

PRODUCTION AND EVALUATION OF DATE-MILK BEVERAGE

El-Dieb, Samia M.

Dairy Science and Technology Department, Faculty of Agriculture, Cairo University

ABSTRACT

The nutritious date-milk beverages were made from Hayani date cultivar and from whole or skim cows' milk and evaluated organoleptically, chemically, physically and microbiologically. The beverages containing 15% date pulp and 3% sugar were the most acceptable flavour and sweetness. The use of Lacta-610 stabilizer at ratio 0.25 and 0.35% with beverage made from whole or skim cows' milk, respectively improved the appearance and consistency.

During storage in a refrigerator at $7 \pm 1^\circ\text{C}$ for 60 days, the pH and total sugars decreased slightly, while the reducing sugars, viscosity and browning intensity increased. Coliform counts were not present and total bacterial count and sporeformers were present at low numbers in both beverages either fresh or during storage. The beverages were acceptable up to 2 months of storage.

INTRODUCTION

Fruit flavoured milks are popular beverages. They have always been appreciated and gained wide popularity and acceptance. Their acceptance is because of the delightful taste and nutritive value. Availability of various fruit juices at reasonable prices would offer popular flavoured milk products. In the last few years the annual production of date crop has been markedly increased in many date producing countries. Egypt is producing about 17% of total production of date in the world (*Barreveld, 1993*). It is available all year either soft or dry at reasonable prices, plentiful and nourishing. Date (*Phoenix dactylifera*) is a good source of carbohydrate, fibers, vitamins (A, B₁, B₂ & niacin), and minerals (potassium, calcium & iron) and it contains a fair amount of protein, copper, magnesium, sulphur and phosphorus (*Barreveld, 1993*). Milk is an excellent source of protein and fat but is deficient in iron, copper and magnesium. Blending of milk with date pulp would produce a nutritionally rich food.

Number of workers tried to utilize date at tamar stage in different forms of beverages (*Godara and Parrek, 1985; El-Sadek et al., 1974; Yousif et al., 1996 and Hassan et al., 1996*). *Yousif et al. (1996)* found that the optimum ratio of date juice to cow milk for the production of a date juice-milk drink was 60/40. *Hassan et al., (1996)* prepared beverage from cheese whey mixed with 5% peanut protein concentrate and 15% date syrup. However, no works have been cited on the soft brown date (Rutab)-milk beverage. This investigation has, therefore, been carried out to explore the possibility of preparation of ready-to-serve rutab date-milk beverages and to study their properties and consumer acceptability.

MATERIALS AND METHODS

Materials

Fresh cows' milk was obtained from the herd of the Faculty of Agric., Cairo Univ. Fresh fully ripened Hayani date Cultivar (rutab) and cane sugar were obtained from the local market. Lacta-610 and Lacta-710 stabilizers were obtained from Chr. Hansen's Laboratories, Copenhagen, Denmark. Carboxymethyl cellulose (BDH, U.K) was used.

Methods

Date pulp preparation :

Rutab date fruits were washed, peeled off and destoned, then chopped in a meat chopper. The obtained date pulp was filled into polyethylene bags and stored in a deep freezer (- 18°C) until used.

Preparation of date –milk beverages

1- Effect of date pulp and sugar concentrations:

Date pulp were mixed with either whole or skim cows' milk at a ratios of 5,10,15 and 20% (w/w), three levels of sugar (2,3 and 4%) were added for each concentration of the date pulp. The mixtures were blended in a blender for 2 min and filtered through stainless steel strainer and filled in glass bottles. The bottles were capped and heat treated in a boiling water bath for 30 min and immediately cooled. The prepared date beverages were then tested organoleptically and the best date pulp and sugar ratios was determined.

2- Effect of type and ratio of stabilizer :

Lacta-610 or Lacta –710 stabilizer was added to both date milk – beverages containing 15% date pulp and 3% sugar at ratios of 0.15%,0.25% and 0.35%, while CMC was added at ratio 0.05%. Mixing and heating were done in the same way as before. The prepared date beverages were then tested organoleptically and the best type and ratio of stabilizer was determined.

The best date milk beverages were tested chemically, physically and organoleptically against a reference sample of date juice-milk drink which prepared from tamr as recommended by *Yousif et al. (1996)* and stored in refrigerator at $7 \pm 1^\circ\text{C}$ for 60 days.

