, respectively. The increase in reducing sugars from khalal to rutab stage may be due to the effect of invertase enzyme on the hydrolysis of sucrose to glucose and fructose as found by Sakri *et al.* (1975). Table 2 show a decrease in reducing sugars of dried dates of all treatments when compared to khalal and rutab stages, this decrease was due to nonenzymatic browning reaction (Braverman, 1963 and Reynolds, 1965). The lower content of reducing sugars of khalal matbukh date may be as a result of treating the dates by dipping in boiling water.

Total sugars were high in fresh khalal dates and decreased slightly in the frozen rutab than in oven rutab dates. By drying, marked decrease occurred in the total sugars, hence their content was changed from 85.40 in fresh khalal date to 62.30, 56.00, 77.00 and 55.90% in dried khalal date, dried khalal matbukh date, dried cracked date at 65°C and dried cracked date at 85°C respectively. Such decrease might be attributed to the browning reaction between the free amino acids and sugars as reported by Anet and Reynolds (1957). Date jams were found to have high contents of total sugars which resulted from the added sucrose to date for jam production.

Free amino acids :

Found from Table 2 it can be seen that free amino acids were decreased from khalal date (3.08%) to rutab dates by freezing (2.10%) and rutab dates by heating in an oven (2.40). Such decrease may be due to the effect of polyphenol oxidase on the free phenols and some free amino acids as tyrosine and phenyl alanine during the enzymatic browning reactions as reported by Meyer (1978). By drying dates, a loss in free amino acids occurred which may be attributed to the non-enzymatic browning Table 2. Sugars and free amino acid contents of Bent Aisha date and its jam products

	Reducing sugars*%	Total sugars* %	Free amino acids * %
Fresh khalal date	61.40	85.40	3.08
khalal matbukh date	42.60	57.00	1.82
Rutab date (by freezing)	84.50	85.00	2.10
Rutab date (by oven)	80.75	82.80	2.40
Dried khalal date	60.20	62.30	1.39
Dried khalal matbukh	40.16	56.00	1.80
Dried cracked date (at 65C)	77.00	77.00	1.87
Dried cracked date (at 85C)	50.40	55.90	1.08
Jam of minced khalal date	60.10	91.00	1.38
Jam of minced and blanched khalal date	59.90	93.00	1.33
Jam of minced khalal matbukh date	40.00	90.00	0.65
Jam of khalal date	41.10	92.00	1.27

* The percentage was measured on dry weight basis

reactions between the free amino acids and sugars as mentioned by Reynolds, (1965). Drying cracked date in an oven at 85°C decrease the free amino acids compared to the other treated date samples. This decrease may be attributed to the high temperature of drying which accelerated the loss of free amino acid and sugars through the browning reaction as mentioned above.

Jam products of date contained low concentrations of free amino acids which resulted from the heating during processing which led to increasing the browning reaction (Reynolds, 1965).

Phenols and tannins :

Khalal stage of Bent Aisha date contained anthocyanin pigment (red color) which contained the cyanidin aglycon of the red pigment (Nezam El-Din, 1983). Anthocyanidin and condensed tannins were measured as cyanidin chloride. Dried date treatments showed a decrease in anthocyanidin contents which was attributed to the effect of phenolase enzyme on anthocyanin pigment (Meyer, 1978) and increasing the degree of temperature of drying to be enough for phenolase enzyme inhibition as it was found in dried cracked date at 85°C. So the anthocyanin degradation by heat played a good role in the previous treatment (Markakis, 1982).

Jam products of khala date had low contents of anthocyanidin when compared to the different stages of Bent Aisha dates, the decrease of anthocyanidin content could be attributed to the long time of heating during jam processing.

Low molecular weight tannins were high in fresh khala date and decreased gradually by heating in the oven at 65°C for rutab and dry dates. Also, it can be seen from Table 3 that the lowest content of low molecular weight tannins was observed for the rutab date obtained by freezing, this could be related to the effect of tanninase enzyme on the hydrolysis of tannins. Increasing temperature of heating decreased low molecular weight tannins. Maier and Metzler (1965) found that the decrease of soluble tannins by heat was associated with the conversion of soluble tannin to insoluble tannin.

High temperature of drying (85°C) led to the decrease of anthocyanidin and the low molecular weight tannins during the heat process and anthocyanin by the degradation of anthocyanidin to form chalcone as mentioned by Markakis (1982). Also simple phenols showed a high decrease which may be related to the non-enzymatic browning reaction (Meyerr, 1978).

Jam of khala date showed a decrease in low molecular weight tannins but jam of khala matbukh date showed high content of low molecular weight tannins than the other processed dates.

High molecular weight tannins decreased in all stages, i.e. khalal, rutab and dry stage while khalal matbukh date and its dried dates showed an increase in their tannins, this increase could be related to the conversion of low molecular weight tannins to high molecular weight tannins as found by Maier and Metzler (1965). On the other hand, other date treatments still had active tannase enzyme to hydrolyze the low molecular weight tannins to basic components such as phenol and sugar.

Jam of khalal date contained low concentration of high molecular weight tannins but matbukh and blanched khalal date jam had high contents of these tannins.

Simple phenols were gradually decreased from khalal to rutab and dry stages, respectively (Table 3). This decrease may be related to the effect of polyphenol oxidase on some phenol compounds such as tyrosin; 3, 4-dihydroxy phenyl alanine; caffeic acid; chlorogenic acid; gallic acid; catechol; hydroquinone and numbers of anthocyanins and flavonoid which act as substrates for the browning enzymes but when the degree of temperature was increased (85°C) and the fruit dried, the non-enzymatic browning had the main role for the reaction between free amino acids and sugars (Mayer, 1978). The changes in jam products were related to Maillard reaction as previously mentioned.

