Utilization of Some Local Date Palm Cultivars in Production of Jam and Assessment of its Quality

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ABSTRACT

The objective of the present work was to study the possibility of the production of jam from three local cultivars of dates, namely; *Jawa*, *Gondaila* and *Kulma*. The chemical, microbiological and sensory characteristics of date jams were determined. The analysis revealed relative increase of moisture content in *Kulma* date jam (KDJ) (54.62%) as compared with those of *Jawa* date jam (JDJ) and *Gondaila* date jam (GDJ) which were 51.09% and 47.94%, respectively. The ash content was 1.7%, 0.4%, and 0.5% in (JDJ), (GDJ) and (KDJ); respectively. The total soluble solids was 80.5%, 80.8% and 78% in (JDJ), (GDJ) and (KDJ); respectively. Reducing sugars were higher in (JDJ) (34.0%) when compared with those of (KDJ) and (GDJ) which were 31% and 24%; respectively. Titrable acidity was 0.4%, 0.32% and 0.37% in (JDJ), (GDJ) and (KDJ); respectively. The highest pH value was found in (GDJ) (4.7) as compared with (JDJ) and (KDJ) which were 4.39 and 4.22, respectively. The highest value of ascorbic acid was found in (KDJ) (220 mg/100g) as compared with (JDJ) and (GDJ) which were 150 and 176 mg/100g; respectively. On the other hand, the microbiological analysis of date jam samples revealed low levels of total microbial load. The sensory evaluation indicated high acceptability for all samples of date jams.

INTRODUCTION

Date palm (*Phoenix dactylifera L.)* is one of the most important fruit crops known by man as a high-energy food as well as being a dessert fruit. The palm tree was mentioned in the Holy Quran twenty times, on fifteen occasions it is mentioned among other plants, while the Prophet of Islam, Mohammed peace been upon him, told his followers many times about dates and date palms.

Date palms are probably one of the oldest fruit trees in Sudan. Northern Sudan is well suited for the date culture (Osman, 2005). There are two major areas for date palm cultivation in Sudan. The Northern State and the River Nile State. The dry date cultivars are dominant in the area (Osman, 1984).

A considerable number of date meals are prepared locally at home and cottage levels. They are consumed by various sectors of Sudanese society. For a long time, especially in the northern region, the people in this region prepare date-based meals suitable for all family members for different occasions. These products include *Medidat Tamr* (date porridge), *Gorast tamr* (date pancake), *Zad Elmusafir* (traveler's food snack), hot drink sweetener, *Sherbout* (non-alcoholic soft drink), *Agwa* (compressed date block) and date syrup (Takrouni, 2005).

Perhaps, jam processing in which pectin is of the most important constituents, may be considered a recent food industry. However, consumption of jam in Sudan may be increased annually as consequence of some factors such as changes in social, demographical, and economical states. The abundance of raw materials in different areas in the Sudan also contributes in this trend.

Nowadays, according to Sudanese Minister's Council Report (S.M.C.R 1996) there are five big jam factories, in addition to many small-scale jam industries, most of them concentrated in Khartoum State. Proposed capacities of these factories are about 5305 tons per year, while the actual production is 935 tons in 1995 (S.M.C.R, 1996).

Although, there are many jam factories, Sudan is currently importing appreciable quantities of jam. The reports showed that total importation of jam were 4318 tons in 1994 and 4820 tons in 1995 (Ahmed, 2002).

The objective of the present study was to produce jam from fruits of selected date palm cultivars and to evaluate its quality.

MATERIALS AND METHODS

Materials

Date fruits of *Gondaila*, *Kulma* and *Jawa* date cultivars were purchased from Wad Medani local market in July, 2009. The experimental work was carried out in the Department of Food Science and Technology, Faculty of Engineering and Technology, University of Gezira Wad Medani, Sudan.

Methods

Production of jam

The steps of the experimental procedure of dates jam are shown in Fig. (1). The processing consisted of the following main operations:

Quality evaluation of date jam

The date jam quality was evaluated immediately after processing for the following parameters:

Total soluble solids (%)

Total soluble solids of dates jam were determined according to the AOAC (1990) methods using a hand refractometer, model (Belling Ham and Stanley) at room temperature, was corrected to 20^{o}C from tables for temperature correction of reading of the refracte meter .

Determination of pH

The pH values of the samples were determined according to AOAC (1990). A digital pH meter was used.

