Quality and acceptability of a set-type yogurt made from camel milk

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ABSTRACT

Camel milk (CM) set yogurts were formulated with gelatin, alginate (ALG), and calcium (Ca). Titratable acidity, pH, sensory properties, and acceptability of CM yogurts were studied. Twelve treatments were prepared; 3 using gelatin at 0.5, 0.75, and 1% levels and 9 with combinations of ALG and Ca at different levels. Titratable acidity and pH of fresh yogurt were not affected by the addition of gelatin or the ALG and Ca combinations. Trained sensory panel results showed that CM yogurt containing 1% gelatin or 0.75% ALG + 0.075% Ca had the highest intensities for firmness and body. Consumer results indicated that the hedonic ratings of the sensory attributes and acceptability of CM yogurt containing 0.75% ALG + 0.075% Ca were similar to that of cow's milk yogurt. The CM yogurts containing ALG + Ca and flavored with 4 different fruit concentrates (15%) had similar hedonic ratings and acceptability. Addition of 0.75% ALG + 0.075% Ca could be used to produce acceptable plain or flavored CM yogurt.

Key words: camel milk, flavored yogurt, sensory quality, acceptability

INTRODUCTION

In the United Arab Emirates (UAE), the camel (*Camelus dromedarius*) is an important livestock species uniquely adapted to the hot and arid environment. Camels can survive under environmental conditions that are difficult for other domestic livestock species. The camel has the ability to produce more milk for a longer period of time in arid zones and dry lands (an environment of extreme temperature, drought, and lack of pasture) than in other domestic livestock species. Daily milk yield varies from 3.5 L (under desert conditions) to 40 L (under intensive management). Feed and availability of water can affect the chemical composition and taste of camel milk (CM). Camel milk contains 2.9 to 5.5% fat, 2.5 to 4.5% protein, 2.9 to

5.8% lactose, 0.35 to 0.90% ash, 86.3 to 88.5% water, and 8.9 to 14.3% SNF (Khan and Iqbal, 2001). Camel milk has similar protein content, lower lactose content (Elamin and Wilcox, 1992), and lower fat containing less saturated fatty acids and greater total cholesterol (Gorban and Izzeldin, 1999) compared with cow's milk. Camel milk has greater contents of vitamin C (Mehaia, 1994), ash, and sodium, potassium, phosphorus, zinc, iron and manganese (Gorban and Izzeldin, 1997) than cow's milk. Although there are many camel farms in UAE producing 39,350 t of milk (FAO, 2008), a limited amount of pasteurized CM is available at local markets. During the pre-oil period, CM was considered an important food for nomads, but because of socio-economic changes, CM is consumed mainly by the older generation and has lost its popularity among the younger generations. Camel milk has different sensory properties compared with cow's milk, and flavoring camel milk with chocolate improved its acceptance among elementary school children (Hashim, 2002). Camel milk has been used to treat tuberculosis and other lung ailments in Russia, and tuberculosis, dropsy, jaundice, and anemia in India. Traditionally, CM has been used to treat diabetes. Agrawal et al. (2005) also reported that CM improved long-term glycemic control and reduced insulin dose in patients with type-1 diabetes. In Sudan, garris, a traditionally fermented CM product, is used to cure leishmaniasis and the protozoal disease of the belly (Dirar, 1993).

Products made from CM include the traditionally fermented products garris and koumiss (Dirar, 1993), Domiati cheese (Mehaia, 1993a), fresh soft white cheese (Mehaia, 1993b), hard cheese (Mohamed et al., 1990), and ice-cream (Hammad, 1992). In contrast to CM, goat milk products, especially cheeses and yogurt, are very popular in the Mediterranean peninsula and in the Middle East (Tamime and Robinson, 1999). Caprine milk produces a very delicate yogurt with soft texture (Stelios and Emmanuel, 2004), whereas CM was shown to have greater resistance to bacterial growth leading to less active cultures, and thus causing quality problems in its fermented products. The proteolysis rate in fermented CM has been reported to be greater compared

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with cow's milk (Abu-Tarboush, 1996). Mohamed et al. (1990) reported that CM failed to reach a gel-like structure after an 18-h incubation with lactic acid cultures. The rheological and microscopic characteristics of the dromedary milk coagulum did not reveal curd formation and produced a fragile and heterogeneous structure. Attia et al. (2001) suggested the presence of antibacterial factors in dromedary skim milk because the starter culture showed a longer lag phase and an earlier decline phase resulting in a fragile coagulum. Jumah et al. (2001) reported that CM viscosity was not changed during gelation process of yogurt. El Agamy et al. (1992) reported that CM contains good amounts of lysozyme, lactoferrin, lactoperoxidase, immunoglobulin G, and secretory immunoglobulin A. These antimicrobial factors were present at significantly greater concentrations in CM and were more heat stable compared with those in cow and buffalo milks (El Agamy, 2000).

Producing fermented CM products may be difficult because of the problem of milk coagulation. Yogurt texture is a very important characteristic that affects its quality (appearance, mouthfeel, and overall acceptability). In an attempt to increase firmness and prevent syneresis, stabilizers and hydrocolloids have been added to yogurt (Keogh and O'Kennedy, 1998). Other researchers (Fizman et al., 1999; Koksoy and Kilic, 2004; Kumar and Mishra, 2004; Ares et al., 2007; Supavititpatana et al., 2008) have reported that addition of gelatin increased viscosity and firmness, prevented syneresis, and improved the sensory attributes of yogurt. Herrero and Requena (2006) reported that the addition of whey protein concentrate enhanced the textural properties of yogurt made from goat milk. Yogurt fortified with calcium was produced without affecting its microbiological, sensory, and rheological characteristics (Fligner et al., 1988; Pirkul et al., 1997; Singh and Muthukumarappan, 2008). The objectives of the study were to investigate the factors affecting CM fermentation and to determine the effects of addition of gelatin, alginate, and calcium on yogurt quality.

