

CHARACTERISTICS OF A FLAVORED BEVERAGE

FORMULATED WITH DATE SEED SOLIDS

by

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This thesis is dedicated  
with much love and sincerity  
to all people of this world;  
especially to those  
who cannot find  
enough food for the day,  
to all scientists  
and to all members of human society.

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In the name of God,  
the Merciful, the  
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## ABSTRACT

A flavored beverage consisting of water, together with milled, pulverized date pits, cocoa powder and sugar was developed. Preparation included grinding the seeds, retort heating at 121°C and 5.12 Kg/Cm<sup>2</sup> pressure for ten minutes, and then adding cocoa powder, sugar and a stabilizer. Homogenization at 90°C and a pressure of 317.125 Kg/Cm<sup>2</sup> was needed.

The resulting beverage was viscous, homogenous and had an acceptable flavor and light brown color. Combinations of the basic homogenate with other levels of water, sugar and cocoa syrup were prepared. The most acceptable among those combinations were ones containing 5-7% sugar. Separation of liquid on the surface of the beverage during storage at 4°C was the only observed problem which needs further research in order to correct the abnormality. Heat of homogenization was considered sufficient to produce a pasteurized product.

## INTRODUCTION

As world population is increasing drastically, natural food resources tend to become limited. This focuses attention on the importance of searching for possible additional food sources. Since the use of date pits in animal feed has shown positive results, especially in poultry, it is felt that there would be value in studying the processing of this crop by-product for use as a human food thereby providing one possible partial solution to food shortage problems in some countries.

An example of expanding the use of a crop plant for human use is the development of processed food products from the soybean. In this category, are various types of beverage-type foods. A full-fat soybean milk base (Aminlari et al, 1977) has been produced by grinding blanched soybean cotyledons with water, heating and homogenizing the resulting slurry (Nelson et al, 1976). Umakapoor et al., 1977, prepared soy-milk virtually free from offensive flavor. The University of Illinois (Priepke, 1977) has developed a soybean milk analog that is completely free of bad flavor, with 100% protein recovery and excellent suspension stability. Similar to these products, soybean research on date pits can be conducted.

The purpose of this work was to study the characteristics of a flavored beverage formulated with milled date seed solids. The major ingredients in flavored beverages (Woodroof and Phillips, 1974) are water, sugar and flavoring. Among the other ingredients that may give

character and individuality to beverages are acids, flavors, colors, emulsifiers, gums, essential oils, tannins, caffeine and traces of "secret additives."

While it is beyond the scope of this work, it would be of interest to make similar observations concerning other processed food products which might utilize date pit solids. These might include frozen desserts, bakery products, etc.

## REVIEW OF LITERATURE

Dates, the fruit of Phoenix dactylifera, are an important commodity of the human diet in some areas of the world. For example, people in the Arabian peninsula regularly depend on dates as a part of their daily meal.

The date palm (Dowson 1921, Part 1, p. 1) has a moderately stout stem with persistent bases of spiny petioles. Leaves are pinnate, pinnae scattered, rigid and lanceolate. Spadices are several, interfoliar, erect, afterwards drooping and branched. Flowers are small and dioecious. Fruits are oblong, terete, one seeded, fleshy and the endocarp is membranous. The seeds are oblong and ventrally grooved.

The habitat (Postlethwaite 1938, p. 14) of the date palm is generally restricted to areas between latitudes 40 north and south of the equator. It is sub-tropical but will only mature its best fruit in certain comparatively small areas which have a combination of low atmospheric relative humidity and high cumulative heat units during the fruiting season.

The temperature requirement for proper ripening of most varieties is computed as a summation of daily mean temperatures above 20°C for the time between May and October 31<sup>st</sup> in areas north of the equator. This summation ought to be not less than 3750 heat units or an average daily temperature of 29°C for the six months.

At a minimum atmospheric temperature below  $10^{\circ}\text{C}$ , growth ceases. Normal growth takes place at a mean daily temperature of  $20^{\circ}\text{C}$  or above; nevertheless, date palms will stand  $-12^{\circ}\text{C}$  or even less for short periods of time.

The atmospheric relative humidity requirements are quite as exacting as the heat units. A daily mean average of not exceeding 35% is required for the proper ripening of the fruit.

While the date palm will give better results on well-drained soil of low alkali content, it is one of the more alkali-resistant plants such as rice and will grow, once rooted, in a soil containing up to 1% total alkali in the upper two meters.

