

## Research Article

# Comparative Study of Jam Processing From Pumpkin with Sugarcane and Pumpkin with Date Juice

Ahmed HA, Idriss SHE, Elhesain MHA\*, Babiker AMOA, Widatalla MM and Abdallaa M

Department of Food Processing Engineering, University of El Imam El Mahdi, Sudan

\*Corresponding author: Mortada H.A. Elhesain, Department of Food Processing Engineering, Faculty of Engineering and Technical Studies, University of El Imam El Mahdi, P O Box 209, Kosti, Sudan

Received: June 06, 2022; Accepted: July 11, 2022;

Published: July 18, 2022

## Abstract

Sudan produced more than 300000 ton of date yearly with different types. For the mentioned reasons this study aimed to process two types of jam of pumpkin fruit, use sugarcane to sweetness one of them, and use a Sudanese date syrup (Wad-laggai Variety) to sweetness the other by concentrate (25%, 50%, 75%, and 100%). Chemical analysis and sensory evaluation for all types of jam were done. Jam that sweetens by concentrate (100%) of date syrup was found to contain high level of minerals (1.40%), protein (2.03%), lipids (0.44%), Reducing sugar (48.36%) and total soluble solids (51.75%), these values present in 100% date syrup were very satisfaction. Jam that sweetens by concentrate 50% of date syrup was found to contain high level of ph (5.01). The jam with (fifty: fifty) date syrup and sucrose was found superior in texture, color, flavor, and general acceptability but Jam with concentrate (100%) of date syrup was found superior in taste. Jam with (0%) concentrate of date syrup was found to be less in texture, color, taste, and general acceptability. There is no significant difference between the panelists at 0.05 and 0.01 degrees of freedom for texture, color, flavor, taste, and general acceptability. Found a significant difference between samples at 0.05 degree of freedom and high significant difference at 0.01 degrees of freedom.

**Keywords:** Date; Date Syrup; Pumpkin; Pectin; Jam

## Introduction

Jams are made primarily from sugar and fruits. By binding the water in the jam, sugar (sucrose) derived from sugar cane or sugar beets is added to the jams to create a sweet taste and inhibit microbial growth. However, high consumption of sugar is associated with high consumption of energy, which can raise the risk of diabetes, obesity and cardiovascular disease [1].

The pumpkin has a rough skin and is available year-round commercially. In pumpkin, the presence of carotenoids gives them their distinctive yellow-orange hue. Pumpkin is eaten in desserts, soups, cookies, marmalades, and jams as a fresh vegetable or ingredient [14].

In many parts of Sudan, pumpkin is a cheap vegetable, particularly during the rainy season. When cooked with meat and tomato (Mulah), most pumpkin pulps are consumed locally, but recently pumpkin pulp has different applications, such as pie filling, nectar and jam making, since it has good properties, bright color, sweet taste and needs less quantities of pectin when used for jam making [8]. The most prevalent single factor in dates is the contribution of sugar. The date was used more as a sugar source than as a fruit in the ancient date producing nations. Mixtures of sucrose ( $C_{12}H_{22}O_{11}$ ), glucose ( $C_6H_{12}O_6$ ) and fructose ( $C_6H_{12}O_6$ ) are found in both date sugars. The derivation of sucrose after inversion by enzyme inverters is fructose and glucose [8]. The most common derived date product is date syrup (concentrated date juice). For the preparation of date syrup, Sudanese date cultivars were used and the products showed good color and strong flavor [10].

Fruit pulps as pumpkin are often preferred by food industry as ready to use raw materials. It will be purpose of one phase of this investigation to develop a new product of high nutritive value such as date syrup which would possess a pronounced date flavor and can be used as a main ingredient in the manufacture of jam [15]. The chemical composition and the pumpkin fruit's antioxidant content make it an important food product for human consumption. [11], at the same time, pumpkin is a perishable food, like most vegetables, so it is important to use methods that allow its properties to be stored, prevent its loss after harvest, and try to process it into a value-added product. Therefore, the objective of our study is to produce two types of jam from pumpkin fruit, by using cane sugar to sweetness one of them, and date syrup to sweetness another by different concentrate of date syrup and evaluate the chemical and sensory characteristics for all types of jam produced.

