

## Effects of Pectin on the Reducing and Non-Reducing Sugar and Total Sugar Percentage of Date Jam

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### Abstract

The research was performed to study the production and processing of date jam during the year 2011-12 at the Institute of Food Sciences and Technology, Faculty of Crop Production, Sindh Agriculture University Tandojam. This work intended to add value to the date raw material into jam production by standardizing the production process with different pectin concentrations. For this purpose four pectin concentrations were used i.e., 1 g pectin, 2 g pectin, 4 g pectin and 1g pectin + 1 g citric acid. Chemical analysis such as total sugar, reducing sugar, non reducing sugar, was recorded. The results showed a significant effect of pectin concentration and storage period on the chemical and sensory characteristics of date jams. Moreover, the results from this work revealed essential information that could promote the commercialization of date jam.

**Keywords:** Reducing, Non Reducing, Total, Sugar, Date jam.

### Introduction

Date palm *Phoenix dactylifera* (Arecales: Areaceae) is evergreen flowering plant species, cultivated for its edible sweet fruit. Although its place of origin is unknown because of long cultivation, it probably originated from lands around Iraq (Morton 1987). The species is widely cultivated and is naturalized in many tropical and subtropical regions worldwide. Date palm trees typically reach about 21-23 m in height with 3-6 meters long leaves having 150 leaflets (Divya Bichu 2011). Date is an important fruit play an important role in account of diet of peoples in date palm growing regions around the world. It is marketed all over the world as high value confectionery and fruit crop (Abdelouahhab 2006). Many products, including date syrup, date powder, different types of bread, marmalade, sweet candy, chocolate, date paste, and others, can be obtained from date (Ashraf and Hamidi-Esfahani 2011).

Due to high nutritional, health and economic values in addition to its aesthetic and environmental benefits date have major role in the diet of natives of date growing regions. Date has effective role in providing the nutritional needs of humans, one kilogram of fresh date contains approximately 1570 calories of energy (Rohani, 1988). The chemical composition of dates is variable due to various factors such as variety, region, climate, amount of fertilization and type of cultural practices (Al-Rawahi et al., 2005). Other important nutrients include silicon and boron in adequate amounts. Silicon plays a significant role in bone development, while boron is a natural steroid replacement that helps against demineralization in Osteoporosis. Dates have beneficial if used during pregnancy and lactation, (Rashida, 2003).

As there is less demand for table dates however, new trends are developing in the date consumption as a component of new food products. Food industries are now producing different types of date products including date bars, date-paste, date-syrup, date-honey, date-jam, date vinegar, date cookies, date wafers, date squares (Ahmed and Ramaswamy, 2005). Amount of sucrose can be replaced with date-paste in many food products and used as filler in food formulations (Al-Hamdan and Hassan, 1999). Jam is a fruit preserve with a stable shelf life that depends on high sugar content (68-72%) combined with the fruits acidity that prevents microbial growth. Pectin substances are a complex mixture of polysaccharides, it contributes both to the adhesion of between the cells and to the mechanical strength of the cell wall in the form of stabilized gels (Jarvis 1984). In dates as the fruit matured, the pectin content increased. The date fruit is considered as a reasonably good source of pectin (Saleh et al., 1987).

Therefore keeping in view the importance of the subject the present study was designed to standardize the process for preparation of date jam and evaluate the chemical and sensory properties of date jam

### Materials and Methods

#### *Collection of samples*

The date variety Aseel was purchased from local market and was brought to the laboratory of Institute of Food Sciences and Technology, Sindh Agriculture University Tando jam. The fruit was washed, cleaned, dried and pulp was collected for Jam processing.

#### *Preparation of fresh date sample for chemical analysis*

Fresh date fruit was peeled with knife and cut into equal pieces. Homogenous mixture was prepared by blending the flesh in blender. The sample was thoroughly homogenized and the pulp was used as sample for each chemical analysis. Analysis of fresh date samples is given in Table 1.