Methods of analysis

Date-milk beverages were sampled either fresh or after every 20 days throughout 2 months of storage. Total solids (T. S), fat and total nitrogen (T.N) were determined by the techniques described by Ling (1963). The total carbohydrate was determined with the phenol –sulfuric acid method (*Dubois et al., 1956*), reducing sugars were determined in the ethanolic extract, using dinitrosalicylic acid method according to *Miller (1959)*. Non- reducing sugars were calculated by difference between the total carbohydrate and the reducing sugars. Fibers and phosphorus were estimated by the methods described by (*A.O.A.C, 1984*). The concentration of potassium, calcium and iron were determined by the atomic absorption spectrophotometer PU 9100x,

PHILIPS. The pH was determined using digital pH meter model GPH-014(Germany), while the viscosity was determined using a Brookfield viscometer (Model DV-II+; Brookfield Engineering Laboratories, USA) with UL adapter and RV spindle No.2. The speed of the spindle was set to 80 r. p. m and the sample temperature was maintained at 20 ±2°C. Samples were also microbiologically analyzed for total bacterial count (T. C), coliforms and sporeformers according to the American Public Health Association (A.P.H.A.,1992).

Beverage samples were also organoleptically judged by 10 panel members of the Dairy Dept., Faculty of Agric., Cairo Univ. The beverages were judged for flavour (10 points), sweetness (10 points), colour (10 points) and consistency (10 points).

RESULTS AND DISCUSSION

The results presented in Table (1) indicate that the storage at -18°C for 12 months had no effect on the composition of date pulp except fibers, as a slight decrease was found during storage from 2.39% when fresh to reach 2.21% after 12 month.

Table (1): Effect of storage at -18°C on the composition of date pulp.

Component (%)	Storage period, month		
	Fresh	6	12
Total solids	37.3	37.2	37.2
Protein	2.23	2.21	2.20
Total carbohydrate	31.90	31.88	31.89
Reducing sugars	30.12	30.10	30.05
Non-reducing sugars	1.78	1.78	1.84
Fibers	2.39	2.28	2.21
<u>Minerals, mg/100g</u>			
Potassium	272.5	272.3	272.6
Calcium	61.7	62.4	61.4
Phosphorous	20.53	20.53	20.41
Iron	2.89	2.91	2.90

Factors affecting the acceptability of date-milk beverages:-

1- Effect of date pulp and sugar percentages :-

The flavour scores for the evaluated date-milk beverages of whole or skim cows' milk are presented in Fig. (1-a & b). It is evident that 15% date pulp with 3% sugar gave the most acceptable flavour with both beverages. Accordingly, these concentrations were examined the following experiments.