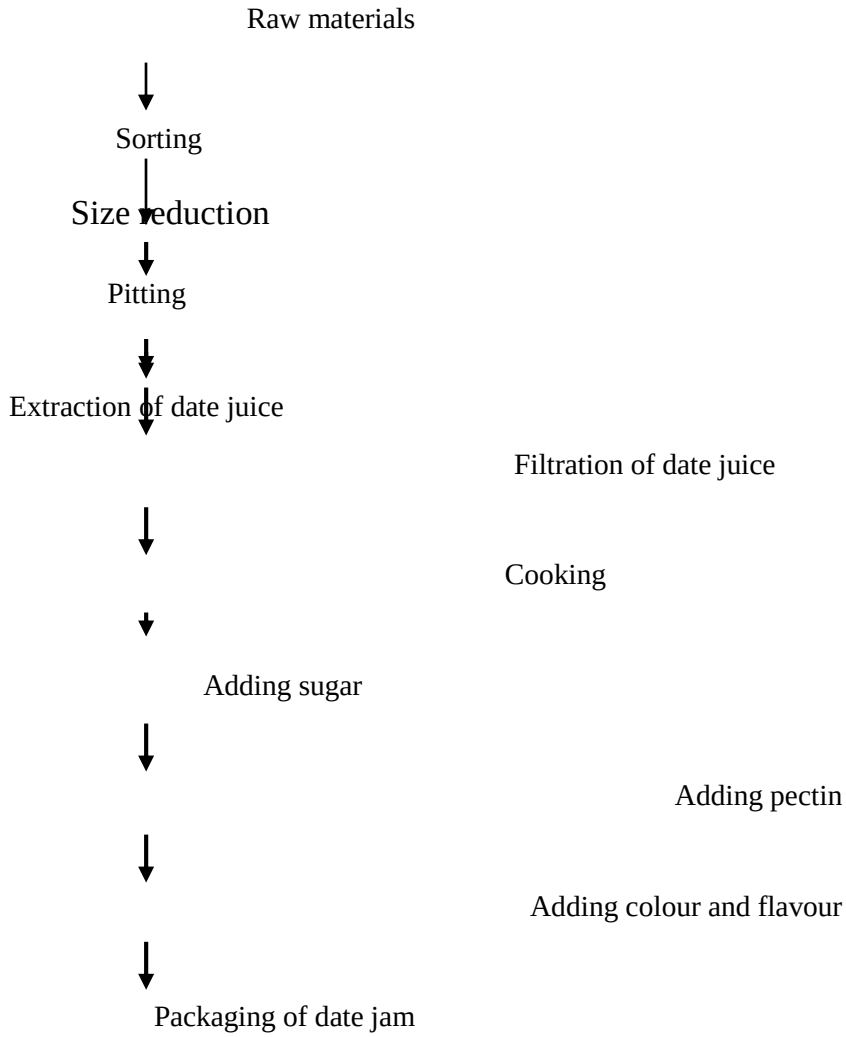

Fig. 1. Jam production flow diagram

Titrable acidity

The total titrable acidity was determined according to AOAC (1990). Ten ml of the jam were taken in a beaker. Then 20 ml of distilled water were added, drops of phenolphthalein indicator were added and the sample was then titrated with 0.1M sodium hydroxide solution until a faint pink colour persisted. The total titrable acidity was then calculated as follows:

$$\% \text{ Acid} = \frac{(\text{ml of NaOH})(\text{N.NaOH})(\text{dil. Factor})(\text{Equ.wt})}{\text{Wt. of sample}} \times 100$$

Reducing sugars

The reducing sugars content of jams were determined according to the method of ICUMSA (1998). In this method, ten g of sucrose were weighed and poured into 1000 ml flask, then 10ml of HCl 0.1N was added, and made up to the mark with distilled water. The mixture was left overnight to make standard invert of sucrose solution. After that, inverted extract was poured into burette 50 ml. Five ml of each Fehling solution and 10 ml distilled water were mixed into glass flask, then it was transferred to heater. The titration was started while the mixture was boiled. While the color of mixture was changed, during titration, 3 drops of methylene blue indicator were added into mixture and addition of the sugar solution was continued until the indicator was completely decolorized.

Calculations:

To get Fehling factor (F.F)

$$F.F = \frac{C \times v \times R.S.}{100}$$

Where:

R.S. = Reducing sugar %

F.F. = Fehling factor

C = Concentration of standard reducing sugar %.

V = ml of standard solution for titration.

Four grams of jams were weighed and poured into 200 ml flask, and then the volume was completed to mark with distilled water. The mixture was filtered using a Whatman (No. 1) filter paper. After that, the liquid was poured into50 ml burette. Then the titration was made as mentioned above to determine reducing sugars %.

$$R.S. = \frac{F.F. \times 100}{C \times v}$$

Where:

R.S. = Reducing Sugar %

F.F. = Fehling factor

C = Concentration of sample

Determination of ascorbic acid (vitamin C)

Ascorbic acid content was determined according to the method published in Food Chemical Codex (Committee on Specifications of the Food Chemicals Codex of the Food Protein Committee, 1966).