**Table-1 Chemical analysis of fresh date samples**

Characters	RI	RII	RIII	Mean
Total Sugar %	44.57	45.75	43.45	44.59
Reducing sugar %	26.40	27.50	25.80	26.56
Non Reducing Sugar %	18.17	18.25	17.65	18.02

### Preparation of jam

The obtained fruit pulp was weighed and placed in a stainless steel pan and heated. The pectin was added at different concentration. The treatments used were T<sub>1</sub> (1g pectin), T<sub>2</sub> (2g pectin), T<sub>3</sub> (4g pectin) and T<sub>4</sub> (1g pectin + 1g citric acid). The pulp was stirred constantly in order to prevent the pectin from clotting. When the pectin was dissolved completely, the remaining sugar was added to the heating mixture and allowed to boil until the total soluble solid (TSS) content of the jam reached 66-68° Brix. The total soluble solid was monitored throughout boiling period. The jam was then quickly removed into sterilized glass bottles. The filling operation was prepared rapidly in order to prevent the contamination. The jars were sealed and cooled in ambient temperature 30± 4°C. The sample was taken after every 14 days interval from jam bottle for analysis.

### Total sugar

One hundred (100) ml of filtered sample was taken into conical flask from solution prepared for reducing sugar was used to observe the total sugar of date jam. Solution (100 ml) was measured into conical flask and 10 ml of 8.6% HCl (8.6ml HCl was taken and mix into small volume of water and then up to final volume of 100 ml with distilled water) was added. The solution was boiled for 5 minutes and left for cooling, after cooling the solution was neutralized with NaOH containing 3-4 drops of phenolphthalein indicator and NaOH was added drop by drop till pink color appeared. The solution was transferred into volumetric flask and made up to 250ml with distilled water. The solution was transferred to burette and titrated against the 10ml Fehling's solution containing 4-5 drops of methylene blue indicator till brick red color appeared. The quantity of solution used was noted and calculation was made according to following formula:

$$\text{Total sugar \%} = \frac{\text{Factor (4.95)} \times \text{dilution (250)}}{\text{Titre} \times \text{wt of sample} \times 10}$$

### Reducing sugar

Reducing sugar was analyzed according to the method as described by AOAC (2000). Ten grams of date jam sample was mixed in a beaker with 100ml warm water. The mixture was stirred until the soluble matter was dissolved. They were then filtered through Whatman filter paper No. 4 and then distilled water was added to make final volume of 250 ml. The solution was transferred to burette and titrated against the 10ml Fehling's solution in conical flask containing 4-5 drops of methylene blue indicator till brick red color appeared. The reading on burette was noted and calculation was made according to following formula:

$$\text{Reducing sugar \%} = \frac{\text{Factor (4.95)} \times \text{dilution (250)} \times 2.5}{\text{Titre} \times \text{wt of sample} \times 10}$$

### Non-reducing sugar

Non-reducing sugar was estimated by difference using following formula:

$$\text{non-reducing sugar (\%)} = \text{Total sugar (\%)} - \text{reducing sugar (\%)}$$

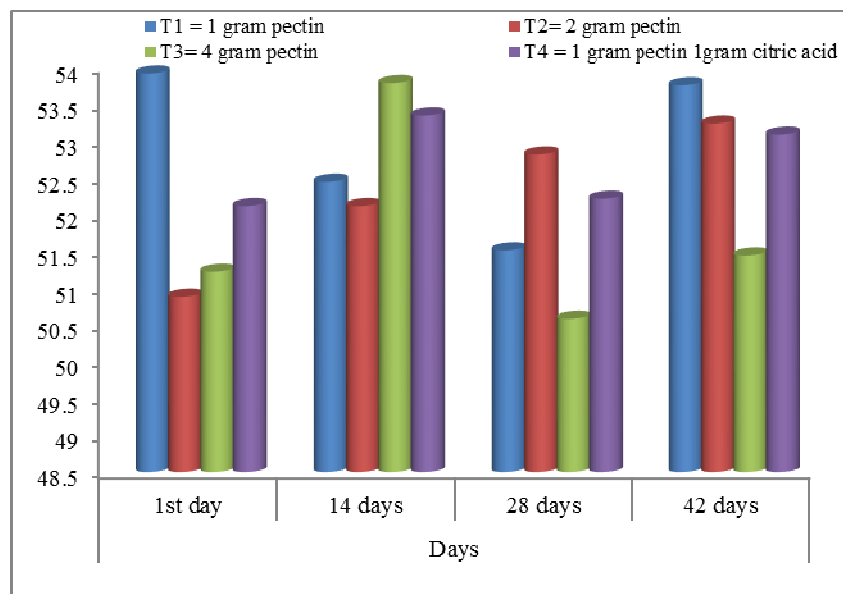
### Statistical analysis

The collected data were statistically analysed for analysis of variance and other comparisons as described by (Gomez and Gomez, 1984).