## Materials and Methods

### Materials

Date fruits, Pumpkin, Additives, Pectin, Citric acid, Sugarcane (sucrose)

**Equipment:** Cooking facilitates, gas ring, stainless steel saucepan, stainless cutting knives, Spoons, wooden spoon (for stirring), muslin cloth, and jars. Refractometer, oven, soxhelt extractor, crysibles, conical flask, finger condenser, Buchner funnel, wash bottle, air oven drier, descators, muffle furnace, a thimble, cotton wool, round flask, siphoning apparatus, condenser, heater, thermometer, what man filter paper and volumetric flask.

## Methods

**Selection of Date Cultivar:** The selection of date cultivars that the place of study was depended on the ratios of sugars in the date fruits. The brix was measured for four cultivars of dates (Barakawi, Gondaila, Gaw, and Mishrig Wad Laggai). The suitable cultivar was found to be Wad Laggai.

**Extraction of Date syrup:** Date syrup was extracted from wad laggai dates by heat extraction. Date fruits were cleaned from extraneous material, pitted and pulped. The pulp was placed in pressure cooker, mixed with equal amount of water and boiled for 5 minutes at 115 °C. Date juice from the insoluble solids (date cake) was done by passing through a double fold cheese muslin cloth. To obtain the date syrup, the juice was concentrated to 55% TSS at atmospheric pressure using open jacketed pan of 6 liters capacity. The syrup was preserved in glass jars and kept at room temperature for further use.

## Jam Processing

**Trial batches:** Trial Patches were conducted to establish the appropriate amounts of pectin and citric acid needed for proper gel setting and adjustment of PH between 3.2 - 4.0, which are important for storage and gelling of the jam.

**Preparation of the control pumpkin jams:** The control pumpkin jam was prepared according to [9] using pumpkin pulp (1kg), citric acid (0.39mg/100g) and commercial pectin (10gm/kg) according to the follow in procedure.

**Preparation:** The pumpkin stocks are peeled using a sharp clean stainless-steel knife, after removal of seeds; the pulp was made into dices. The prepared pulp was placed in cooking kettle and leached in water until it became soft. Addition of excess water was avoided to reduce the boiling time. The pulp was then blended by an electrical blender and more water was added when needed. Finally, the pulp was passed through a pulper of medium sieve.

**Pectin:** Pectin was added in dry from with half amount of sugar to facilitate dissolving of pectin and to prevent lumping.

**Cooking:** Water, prepared pumpkin pulp, citric acid and half amount of sugar are mixed in stainless steel saucepan and boiled for just 12 - 15 minutes to a void rise of caramel flavors, over-sweetness and discoloration. The jam was stirred at all times otherwise burning will occur at the bottom of the saucepan, causing off flavors and discoloration. After that the dry mixture of pectin and sugar were added (The pectin should not be heated for longer than necessary because it will be broken down and then the jam will not set). When the jam reached nearly temperature of 106° -108 °C, small sample was taken, cooled by smearing in a cold dry plate and tested on a hand refract meter. The 'end point' is reached when the total soluble solids was up to 68%.

Finally, to prevent excessive heating and contamination of jam, the product was quickly put into dry clean steam sterilized jars, which were still hot so that they do not crack. The filled jars were then placed in water to cool down the jam so that it does not keep cooking in the jar, the water level was kept bellow the lid of the jars. Jars cooling, washing and labeling are the last stages before storage and use.

## Preparation of pumpkin jam using different concentrate

**of date:** The same above-mentioned procedure was adopted with little modification as fallowed. 25, 50, 75 and 100% of the sugar concentration was substituted by Wad laggai dates syrup. The four products were designated sequentially as 25, 50, 75, and 100%.