Four hundred milligrams of jam samples were mixed with 100ml distilled water and 25 ml of sulfuric acid. The clear solution was titrated immediately with 0.1 N iodine, starch was added near the end point. Ascorbic acid calculated as each ml of 0.1N iodine is equivalent to 8.806mg of ascorbic acid.

Microbiological analysis

Total bacterial viable count

The total count per ml of samples was obtained by making suitable dilutions in triplicates on plate count agar (Oxoid) following the method of APHA (1967). Incubation was accomplished at 30^{o}C for 48 hours. Plates containing between 30 and 300 colonies were counted (cfu/gm).

Yeast and mould count

The yeasts and moulds count was enumerated by culturing on Potato Dextrose Agar (PDA) medium and incubation was accomplished at 25 ^{o}C for 72 hours, then the yeast were counted, plates containing between 30 and 300 colonies were counted as colony forming units (c.f.u.) per /ml of the sample.

Sensory evaluation

Date jam samples were subjected to panel test. The performance of judges towards these products was tested using hedonic scale, whereby ten panelists were selected and the tests were conducted in the Quality Control Laboratory of the Food Science and Technology Department, Faculty of Engineering and Technology, University of Gezira. Ten judges were asked to express their preferences of three coded date jams. The samples were presented so that each sample had an equal chance to be tested first, second or last.

The results obtained by the panelists were converted to scores ranging from like extremely (9) to dislike extremely (1) (Larmond, 1982).

Statistical analysis

Statistical analysis data were subjected to analysis of variance. Mean separation was done according to Duncan's Multiple Range Test at 5% level by using MSTAT.

RESULTS AND DISCUSSION

Chemical composition of date jam:

The chemical composition of the various jam samples was shown in Table (1). The moisture content(%) of *Jawa* date jam (JDJ), *Gondaila* date jam (GDJ) and *Kulma* date jam (KDJ) were 51.09, 47.94 and 54.62% when compared with those reported by sulieman *et al*. (2007) which ranged between (41.61 , 42.62%).

The ash content (%) of JDJ, GDJ and KDJ were 1.7, 0.4 and 0.5%; respectively. Ash content of KDJ was comparable to that reported by Sulieman *et. al.* (2007) which was 0.54%. The ash content found in this study is an indication of high minerals content of the examined dates.

The total soluble solids (TSS%) of (JDJ), (GDJ) and (KDJ) were 80.5, 80.8 and 78%; respectively. The total soluble solids content in JDJ and GDJ date jams were higher when compared with that reported by Barreveld (1993) who gave a value of 76%. On the other hand, total soluble solids in KDJ were in close agreement to that reported by Abdel Rahman (2000) which was 79.8%.The reducing sugar content of JDJ, GDJ and KDJ were 34.0, 24 and 31%, respectively. All values of reducing sugar contents in date jams determined in the present study, were lower when compared with the range reported by Barreveld (1993) which was 65.9- 70.7%.

The titrable acidity values of JDJ, GDJ and KDJ were 0.4%, 0.32% and 0.37%, respectively. The Titrable acidity in all samples were closely related to that reported by Barreveld (1993) which was (0.46 - 0.76%).

The pH values of JDJ, GDJ and KDJ were 4.39, 4.7 and 4.22, respectively. All the values of pH in date jams were within the range 4.14-4.6 reported by Barreveld (1993).

The values of ascorbic acid were 150,176 and 220 mg\100 g in JDJ, GDJ and KDJ ; respectively.

Table 1. Chemical composition of dates jams

Parameter	JDJ	GDJ	KDJ
Moisture (%)	51.09	47.94	54.62
Ash (%)	1.7	0.4	0.5
Total soluble solids (%)	80.5	80.8	78
Reducing sugars (%)	34.0	24	31.00
Titrable acidity (%)	0.4	0.32	0.37
pH value	4.39	4.7	4.22
Ascorbic acid (mg/100g)	150	176	220

JDJ=*Jawa* date jam

GDJ=*Gondaila* date jam

KDJ=*Kulma* date jam

Average of three readings

Microbial analysis of jam

The microbial analysis of jams made from three cultivars of dates (*Jawa* date jam (JDJ), *Gondaila* date jam (GDJ) and *Kulma* date jam (KDJ) is shown in Table (2). The analysis revealed bacterial presence of (4×10^4), (2×10^4) and (3×10^4) c.f.u/g of total viable counts in (JDJ), (GDJ) and (KDJ); respectively. This result is similar to that obtained by Ibnoof, (2007) who reported (3×10^4) c.f.u/g for both tamarind (*Tamaridus indica*) pectin jam and commercial pectin jam. The increase of total microbial load in JDJ and KDJ could be attributed to post-contamination or cross contamination during the process.