### Results

#### Reducing sugar percentage

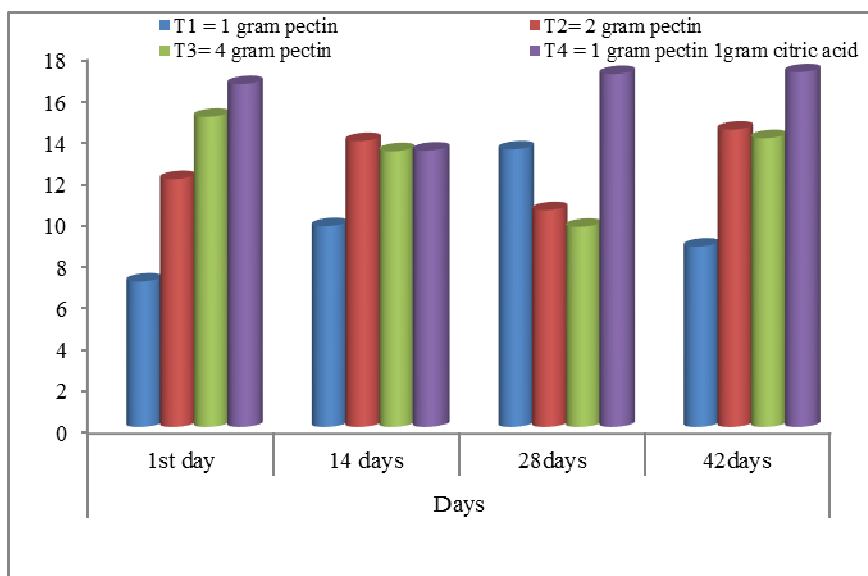
The results of reducing sugar of date jam are presented in Figure 1. The results indicated that the highest reducing sugar 52.9% was observed in T<sub>1</sub>, whereas, the lowest reducing sugar 51.75% was recorded in T<sub>3</sub>. The data recorded for interactive effect of days x treatment showed significant effect on date jam stored at room temperature 30±4°C. The results revealed that the highest reducing sugar 52.91% was recorded in date jam stored after 14 days and the lowest reducing sugar 52.03% was observed at initial stage. The results are statistically significant on the interactive effect of days x treatments. The results are statistically non-significant among the treatments at (P<0.01) probability level.



**Fig.1. Effect of different Pectin Concentration on the Reducing Sugar**

#### Non reducing sugar (percentage)

The results of non-reducing sugar of date jam are presented in Figure 2. The results indicated that the highest non-reducing sugar 15.98% of date jam was observed in T<sub>4</sub>. The results further indicated that non-reducing sugar was 12.94, 12.49% in T<sub>3</sub> and T<sub>2</sub>, respectively. However, the lowest non-reducing sugar 9.68% was observed in T<sub>1</sub>.



**Fig.2. Effect of different Pectin Concentration on the Non Reducing Sugar**

It was further observed that during storage the highest non-reducing sugar 13.50% recorded from date jam after 42 days stored at 30±4°C, whereas, the lowest non-reducing sugar 12.50% was recorded from date jam at initial stage (14 days). The data recorded for interactive effect of days x treatment showed significant effect on date jam stored at 30±4°C room temperature. The results are statistically significant on the interactive effect of days x treatments.

#### Total sugar %

The results of total sugar of date jam are presented in Figure 3. The results indicated that the mean maximum total sugar 68.53% was observed in T<sub>1</sub>, whereas, the lowest total sugar 62.58% was recorded in T<sub>4</sub>.

The data recorded for interactive effect of days x treatment showed significant effect on date jam stored at room temperature 30±4°C. The results revealed that the highest total sugar 66.37% was recorded after 42 days of storage. However the lowest total sugar 64.36% was observed in jam stored after 28 days. The results are statistically non-significant among the treatments at (P<0.01) probability level.