## Physical properties of date fruits

**Length, Diameter, weight, and Pit (%):** Fruits length, and diameter were measured by using tape meter. Fruit pulp and seed weights were determined using digital balance. The pit percentage was calculated according to the following formula:

$$\text{Pit \%} = \frac{w_1}{w_2} * 100 \quad (2.1)$$

**Where:**

$W_1$  = Weight of whole date fruits (with seeds).

$W_2$  = Weight of seeds removed from the date fruit.

All values were recorded by taking the average of 5 fruits from date sample.

**Total soluble solids (TSS):** TSS (°Brix) was measured at 25 °C with hand refractometer [2].

## Chemical analysis

**Ash content:** Ash was determined according to the standard method of [18].

Sample 5gram was accurately weighed into relatively road crucibles that have been per ignited in a muffle furnace at 550 °C until light grey ash of constant weight was obtained.

**Crude fiber content:** Crude fiber was estimated according to [18].

**Crude proteins:** Crude protein content was determined using Kjeldahl method and calculated by multiplying the amount of nitrogen by 6.25 [18].

**Oil Content:** The oil content was determined according to [2,18] using soxhelt method.

**pH value:** The pH was measured with glass electrode PH meter (hand refractometer) (Model; HANNA instruments 8521) at ambient temperature [18].

**Total sugar:** Total sugars were assessed according to Lane and Eynontometric method [3].

**Standard methods for titration:** 10 ml (25 ml in case of jam) mixed solution of Fehling (A) and (B) were pipette into a conical flask. A burette was filled with the clarified sugar and running the whole volume required to reduce the Fehling solution so that, 0.5-1.0 ml was still required completing the titration. The contents of the flask were mixed, heating to boiling for 2 minutes and the three drops of methylene blue indicator were added. The titration was continued till the color completely disappeared. Calculation:

$$\text{Mg total sugars / 100 ml} = \frac{\text{factor} * 100}{\text{titer}} \quad (2.2)$$

$$\text{Totl sugars \%} = \frac{\frac{\text{mg}}{100} \text{ ml} * \text{dilution} * 100}{1000 * \text{weight taken}} \quad (2.3)$$

The factor is obtained from the invert sugar table [16].

**Reducing sugars:** Reducing sugars were estimated according to [3].

Using the following equation:

$$\text{Mg reducing sugars} / 100 \text{ ml} = \frac{\text{factor} \times 100}{\text{titer}} \quad (2.4)$$

$$\text{Reducing sugars \%} = \frac{\frac{\text{mg}}{100} \times \text{mi} \times \text{dilution} \times 100}{1000 \times \text{weight taken}} \quad (2.5)$$

Where:

Factor = 20.36/AA= Volume (ml) of the standard invert sugar solution required. A=10

**Sucrose %:** The sucrose (%) was calculated using the following equation [18]:

$$\text{Sucrose (\%)} = \{\text{Total sugar} - \text{Reducing sugar}\} \times 0.95 \quad (2.6)$$

### Organoleptic Test

The organoleptic quality of the jam samples was assessed according to the ranking test described by [12]

### Statistical Analysis

The data of chemical characteristics were statistically analyzed by the F-test and Analysis of Variance (ANOVA). The means separation of organoleptic test was assessed by Factorial test. The data was calculated using the following equations:

$$CF = \frac{(\text{Grand total})^2}{(P \times S)} \quad (2.7)$$

$$\text{Total SSQ} = \sum \{\text{Ech replication}^2\} - CF \quad (2.8)$$

$$\text{Sample SSQ} = \frac{\sum (\text{sample total})^2}{(S)} - CF \quad (2.9)$$

$$\text{Panelist SSQ} = \frac{\sum (\text{Panelist total})^2}{(P)} - CF \quad (2.10)$$

$$\text{Error SSQ} = \text{Total SSQ} - (\text{Sample SSQ} + \text{Panelist SSQ}) \quad (2.11)$$

Where:

CF = Correction Factor SSQ= some of squares

S= number of sample P= number of panelists

## Results and Discussions

### The Selection of Date Fruits

Table (2) shows the brix was measured for four cultivate of dates (Barakawi, Gondaila, Gaw, Mishrig Wad Laggai). A Mishrig wad laggai date was found to be a highest brix number. That is a strong indicator for sugar content.