#### Geographical Distribution

The date palm (Dowson 1921, Part 2, p. 1) has been known to fruit on all continents with the exception of South America. The Countries which (Dowson 1921, Swingle 1949, Hilgeman 1953, and others) produce dates are: U.S.A., Spain, France, Italy, Greece, Morocco, Algeria, Tunisia, Egypt, French Niger, Zanzibar, Tanganyika, Lybia, Somaliland, Cyprus, Palestine, Turkistan, Saudi Arabia, Yemen, Oman, Iraq, Persia, India and Baluchistan. A close estimate (Postlethwaite 1938, p. 15) of the palms actually growing in the world is impossible to obtain but the estimate of Popeno; namely, 90 million is one which may be considered a good approximation. In the areas which export dates, the number of palm trees can be more closely estimated and, in millions, is roughly as follows: Iraq 30, Egypt 11, Saudi Arabia 9, Algeria 7, Persia 3.75, Tunisia 2.25, Morocco 1.

## DATE CULTURE

### Propagation

Date palms may be propagated (Swingle 1949, Nixon 1930 and Hodgson 1932) either from a seed or from an offshoot. Seedlings do not breed true, the dates usually are inferior to those of the parent and the sex may be different. While the offshoot needs four to five years to become a bearing tree, the seedling needs nine years. Offshoots are removed (Hilgeman 1953, p. 17) from the mother stock when they are about four years old. Based upon experience, the Israelis have found that the best results are obtained by cutting and planting the offshoot in July.

### Spacing

In Tunisia (Hodgson 1932, p. 8) plantings are, for the most part, dense jungles of palms of all ages, kinds and varieties planted without reference to alignment and under which vines and other fruit trees of all kinds are grown. In new plantings, trees are planted in rows eight to ten meters apart usually in permanent basins with broad, flat ridges in alternate middles providing an appearance much like that of some California plantings. Spacing is currently nine to 11 meters, which is about the same as that being used in the United States. In Saudi Arabia (Nixon 1954, p. 17), the trees are planted five to seven meters apart; some closer and few further. A distance

of seven meters may provide sufficient space if the growth is stunted by a very high water table or other unfavorable conditions. In Iraq (Nixon 1930, p. 4), five to six meters distance is commonly used.

In some palm gardens where cover crops or fruit trees are desired, the distance should be more than eight meters to provide enough sunlight for the inter-plantings.

#### Fertilization

Animal manures (Dowson 1921, and Nixon 1954) are widely used as fertilizers in the Arabian countries. Application frequency varies from one to three years in Saudi Arabia to four years in Iraq. Three to five donkey loads of manure is applied per tree sometime after harvest. In Tunisia (Hodgson 1932), some farmers use commercial fertilizers.

#### Pollination

Since the date palms are dioecious and the number of male trees needed is not usually provided, man's aid is required. One, two, (Dowson 1921, p. 27) three or four (Nixon 1967, p. 9) sprigs from freshly opened male inflorescences are inserted among female cluster strands, usually after (Nixon 1954, p. 18) they are first shaken over it. Another method is to (Dowson 1926, Nixon 1954, Dowson 1939, and Hodgson 1932) shake the pollen out of ripe male flowers and tie it in a bag of fine muslin to be used for dusting female inflorescences. An acceptable mechanical pollination system (Perkins and Burkner 1973, p. 6) is also now available.

### Harvest

Time of harvest varies depending on variety and desired stage of maturity. The season during which dates ripen in Saudi Arabia (Nixon 1954, p. 18) extends from June to February. Often the finest dates are (Dowson 1921, p. 35) picked up singly in Iraq as they become Ratab (soft or juicy in the second stage of ripening) for the main date crop, however, the fruit (Nixon 1954) is usually left on the palm until the majority is ripe and then the bunches are cut from the tree and thrown to the ground to be picked up in Iraq and Saudi Arabia. The fancy varieties in Tunisia (Hodgson 1932), however, are cut and passed hand to hand to the ground.

### Packaging

Dates are packed (Dowson 1921, Nixon 1954, and Mason 1924) in large palm-leaf baskets, empty gasoline tins, tanned skins or wooden boxes. Fruits are graded, cleaned and polished. They might be (Hodgson 1932) seeded and stuffed with pistachio before packaging. Frozen dates are stored at  $-29^{\circ}\text{C}$  for quick freezing and to retain the maximum nutritive value and palatability (Mantonya, 1949, p. 21).