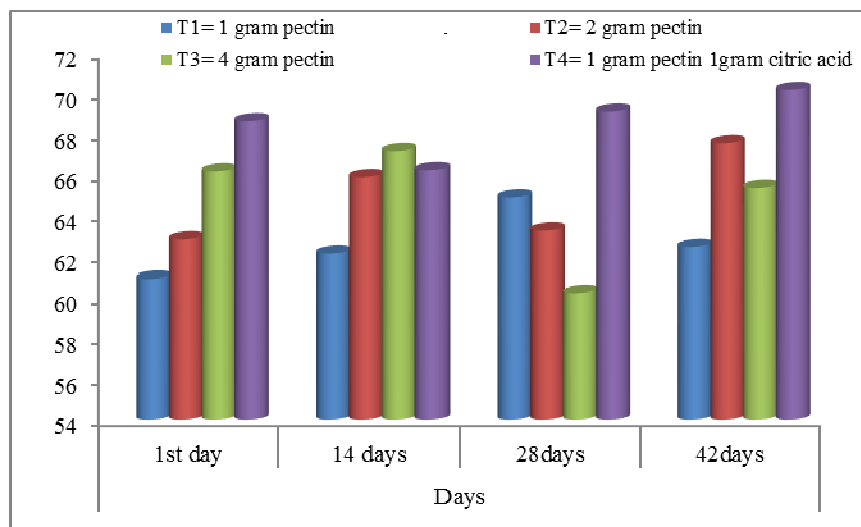


Fig. 3. Effect of different Pectin Concentration on the Total Sugar

### Discussion

Reducing sugar, non reducing Sugar and Total Sugar were recorded. In present study it was further observed that in prepared jams the reducing and total sugar increased from initial stage up to the end of storage period (42 days) at room temperature. The results are in agreement with the findings of the Besbes *et al.* (2009), furthermore, Pearson (1976) reported that the increase in reducing sugars content in date jam compared with the raw material could be explained by a partial hydrolysis of sucrose (initial and added) during cooking. The results are further supported by the Chefteland Cheftel (1976) they investigated that the reducing sugars, which have more affinity for water than sucrose, could contribute to the reduction of the jam crystallization phenomenon. The sugar fraction of dates was essentially formed by non-reducing sugars. This could be attributed to a higher invertase activity. It is worth noting that sugar fraction of the majority of date cultivars was dominated by the reducing sugars (Barreveld, 1993). These reducing sugars are essentially glucose and fructose (Al-Hootiet *al.*, 1995). The results revealed that the highest total sugar was recorded during the storage period. Our result are in agreement with the findings of Besbes *et al.* (2009) they reported high content of sucrose and low reducing sugar content; contrary to Allig and the majority of other date varieties tested. This work intended to add value to these raw materials by using them in jam production. Total sugars were not affected by the storage conditions up to 6 weeks.

### Conclusions

It is concluded from the present study that pectin concentration have pronounced effect on the quality of date jam and this study has provided baseline information regarding the date jam processing. This laboratory scale study highlighted the possibility of processing the surplus dates into date jam. Moreover, the results from this work revealed essential information that could promote the commercialization of date jam.

### Reference

1. Morton J. 1987. Date. p. 5–11. In: Fruits of warm climates. Julia F. Morton. Miami, FL. Purdue University. Center for New Crops and Plants Products.
2. Divya Bichu. 2011. Arabian Desert Plants. *Buzzle*. Retrieved 08 January 2017.
3. Abdelouahhab Z. 2006. World date industry: Situation, challenges and opportunities.
4. Ashraf Z. and Z. Hamidi-Esfahani. 2011. Date and Date Processing: A Review. *Food Reviews International*, 27: 101- 133
5. Rohani A. 1988. Date palm. Tehran University Publication Centre: Tehran, Iran. pp.295.
6. Al-Rawahi AS, S Kasapis and IM Al-Bulushi. 2005. Development of a date confectionary: Part 1. Relating formulation to instrumental texture. *Intr. J. Food Prop.*, 8:457-468.
7. Rashida A. 2003. A time for date H.E.J. Research, Institute of Chemistry University of Karachi.
8. Ahmed J. and HS Ramaswamy. 2005. Effect of temperature on dynamic rheology and color degradation kinetics of date paste. *Food Bioprod. Process.*, 83:198-202.
9. Al-Hamdan AM and BH Hassan 1999. Water sorption isotherms of date pastes as influenced by date cultivar and storage temperature. *J. Food Eng.*, 39:301-306.
10. Saleh R, A Ogunro and N Sarah. 1987. Effect of Storage Time on Ascorbic Acid Content of Some Selected Made in Nigeria” *Fruit Preserves. Pak J Nutri*, 7 (6): 730-732.