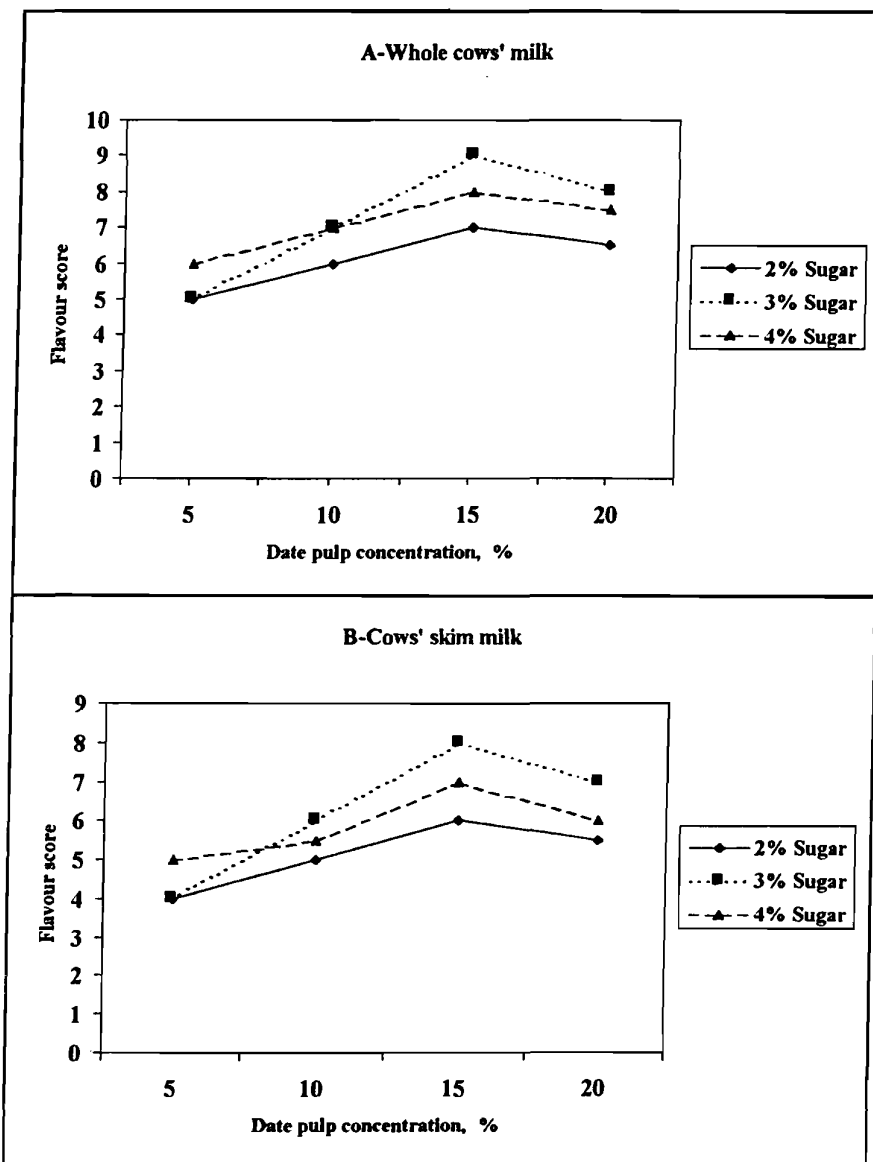


Fig (1): Effect of date pulp and sugar concentrations on flavour score of date-milk beverages made from whole [A] or skin [B] cow's milk.

2- Effect of type and ratio of stabilizer :-

The mean score gained for flavour, colour and consistency of date milk-beverages increased with added stabilizers of Lacta-610 and Lacta -710 compared with CMC as shown in Table (2). This is in agreement with the results reported by Sanderson (1981) and Ibrahim et al. (1993). Beverages contained 0.25 or 0.35% Lacta-610 with whole or skim cows' milk, respectively gained the highest score values.

Table (2): Effect of type and ratio of stabilizer on organoleptic properties of date – milk beverage.

Type of beverage milk	Type of stabilizer								
	Lacta – 610				Lacta – 710				CMC
	0	0.15	0.25	0.35	0	0.15	0.25	0.35	0.05
A- Whole cows' milk ⁽¹⁾									
Flavour (10)	7	8	9	8	7	7	8	8	7
Sweetness (10)	9	9	9	9	9	9	9	9	9
Colour (10)	7	7	8	8	7	7	8	8	7
Consistency (10)	6	7	9	8	6	7	8	7	7
Total Score (40)	29	31	35	33	29	30	33	32	30
B- Cows' skim milk ⁽²⁾									
Flavour (10)	6	7	8	8	6	7	8	8	6
Sweetness (10)	9	9	9	9	9	9	9	9	9
Colour (10)	7	7	8	8	7	7	8	8	7
Consistency (10)	5	6	7	8	5	6	7	7	7
Total Score (40)	27	29	32	33	27	29	32	32	29

(1) Date milk beverage made from whole cows' milk with 15% date pulp and 3% sugar.

(2) Date milk beverage made from cows' skim milk with 15% date pulp and 3% sugar.

Composition of the date-milk beverages :-

The chemical, physical, and sensory properties of date milk-beverages were determined and compared with the reference sample of date juice milk drink prepared as recommended by Yousif et al. (1996). Data in Table (3) show that the date-milk beverages made from whole or skim cows' milk had higher total solids, protein, non-reducing sugars, calcium and phosphorus and lower total sugars, reducing sugars, fibers, potassium, iron and pH comparing to reference sample. This might be due to the different chemical composition between rutab date and tamar which used in reference sample.