Table (2) also shows absence of coliforms in all tested dates jams samples. Coliforms are a group of microorganisms which include *E.coli* (Monika, 1984). It also shows absence of *Staphylococcus* and yeasts and moulds in all tested jam samples. It is known that *staphylococci* can not grow in medium with higher sugar concentration.

Staphylococcus sp could cause food poisoning from enterotoxin B in food. Yeast and moulds are fungi which are responsible for the food spoilage and may produce mycotoxin (Buchanan and Doyle, 1997). Yeasts can spoil food rapidly, and both yeasts and moulds grow well in acidic food with low water activity (Cliver, 1990).

Table 2. Microbial load (c.f.u/g) of date jam

Date's jam	Total bacterial viable count	Coliforms	Staphylococcus	Yeasts and moulds
Jawa	4×10^4	Nil	Nil	Nil
Gondaila	2×10^4	Nil	Nil	Nil
Kulma	3×10^4	Nil	Nil	Nil

Average of three readings

Sensory evaluation of date jam

Sensory evaluation was carried out by senescent of taste, smell, touch and hearing when food is eaten. The complex sensation that results from the interaction of senses is used to measure food quality in programs for quality control and new product development (Larmond , 1982). The results of taste panels of jam produced by using date cultivars "*Jawa*, *Gondaila* and *Kulma*" are shown in Table (3), which indicates that there was no-significant differences in appearace, texture colour, flavour and overall acceptability of the three types of jams. The sensory analysis indicated that all types of jams were accepted by panelists.

Table 3. Sensory evaluation of date jam

Cultivar	Appearance	Texture	Colour	Flavour	Overall acceptability
JDJ	7.00 ± 0.67ab	6.90 ± 0.53ab	7.30 ± 0.47a	6.6± 0.7ab	7.3 ± 0.5ab
GDJ	6.70 ± 0.60a	6.50 ± 0.64a	6.90 ± 0.48a	7.0 ± 0.7ab	6.9 ± 0.5ab
KDJ	6.30 ±0.52ab	6.00 ± 0.79ab	6.70 ± 0.45a	5.8 ± 0.7ab	6.2 ± 0.7ab

*Means followed by the same letter (s) are not significantly different according to Duncan's Multiple Test at 5% level.

CONCLUSION

Date jam production could be promising, particularly from lower grade dates like *Jawa* date. Since these varieties of dates generally have low cost and sometimes were used for feeding animals, or even if it is sold, it is not profitable to the farmer. Attention should be paid to this industry which could be very successful in the local and world markets. If date

jam is made available at high quality and low prices it could be preferred by local consumer and compares well with the current jams made from other fruits. Studies are needed in the area of economic feasibility of date jam production. Hygienic conditions must be available while making jam at home. Further study is required to investigate the effect of other factors like types of packaging materials and storage on the quality of date jam.

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استخدام بعض أصناف البلح المحلية في صناعة المربى و تقييم جودتها

عبدالمنعم الهادي سليمان وبسمات إبراهيم الصديق على و الأمين عبدالله الخايفة
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الخلاصة

هذا البحث يهدف إلى دراسة ملائمة إنتاج مربى البلح من ثلاث أصناف محلية من البلح وهي الجاوا ، القنديلا والكلمه . تم إجراء الإختبارات الكيميائية والميكروبية والحسية على عينات مربى البلح. أظهرت التحاليل إرتفاع في محتوى الرطوبة في مربى الكلمه 54.62% مقارنة بمربى البلح من الجاوا والقنديلا 50.09% و47.94% على التوالي. محتوى الرماد في مربى بلح الجاوا والقنديلا والكلمه كان 1.7% و0.4% و 0.5% على التوالي. نسبة المواد الصلبة الكلية 80.5% و80.8% و 78% لمربى بلح الجاوا والقنديلا والكلمه على التوالي. أعلى محتوى للسكريات المختزلة وجد في مربى الجاوا 34% تتبعه مربى بلح الكلمه والقنديلا 31% و 24% على التوالي. الحموضة الكلية كانت 0.4 ، 0.32 ، 0.37% لمربى بلح الجاوا والقنديلا والكلمه على التوالي. أعلى قيمة للأس الهيدروجيني وجدت في مربى بلح القنديلا 4.7 تتبعه مربى الجاوا والكلمة والتي كانت 4.39 و 4.22 على التوالي. أعلى قيمة لحمض الأسكوربك وجدت في مربى بلح الكلمة 220 ملجم/ج بينما 150 و 176 ملجم/ج بكل مربى بلح الجاوا والقنديلا على التوالي. من ناحية أخرى أظهرت نتائج التحليل الميكروبي لعينات مربى البلح الثلاث مستويات منخفضة للعد الميكروبي الكلي والتقييم الحسي أظهر قبولاً حسناً لجميع العينات.