### Physical Properties of Date Fruits

As shown in (Table 3), the physical properties of Sudanese date cultivar (Mishrig Wad Laggai) used in this study, the average fruit length, diameter, and weight were found to be 3.2 cm, 1.8 cm, 7.8 g, respectively. When comparing this length was 2.83 cm, diameter 1.77 cm, fruit weight 7.01g, and pulp weight 6.09g. This result was in a good agreement with [13] they were found that Wad Laggai fruit.

### Chemical Composition of Date Pulp

As show in (Table 4), Wad Laggai date contained about 81.8% sugars, satisfaction percentage. At the comparison with [13] there are some analogical whereas the percentage of moisture, crude protein, ash, crude fiber, oil, total sugar, reducing sugar, and sucrose were 11.4%, 2.62%, 1.18%, 1.74%, 0.31%, 67.32%, 63.5%, and 3.82% respectively.

**Table 1:** Preparation of pumpkin jam complemented with dates syrup.

Jam	Date syrup (kg)	Sugar (kg)
Control	0.0	1.0
25%	0.25	0.75
50%	0.5	0.5
75%	0.75	0.25
100%	1.0	0.0

**Table 2:** The Brix of deferent types of Sudanese date.

Cultivar of date	Brix
Barakawi	26.3
Gondaila	22.8
Gaw	22.3
Mishrig (wad laggai)	48.1

**Table 3:** Physical properties of WadLaggai date fruits.

Physical properties	Value
Fruit length (cm)	3.2
Fruit dim (cm)	1.8
Fruit weight (g)	7.8
Pulp weight (g)	6.5
Seed weight (g)	1.1
Crust weight (g)	0.1
Pit %	83.8

**Table 4:** Chemical compositions of 100gram of WadLaggai date pulp.

Chemical composition	Ratio (%)
Moisture	11.06
Crude protein	1.2
Ash	2.2
Crude fiber	3.44
Oil	0.3
Total sugars	81.8
Reducing sugars	73.6
Sucrose	8.2
TSS	85.5

### Characteristics of the Wad Laggai Date Syrup

As presented in (Table 5), Wad Laggai date syrup contained about 81.4% sugars. These results considered good when a compare with [10], whereas the pH value was (4.91%), protein (1.16%), ash (1.82%), Lipids (2.04%), TSS (84.25%), and the total sugars was 81.88% in his study.

### Chemical Compositions of Jam Products

Table (6) shows the chemical characteristics of jam. The results of above chemical analysis consider very satisfaction at comparison with [5,17], whereas the results of chemical compositions were some analogical. [5] used tow cultivars of Sudanese date (Barakawi and Gondaila) in his study; he made jam of pumpkin fruit and use the date syrup for sweetening it by concentrate (B30%, B50%, B100%, G30%,

**Table 5:** Characteristics of the date Syrup.

Characteristics	Ratio
pH	4.7
Moisture	11.09
Crude protein	1.3
Ash	2.4%
Crude fiber	3.46
Oil	0.35
TSS	84.3%
Total sugars	81.4%
Reducing sugars	72.0%
Sucrose	9.4%