Results also showed that the viscosity of date-whole milk beverage was higher than date-skim milk beverage and both beverages were higher than the viscosity of reference sample. This might be due to the higher content of total solids of date-milk beverages. In addition, the stabilizer in beverages has been attributed to interactions between the hydrocolloid and milk proteins (Grindrod and Nickerson, 1968). Organoleptically, the highest score (35) was gained by for the beverage prepared from whole cows' milk and the beverage prepared from cows' skim milk also gave a good score (33). The lowest sensory score was awarded to the reference sample due to light consistency and an increase the browning intensity.

Table (3): Chemical, physical, and organoleptic properties of fresh date-milk beverages compared with reference sample of date juice milk drink.

Parameters (%)	Date-milk beverage ⁽¹⁾		Date juice milk drink ⁽⁴⁾
	Whole cows' milk ⁽²⁾	Cows' skim milk ⁽²⁾	
Total solids	18.77	16.34	14.59
PH	6.49	6.46	6.52
Protein	3.15	3.4	1.64
Fat	2.3	0.4	1.3
Total sugar	11.56	11.68	12.05
Reducing sugar	8.44	8.54	11.33
Non-reducing sugar	3.12	3.14	0.72
Fibers	0.29	0.31	0.48
Calcium, mg/100ml	230.8	245.8	166.3
Potassium, mg/100ml	192.3	194.8	151.0
Phosphorus, mg/100ml	91.6	97.1	81.6
Iron, mg/100ml	0.87	0.89	0.83
Viscosity, cp	77	62	51
Organoleptic score (out of 40)	35	33	27

(1) 15% date pulp and 3% sugar.

(2) Date-milk beverage was made from cows' milk with Lacta- 610 stabilizer at 0.25%

(3) Date-milk beverage was made from cows' skim milk with Lacta - 610 stabilizer at 0.35%

(4) Reference sample was prepared from tamr as recommended by yousif et al. (1996).

Effect of cold storage of beverages:

As can be seen from Table (4), storage in a refrigerator at $7 \pm 1^\circ\text{C}$ up to 60 days had a slight effect on chemical, microbiological and organoleptic properties of beverages.

The pH of fresh date-milk beverages was found to be 6.49 or 6.46 which is lower than that of milk due to the added date pulp (pH=6.48). Storage caused a slight decrease in the pH value. This decrease amounts to 0.08 and 0.09 units in both beverages after 60 days. This might be attributed to acid formation during storage which is in agreement with *EL-Sadek et al. (1974)*.

The total sugar and fibers decreased slightly throughout the storage period in both beverages. This slight decrease in total sugar might be due to decomposition of sugars to different organic acids. On the other hand, reducing sugars increased gradually in both beverages, while non-reducing sugars decreased. The decrease in non-reducing sugars might be due to their decomposition to reduced sugars.

The same Table (4) show that the viscosity of both beverages was increased gradually during storage until it reached maximum values after 60 days. This increase might be attributed to interaction between the stabilizer // and milk proteins as suggested by *Schmidt and Smith (1992)*.

Regarding the coliform counts results in the same Table (4) show that it was not detected in both beverages either fresh or during storage, which indicates that beverages were of good quality. The total bacterial count (TBC) and sporeformers were present in low numbers ranged between 15-18 and 12-14 cfu/ml, respectively, in both beverages when fresh, and no marked changes in their counts during storage.

The organoleptic scores of date-milk beverages presented in Table (4) indicated that the beverages gained the highest scores when fresh and after 40 days, while the scores begin to decrease slightly after 60 days. This decrease in acceptability was mainly due to the increase of browning intensity which may be due to the chemical reaction that continued during the storage. Also, coarse in mouth feeling was noticed. In spite of this drawback in its sensory evaluation mean scores after 60 days of storage, the beverages were still acceptable for consumption as judged by the panelists.

Cost price of the date-milk beverages:

The approximate price of the different ingredients used in date-milk beverages was as follow in the 2001 – 2002 seasons is presented in Table (5).

On the basis of the recommended beverages composition (being 15% date pulp, 3% sugar, 81.75% whole or skim cows' milk and 0.25 or 0.35% Lacta-610, respectively), the approximate cost of one kilogram of date-milk beverages will be 111.2 or 73.1 P.T for beverage made from whole or skim cows' milk, respectively. Thus, these prices will encourage to consume more milk in this form.