### Diseases

There are several date palm diseases and ones seen in certain countries may not be found in others. Following is a list of diseases and pests that have been recorded and identified (Stickney 1924, Dowson 1955, and others):

Fungi	<u>Omphalia sp</u> (decline disease)	on roots
	<u>Rhizosis sp</u>	on roots
	<u>Graphiola phoenicis</u>	on leaves
	<u>Graphiola</u> (flower cluster rot)	on flowers
Insects	<u>Parlatoria blanchardii</u>	on leaves
	The longicorn beetle larva	on leaves
	<u>Gelechiidae sp</u>	on fruits
	<u>Poenicococcus marlatii</u>	on fruits
	<u>Schisticerca gregaria</u>	on the plant
	<u>Paratetranychus afrasiaticus</u>	on the plant
	<u>Batrachedra anydraula</u> (larva)	on fruits
	<u>Pseudophilus testaceus</u>	on trunk
	<u>Ephestia cautella</u>	stored fruits

#### Date Varieties

There are three general types of dates, (Smith and Farrankop 1945, Cook and Furr 1952) one of which is usually described as soft. This type has a juicy flesh, ripens earlier in the season and is relatively high in water and low in sugar content. Some dates of this type, such as Hayany, are easily fermented. The second type is semi-dry, has a high storage stability and is exemplified by Dairi.

Dates pass (Dowson 1921) through four stages before complete maturity and are described by the Arabs of Iraq as Chimri, Khalal, Ratab and Tamar. In the Khalal stage, they might have a yellow or red color. The date becomes soft and juicy in the Ratab stage.

In the final tamar stage, the date becomes soft, semi-soft or dry. The following (Smith and Ferrankop 1945, Dowson 1921, Nixon 1954 and 1967, Mason 1924 and Yost 1950) is a partial list of some of the most important date varieties:

Amarillo	As-Sayyid	Ashgar	Ashrasi
Barakawi	Bentamoda	Berhi	Bukaira
Bikaraari	Beiyudhi	Burunzi	Bunni
Dairi	Deglet Noor	Gharra	Ghondeila
Gush	Hallawi	Horra	Hayani
Khadrawi	Kenta	Khalasa	Khunsizi
Khisab	Kulma	Kustawi	Lagunda
Maktoom	Medina	Munakher	Mishrig
Nboot saif	Nesheem	Rhas	Ruzaiz
Saidy	Sayer	Tadal	Tayyor

#### Uses of Dates

The date palm is probably (Postlethwaite 1938) the oldest recorded fruit bearer known to man. It produces fruit of unusually high food value. Dates are eaten (Dowson 1921) uncooked, often together with bread. There is, however, a variety of ways in which dates may be eaten; such as Dibis (date syrup) or Roba (curd). From date juice, a beverage can be obtained either fresh or distilled into a highly alcoholic one now known to the Arabs as Araq (Arrack).

"Datettes" are (Anderson and Anderson 1963, p. 11) chopped, pitted dates found in the market under the names of Crunchies, Redidates, etc., and are a great boon to the housewife, baker or candy manufacturer. They

are also made into an unbaked fruit cake for those who prefer unheated food. Dateletes (coconut confection) are tasty in salads or in puddings and may be coated with chocolate, soya-chocolate or carob. Date butter and creamed dates are excellent when used for date shakes, ice cream toppings, in baking and in sandwiches. Grinding bone-dry dates gives (Vison 1924, p. 11) date sugar, date granules and date chips.

#### Date Stones (Pits)

Date stones are occasionally (Dowson 1921, p. 60) collected from roads and gardens in Iraq by Utchins who sell them to charcoal makers. In parts of Arabia and Northern Africa, date stones are ground and fed to camels and other livestock. They are also strung together as necklaces. Because they are very hard and difficult to prepare or process into palatable food products, they have been largely ignored and rejected as food for man. They are usually considered waste by-products and are used only for some animal feed applications as previously mentioned.

Composition of date pits varies insignificantly between varieties. A typical analysis is reported by Lofgreen (1961), University of California, Davis, (Table I). The protein is relatively (Meyer 1959) indigestible by ruminant animals. When date pits (Peightal 1961) are considered for animal feed, their total digestible nutrients (T.D.N.) are 82.7% and the net energy is 134.43 mCal./100Kg.