G50%, G70%, G100%). As afore mentioned the results of this study were more corresponding Awadalgeed study, for example: Moisture: was ranged between 11.5% - 33.33% in this study, and it was ranged between 25.5% - 26.5% in [17] study. Minerals: were discerned by ash percentage, it increased with date concentrate increasing and it was ranged between 0.95% - 1.40% in this study, 0.22% - 1.71% in [17] study. Protein: was increased with date concentrate increasing. And it was ranged between 0.64% - 2.03% in this study, and ranged between 0.32% - 1.68% in [17] study. Lipids: increased with date concentrate increasing. It was ranged between 0.30% - 0.44% in this study. Fiber: was ranged between 1.51% - 1.56% in this study, and it was ranged between 0.23% - 1.63% in [17] study. PH value: was ranged between 4.3% - 5.1% in this study, and ranged between 2.91 - 4.23 in [5]. Total sugars: were ranged between 50.86% - 43.94%, it is a good ratio, and it is higher than [5] study which ranged between 30.13% - 49.67%. Reducing sugars: indicates to Monosaccharides. It was 3.07% for pumpkin jam with sugar in this study, 3.33±0.33 in [5] study. And it

**Table 6:** Chemical compositions of pumpkin jam with date syrup.

Chemical compositions	Sample 1 (0% date syrup)	Sample 2 (25% date syrup)	Sample 3 (50% date syrup)	Sample 4 (75% date syrup)	Sample 5 (100% date syrup)
Moisture %	11.50	31.72	17.14	19.28	33.33
Ash%	0.95	1.10	1.18	1.25	1.40
Protein %	0.64	0.72	0.93	1.22	2.03
Lipids %	0.30	0.33	0.37	0.40	0.44
Fiber %	1.53	1.51	1.54	1.56	1.55
PH	4.30	4.66	5.01	4.67	4.50
Total sugar%	50.86	47.22	43.94	47.50	48.36
Reducing sugar%	3.07	17.88	31.88	37.54	48.36
Sucrose%	45.40	27.87	11.46	9.46	0
TSS %	54.28	50.88	47.95	51.93	51.75

**Table 7:** Sensory evaluation of jam produced from pumpkin with date syrup.

Sample	Texture	Color	Flavor	Taste	General acceptability
Sample 1 (0%)	3.5	3.0	4.1	4.3	4.8
Sample 1 (25%)	4.4	4.3	4.3	4.7	5.3
Sample 1 (50%)	4.9	5.0	4.4	5.6	5.7
Sample 1 (75%)	4.3	4.2	4.4	5.4	5.4
Sample 1 (100%)	4.2	3.7	3.1	5.0	4.6

was ranged between 17.88- 48.36% for pumpkin jam with date syrup in this study, 5.12 - 15.48 in [5] study. It increased with date concentrate increasing. This result was too comfortable whereas Monosaccharides is better than di and Polysaccharides for human health. Sucrose: The ratio of sucrose was ranged between 45.40% - 0.00% in this study, and it was ranged between 14.65 - 44.99 in [5] study. It decreased with date concentrate increasing. TSS (total soluble solids) is the sum total of solid components, TSS value was a little difference from Awadalgeed study. It ranged between 50.86% - 47.22% in this study, and it ranged between 58.88 - 70.78 in Awadalgeed study. The results of above chemical analysis consider very satisfaction at comparison with [17]. Whereas they've produce carrot jam by replacing 0, 25, 50 and 75% of sugar with date paste from two varieties of Saudian date, and the results of the was related the results of this study.

### Sensory Evaluation of Jam Produced from Pumpkin with Date Syrup

According to the panel test ranking shown in (Table 7), jam with concentrate 50% date syrup showed the best Texture, color, flavor and general acceptability, jam with concentrate 75% date syrup showed the best flavor in conjunction with jam 50%. On the other hand, jam with 100% concentrate date syrup showed the best taste. Point out the values above is the average of ten replicates for ten panelists, whereas panelists gave degree (6) for the best evaluation, and gave degree (0) for the worst evaluation. The bottom-line; usage of date syrup to jam sweetening was agreeable to Sudanese consumers, particularly jam of pumpkin sweeten by date syrup and cane sugar (fifty-fifty).