In conclusion, since, the date pulp of Hayani cultivar at rutab stage is easy to prepare and keep at -18°C for several months. It can be used for production of date-milk beverage with high nutritive value all over the year. The best organoleptic properties were observed for beverage containing 15% date pulp, 3% sugar and 0.25% or 0.35% Lacta –610 with whole or skim cows' milk, respectively. The storability of beverages were of good shelf life and could be kept up to 2 months in refrigerator at $7 \pm 1^\circ\text{C}$ without affecting its good quality attributes.

Table (4): Effect of cold storage⁽¹⁾ on some chemical, physical, microbiological and organoleptic properties of date – milk beverage.

Parameters	Whole cows' milk ⁽²⁾				Cows' skim milk ⁽³⁾			
	Storage period (days)				Storage period (days)			
	Fresh	20	40	60	Fresh	20	40	60
pH	6.49	6.46	6.42	6.40	6.46	6.42	6.39	6.38
Total sugar, %	11.56	11.52	11.49	11.48	11.68	11.63	11.61	11.59
Reducing sugar, %	8.44	8.49	8.61	8.67	8.54	8.61	8.70	8.78
Non-reducing sugar,%	3.12	3.03	2.88	2.81	3.14	3.02	2.91	2.81
Fibers,%	0.29	0.29	0.27	0.23	0.31	0.30	0.27	0.25
Viscosity, C.P ⁽⁴⁾	77	81	83	86	62	65	67	70
Total bacterial count (cfu/ml)	18	19	17	16	15	17	14	17
Coliform count (cfu /ml)	N.d	N.d	N.d	N.d	N.d	N.d	N.d	N.d
Sporeformers (cfu /ml)	14	16	15	14	12	13	12	14
Organoleptic score (out of 40)	35	35	33	31	33	33	31	28

(1) storage at 7 ± 1°C

(2) Date-milk beverage was made from whole cows' milk with Lacta-610 stabilizer at 0.25%

(3) Date-milk beverage was made from cows' skim milk with Lacta-610 stabilizer at 0.35%

(4) Viscosity reported in centipoises at 20°C.

Table (5): Cost price of the date-milk beverages.

Ingredient	Price (P.T./kg)	Amount of ingredient (g)		Price (P.T)	
		Whole cows' milk	Cows' skim milk	Whole cows' milk	Cows' skim milk
Whole cows' milk	100	817.5	-	81.8	-
Cows' skim milk	50	-	817.5	-	40.9
Date fruit	100	-	-	-	-
Date pulp	117.6	150	150	17.6	17.6
Cane sugar	150	30	30	4.8	4.8
Lacta-610	2800	2.5	3.5	7	9.8
Total	-	1000	1000	111.2	73.1

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إنتاج وتقييم مشروب اللبن بالبلح

سامية محمود محمد سالم الديب

قسم علوم وتكنولوجيا الألبان - كلية الزراعة - جامعة القاهرة

يهدف هذا البحث إلى إنتاج مشروب ذو قيمة غذائية عالية من البلح الحيثاني الرطب سواء من اللبن البقري كامل الدسم أو الفرز مع تقييم المشروبات الناتجة من الناحية الحسية والكيميائية والفيزيائية والميكروبيولوجية. وقد تبين أن المشروبات المحتوية على 15% بلح، 3% سكر هي الأفضل من ناحية الطعم والحلاوة وأن إضافة المثبت Lacta-610 بنسبة 0.25%، 0.35% للمشروب المصنع من اللبن البقري الكامل الدسم والفرز على التوالي قد أدى إلى تحسين المظهر والقوام.

وأثناء تخزين هذه المشروبات في الثلاجة على درجة حرارة 7 ± 1 °م لمدة شهرين حدث انخفاض بسيط في كل من درجة الـpH والسكريات الكلية بينما زادت كل من السكريات المختزلة واللزوجة وكثافة اللون البني. أما من الناحية الميكروبيولوجية فقد خلت هذه المشروبات من بكتيريا القولون واحتوت على أعداد قليلة من العدد البكتيري الكلي والجراثيم سواء وهي طازجة أو أثناء فترة التخزين.

وقد ظلت المشروبات مقبولة لأكثر من شهرين تخزين داخل الثلاجة.