Date pits and barley have a similar chemical composition (see Table 1). The notable differences are that barley has more protein and less fat and fiber (Afifi et al. 1966, Ali et al. 1956, and Meyer 1959).

Table I. Gross Composition of Date Pits and Barley

Ingredients	Date Pits	%	Barley
Nitrogen Free Extract	65.1		70.1
Moisture	14.1		10.2
Crude Fiber	19.7		2.7
Ether Extract	7.9		2.1
Protein	6.7		12.8
Ash	1.1		2.1

The Chemical analysis (Mehran and Filsoof 1975) of date pit oil of three Iranian varieties (Table II) shows relatively high concentrations of certain fatty acids; namely, oleic ( $C_{18:1}$ ) and lauric ( $C_{12}$ ) and low concentrations of others such as caprylic ( $C_{18}$ ), arachidic ( $C_{20}$ ) and linolinic ( $C_{18:3}$ ).

The data in Table II for the three Iranian varieties does not differ significantly from those obtained for varieties reported by other workers.

The Egyptian production of (Afifi et al. 1966) date fruit is reported to be 332 million kilograms a year. Approximately one percent of this production represents the total available date pit supply. This amount may not all be available, however, as only those from processed dates can be collected.

In Iraq, lactating cattle (Ali et al. 1956) were fed date pits alone or in combination with macerated whole dates, barley or sesame seed meal. The use of up to 85% date pits with a protein supplement, such as cotton seed cake, gave satisfactory growth and milk yield in these animals. When fed to chicks (Afifi et al. 1966), date pits could replace barley in a ration containing five to ten percent of the grain with an improvement in live weight gain.

Table II. Date Pit Oil Characteristics of Date Seeds Typical of Certain Varieties

Variety	Oil	MP(C <sup>o</sup> )	I <sub>2</sub> NO.	C <sub>8</sub>	C <sub>10</sub>	C <sub>12</sub>	C <sub>14</sub>	C <sub>16</sub>	C <sub>18</sub>	C <sub>20</sub>	C <sub>18:1</sub>	C <sub>18:2</sub>	C <sub>18:3</sub>
Musaafti	8.5	15.5	49.7	0.5	0.6	20.1	12.6	11.4	0.9	0.7	45.7	6.8	0.7
Kabkaab	5.0	17.0	51.2	0.6	0.6	22.4	12.5	10.1	1.4	0.7	44.2	7.2	0.7
Sayir	6.9	19.5	52.2	0.7	0.5	21.5	14.6	9.9	1.2	0.6	43.5	6.6	0.7

## MATERIALS AND METHODS

To make a satisfactory beverage from date pits, it was necessary to achieve a particle size as close as possible to a colloidal system (Preipke 1977) in order to create a permanent suspension. In this work, date pits were washed to remove hulls and soil, cut by a knife to 0.5 Cm in diameter, then ground in a Wiley mill. The ground date pits were then pulverized in a cyclone pulverizer. Dry ice was used to reduce the high temperature produced by friction during the pulverization process and to protect the product from scorching or burning. The pulverized powder was processed in a retort cooker at 115°C and a pressure of 5.12 Kg/Cm<sup>2</sup> for 15 minutes to soften the material. Sugar, cocoa powder, fat, water and a stabilizer/emulsifier were then added. Cocoa used was a standard commercial product used in the formulation of chocolate flavored milk beverages. The fat was a partially hydrogenated soybean oil designed for use in milk or cream analogs. The stabilizer/emulsifier was a combination of guar gum and soy lecithin. The mixture was homogenized in a re-circulation system at 90°C and a pressure of 317 Kg/Cm<sup>2</sup> for ten minutes.

## RESULTS AND DISCUSSION

Various preliminary trials were conducted to make a beverage from date pits. For example, whole pits were soaked in either 0.2 or 1% NaOH as well as in 1 or 2%  $\text{NaHCO}_3$  for either eight or 24 hours at  $38^\circ\text{C}$  or  $49^\circ\text{C}$ . After draining, the pits were blanched at  $100^\circ\text{C}$  in the above solutions for 30 or 60 minutes. This treatment did not significantly soften the pits. Autoclaving at  $121^\circ\text{C}$  and  $5.12 \text{ Kg/Cm}^2$  for 30 minutes in distilled water had some effect. Dilute solutions of hydrochloric or sulfuric acids were not effective in softening the pits. Concentrated acid solutions tended to darken them.