### Conclusions

Pumpkin is a suitable fruit for jam manufacturer to its pulp characteristics. The Sudanese date (Mishrig – Wad Laggai) is suitable for the production of date syrup due to its high sugar content. Sweetness jam by percentage (100%) of date syrup was found to

contain high level of minerals, protein, lipids, Monosaccharides and total soluble solids. And jam with (fifty: fifty) date syrup and sucrose was found to contain high level of ph.

## References

1. Amnah M. A. Alsuhaibani and Amal N. Al-Kuraieef. Effect of Low-Calorie Pumpkin Jams Fortified with Soybean on Diabetic Rats: Study of Chemical and Sensory Properties. *Journal of Food Quality*. 2018; 2018: 7.
2. Lepper HA. Official methods of analysis of the association of official agricultural chemists. (journal). 1950; 38: 431.
3. AOAC. Official Methods of analysis of the Association of Official Analytical Chemists, 16<sup>th</sup> Ed. Gaithersburg, USA. 1998.
4. Helrick K. Official methods of analysis. 1990; 52: 148A-148A.
5. Awadalgeed Mohammad Altayieb. Suitability of two cultivars of date syrup (phoenix doctalifira) in jam making. MSC dissertation. University of Khartoum. 2009.
6. Barreveld HW. 1993 Date palm products. FAO agricultural services Bulletin (101) Rome. Bot. Mag. (Tokyo), 96 (1983), pp. 67-73.
7. Center: The Sudan date processing. FAO Tech of the food research.
8. Tinay AHE, Saeed AR, Bedri MF. Fractionation and characterization of guava pectic substances. *International Journal of Food Science and Technology*. 2007; 14: 343-349.
9. Elisa Costa, Sandra Sautos, Ana Corria, Lucia pato. *International Food Congress Novel Approaches in Food Industry*. 2011.
10. Gamal A El-Sharnouby, Salah M Aleid<sup>1</sup>, and Mutlag M Al-Otaibi. Liquid Sugar Extraction from Date Palm (Phoenix dactylifera L.) *FruitsJ Food Process Technol*. 2014; 5: 1000402.
11. Guiné R. P. F., and Barroca M. J. Effect of drying treatments on texture and color of vegetables (pumpkin and green pepper). *Food and Bioproducts Processing*. 2012; 90: 58-63.
12. Ihekoronye,A.I. and Ngoddy ,P.O. *Integrated food science and technology for the tropics*. Mac Millan Pub. London. 1985.
13. Saeed IK, El-Rauof FA, Dawoud HD. Physico-chemical Evaluation of Some Introduced Date Fruits Cultivars grown under Sudanese conditions. *International Journal of Applied Sciences and Biotechnology*. 2015; 3: 731-736.
14. Pla MFDE, Ponce NM, Stortz CA, Gerschenson LN, Rojas AM. Composition and functional properties of enriched fiber products obtained from pumpkin (Cucurbita moschata Duchesne ex Poirer). *Lwt - Food Science and Technology*. 2007; 40: 1176-1185.
15. Mikki MS. Production and processing of dates in Saudi Arabia. The 1st international conference on date palms. Elaine, united Arab Emarites. 1998.
16. Pearson D. *The Chemical Analysis of Food*. 6th Edition, and A. Churchill, 104 Gloucester Palace, London, 1970.
17. Ramadan A. Habiba and Mohamed A. Mehaia. Improving Carrot Jam characteristics and its nutritional value by using Date paste instead of Sugar. *Journal of Agricultural and Veterinary Sciences, Qassim University*. 2008; 1: 13-18.
18. Rashida Rajuva. *A food technology laboratory manual (PHD)*. 2014.
19. Schneider C. Parameterized Telescoping Proves Algebraic Independence of Sums. *Annals of Combinatorics*. 2008; 14: 533-552.