Table 3. Phenols and tannins content of Bent Aisha date and its jam products.

	Anthocyanidin %	LMWT* %	HMWT** %	Simple phenols %	Total free phenols %
Fresh khalal date	1.82	0.48	0.03	1.87	2.65
khalal matbukh date	1.76	0.34	1.19	1.17	2.45
Rutab date (by freezing)	0.77	0.09	0.20	1.60	1.86
Rutab date (by oven)	1.41	0.18	0.10	1.54	1.84
Dried khalal date	0.49	0.30	0.33	1.03	2.01
Dried khalal matbukh	1.80	0.24	1.23	0.54	2.22
Dried cracked date (at 65°C)	0.54	0.12	0.07	1.02	1.91
Dried cracked date (at 85°C)	0.39	0.09	0.08	0.51	1.61
Jam of minced khalal date	0.05	0.27	0.22	1.38	1.88
Jam of minced and blanched khalal date	0.50	0.17	0.24	0.83	1.99
Jam of minced khalal matbukh date	0.89	0.36	0.33	0.52	1.80
Jam of khalal date	0.11	0.12	0.30	1.04	1.97

* Low molecular weight tannins.

** : High molecular weight tannins

All percentage were calculated on dry weight basis

Total free phenols were affected by all types of phenol compounds (simple phenol, low molecular weight tannins and anthocyanidin) which led to the reduction of the total free phenols by drying and processing of jam.

Organoleptic evaluation :

The panel tests of khalal and rutab dates (Table 4) revealed that color of khalal matbukh date had the lowest mean which resulted by boiling in water, this hot water led to dissolve and degrade anthocyanin. The best color appeared in khalal and rutab date obtained by freezing.

Table 4. Means of organoleptic score of Bent Aisha date.

	Color	Taste	Flavor
khalal date	8.70	4.57	9.00
khalal matbukh date	5.40	5.71	8.13
Rutab date by freezing	8.00	7.42	8.00
Rutab date by oven	6.57	6.57	7.63
LSD %	1.21	1.47	NS

Rutab date obtained by freezing had the best taste which is related to lowering the content of low molecular weight tannins and high content of reducing and total sugars. Khalal matbukh date had unacceptable taste associated with low content of sugars and high concentration of low molecular weight tannins. However, the differences between the mean values of flavor were not significant.

From Table 5 it can be observed that dried khalal date at 60°C and dried cracked date at 65°C had the best color but dried cracked at 85°C had the lowest mean value for color. The high degree of heating temperature led to non-enzymatic browning and unacceptable color. The taste of dried cracked date at 65°C had the best mean value with significant difference compared to dried khalal matbukh. The preferable taste of dried cracked date at 65°C may be related to the low content of astringent tannins (low molecular weight tannins) and high content of reducing and total sugars as previously observed in Tables 1 and 3.

No undesirable flavor was observed in all dried date samples and no significant differences were found between them.

Jam of khalal date had the maximum and significant difference in the color than jam of khalal matbukh, also blanched date led to jam with a fade color.

No significant differences were observed for the taste as well for the flavor between all produced jam samples, possibly due to the addition of sucrose to jam.

Table 5. Means of organoleptic score of dried Bent Aisha date variety.

	Color	Taste	Flavor
Dried matbukh date	6.57	6.29	8.50
Dried khalal by oven (at 60 C)	7.86	7.86	8.50
Dried cracked date at 65 C	7.43	8.86	9.00
Dried cracked date at 85 C	6.14	7.86	8.13
LSD %	0.75	1.10	NS

It is concluded that khalal stage of Bent Aisha date variety (soft date) could be developed to rutab stage by freezing (-18°C) or by heating in an oven (65°C).

Khalal or rutab stage of soft date variety could be dried at 65°C. Also khalal date of Bent Aisha date could be processed to jam mincing.

Table 6. Means of organoleptic score of dried Bent Aisha khalal date jam.

	Color	Taste	Flavor
Jam of minced khalal date	7.86	8.14	8.29
Jam of minced and blanched khalal date	6.86	8.29	9.29
Jam of minced khalal matbukh date	6.00	7.41	7.86
Jam of khalal date	8.43	7.14	8.26
LSD %	1.41	NS	NS

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تأثير بعض المعاملات التكنولوجية على انضاج وتجفيف التمور الطرية (صنف بنت عيشة)

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نظرا لاستهلاك معظم التمور الطرية عندما تصل الى مرحلة الرطب فقد أجرى هذا البحث على البلح صنف بنت عيشة حيث تم إجراء عملية ترطيب لثمار البلح خلال (الاحمر) عن طريق التجميد أو بالتسخين في الفرن واتضح ان طريقة المعاملة بالتجميد كانت أفضل اذ انها ادت الى أقل تركيز للمواد التانينية ذات الوزن الجزيئي المنخفض والمسئولة عن الطعم القابض في البلح خلال (الاحمر) كما أنها أعطت اعلا محتوى من السكريات المختزلة. وبهذه المعاملة يمكن التحكم في استهلاك وتسويق بلح بنت عيشة بإمكانية انضاجه وترطيبه مبكراً عن موعده.

ولاطالة فترة حفظ هذه التمور أجرى لها عملية حفظ بالتجفيف وانتاجها في صورة مجففة ذات جودة عالية مقبولة للاستهلاك. كذلك تم استغلال البلح خلال (الاحمر) لنفس الصنف في انتاج مربى ذات طعم وجودة جيدة.