The pits were ground in a Wiley mill to 0.7 mm in diameter, followed by one hour autoclaving at  $121^\circ\text{C}$  and  $5.12 \text{ Kg/Cm}^2$  (date solids: water, 1:4) and then homogenized at  $82^\circ\text{C}$  and  $218 \text{ Kg/Cm}^2$  in a recycling system. The larger size date pit particles tended to block the homogenizer. Prior to this, different sizes and kinds of ball-mills were tried. The small ball-mills did not affect the pits and the large ball-mills created sufficient friction to char the material.

The combination of Wiley mill grinding and a cyclon pulverizer gave close to acceptable results.

The proposed composition of the chocolate flavored beverage is shown in Table III.

Table III. Ingredients in Chocolate Flavored Beverage

Constituents	%
Date seed solids	8.5
Sucrose	5.0
Fat	3.5
Cocoa Powder	1.0
Stabilizer/Emulsifier	0.3
Total Solids	18.3

The homogenate was cooled rapidly by immersing the container in ice and then storing it at 4°C for one week to observe its stability. After one week of storage at 4°C, the homogenate was tested. It was viscous, homogenous and with an acceptable flavor. It had a slightly sandy mouth feel with some liquid accumulation on the surface. The original homogenate was then modified by adding combinations of chocolate syrup, sugar and water, followed by storing at 4°C for three days. Some separation of liquid was observed in all combinations. When tested, those having five to seven percent sugar (2,5,6 and 8 in Table IV) were the most acceptable among all other combinations. Since the beverage was viscous, stabilizer content could be lowered.

Table IV. Final Composition of Chocolate Flavored Beverage

Constituents	%
Moisture	82.58
Carbohydrate	11.09
Fat	4.46
Protein	0.62

Liquid separation might be overcome by achieving a smaller particle size together with stabilizer type and concentration adjustment. The beverage had a light brown, acceptable color. Additional cocoa powder would enhance the chocolate taste and more effectively mask residual date pit taste.

No microbiological testing was done on the homogenate. The homogenization temperature (90°C) is higher than that commonly used in the (Baliga and Ivy 1961) pasteurization of Neera (palm sap) without imparting a cooked flavor. It is expected that yeasts, which are destroyed by holding a pasteurization temperature (79°C) for 25 to 30 minutes, would be killed at the homogenization temperature (90°C). Thus, the product could be packaged immediately after the homogenization process.

Addition of sodium benzoate and citric acid could be considered as a means of further extending shelf life. Other types of flavors would be of interest. Fortification of this product with protein and vitamin sources would increase its nutritive value. For example, non-fat dry milk (N.F.D.M.) or vegetable protein isolates might be used as protein supplements, and vanilla or diacetyl might be used as additional flavoring ingredients.

The basic homogenate was further modified by adding sugar, chocolate syrup and water as shown in Table V.

The product was stored at 4°C for three days and then examined for the same purposes as the original homogenate (see Table VI).

Table V. Constituents of the Modified Combinations (gm)

Sample	Homogenate	Water	Sugar	Cocoa Syrup
1	80	14	3	5
2	80	17	0	3
3	80	15	5	0
4	90	0	5	5
5	90	5	0	5
6	90	5	2	3
7	85	5	5	5
8	85	10	3	2
9	85	7	4	4

Table VI. Composition of the Modified Combinations Shown in Table V

Sample	Protein	Fat	Carbohydrates	Sugar	Water	Total Soluble Solids
1	0.18	4.37	13.00	7.90	82.45	17.55
2	0.68	4.37	10.00	4.90	84.95	15.07
3	0.05	5.59	13.87	9.00	82.49	17.51
4	0.76	5.36	15.36	10.50	78.52	21.48
5	0.76	5.36	10.36	5.50	83.52	16.48
6	0.69	5.36	13.11	7.40	81.84	19.16
7	0.75	5.13	16.30	10.75	77.82	22.18
8	0.61	4.33	12.48	7.85	82.64	17.36
9	0.70	4.86	13.42	9.45	81.02	18.98

## CONCLUSIONS

The degree of success in developing this beverage, leads to the conclusion that date pits can be utilized in a new human food product. It also can be utilized in making other foods such as high-fiber cereal as well as an ingredient for frozen desserts, confections and pastries.

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