MATERIALS AND METHODS

Fresh pasteurized CM, milk SNF (**MSNF**), commercial stabilizer (Grindstred ES255 Emulsifier and Stabilizer system, Danisco Ingredients, Brabrand, Denmark), commercial yogurt culture (Yo-Fast-88, Chr. Hansen, Hørsholm, Denmark), and fruit concentrates (strawberry, cherry, and peach + apricot + mandarin) were provided by a local dairy company. Date paste and date syrup were obtained from a local date factory. Gelatin was purchased from a local supermarket; carboxymethyl cellulose (**CMC**) was obtained from Sigma Chemical Company (St. Louis, MO), and sodium algi-

inate (**ALG**) was obtained from BDH Chemicals Ltd. (Poole, UK).

Yogurt Making

Yogurt samples were made from cow milk (control) and CM in the Food Preparation Laboratory of the Food Sciences Department, UAE University, following the procedure used at a local dairy company (Al Ain Dairy, Al Ain, UAE). Yogurt was made by dissolving MSNF (2.5%) and stabilizer (0.6%); other ingredients were added according to milk composition. The mixture was heated in a water bath at 85°C for 30 min, cooled to approximately 42°C, inoculated with commercial yogurt culture, transferred to plastic cups, incubated at 43°C for 4 h, and stored at 4°C overnight before testing. For fruit-flavored yogurts, dry ingredients (MSNF, commercial stabilizer, ALG, and Ca) were added and blended with the milk. The yogurt mixture was pasteurized at 85°C for 30 min, cooled to 42°C, and divided into 4 equal lots. The fruit concentrates were added to the yogurt mix and blended. The commercial yogurt culture was added and blended into the mixture and packaged into plastic cups. The samples were incubated at 43°C for 4 h and stored at 4°C overnight before testing.

Experimental Design

Preliminary trials were conducted to determine the effects of the main ingredients. Three levels each of MSNF (2.5, 3.75, and 5%), of commercial stabilizer (0.6, 0.9, and 1.2%) and of commercial yogurt culture [the level recommended by the dairy company (**x**), 1.5**x**, and 2**x**] were used to prepare yogurt samples. Then, trials with different levels of colloids and stabilizers (gelatin, CMC, and ALG) and calcium chloride (Ca) were conducted to prepare CM yogurt. The study was designed based on the results of the preliminary trials, where 3 levels of gelatin and ALG (0.5, 0.75, and 1.0%) and 3 levels of Ca (0.05, 0.075 and 0.1%) were used to prepare yogurt samples.

Based on the sensory results of the trained panel, the best yogurt formulations (i.e., with the highest intensities) were selected for the consumer acceptance study. The most acceptable CM yogurt formula was flavored with 15% fruit concentrate [strawberry, cherry, peach + apricot + mandarin, or a mixture of date paste + date syrup (2:1)] and tested for its acceptability.

pH

The pH of the samples was determined using a digital pH meter (Thermo Orion pH meter, model 420, Thermo

Orion, Waltham, MA). The measurements were done in triplicate for each yogurt sample.

Titrateable Acidity

Titrateable acidity, expressed as percentage of lactic acid, was determined by mixing 10 g of yogurt with 20 mL of distilled water and titrating with 0.1 *N* NaOH using a phenolphthalein indicator to an end-point of faint pink color. The measurements were done in triplicate for each yogurt sample.

Sensory Descriptive Analysis

Sensory profiling of the yogurt samples was conducted using a panel of 5 trained judges selected from among the faculty, staff, and students of the Department of Food Sciences, UAE University. Members of the panel were selected based on their knowledge of yogurt and willingness to participate throughout the training and testing period. During the training, panelists were presented with several yogurts (commercial samples and CM yogurt samples). A list of descriptive terms that characterize the sensory properties of yogurt was developed. Yogurt samples were evaluated for firmness, smoothness, sourness, body, and flavor. The panelists were trained to rate the intensity of stimuli using a 10-cm unstructured line scale anchored at both ends with low intensity and high intensity. A commercial cow's milk yogurt was used as a reference sample. Intensities of the reference sample attributes were agreed upon by panel consensus. The evaluation was conducted in partitioned sensory evaluation booths at the Department of Food Science. Panelists marked each scale to indicate their rating for each attribute and the intensity was measured starting from the left side of the scale. Samples were coded with 3-digit random numbers. Each sample was evaluated twice. Water was provided for panelists to cleanse their palates between samples.

Consumer Acceptance Test

A total of 33 panelists consisting of students and staff of the university were recruited based on their liking and consumption of yogurt 2 to 3 times per week, interest in participation, and availability. The evaluation was conducted in partitioned sensory evaluation booths at the Department of Food Science. Panelists were instructed how to evaluate the samples and asked to rinse their palates with tap water after each sample. Yogurt samples were presented in white plastic cups under fluorescent light. All samples were marked with 3-digit codes, and the order of presentation of samples was randomized for each panelist. The panelists rated the appearance, color, firmness (texture or body), smooth-

ness, sweetness, sourness, flavor, and overall acceptance using a 9-point hedonic scale (1 = dislike extremely and 9 = like extremely).

Statistical Analysis

Data analysis was conducted using SPSS Statistical Software program (version 13.5, SPSS Inc., Chicago, IL). Sensory data were statistically tested using ANOVA to determine if statistical difference existed at ($P \leq 0.05$) and the least significance difference (LSD) was used for means comparison.

RESULTS AND DISCUSSION

Preliminary studies were conducted to investigate the effects of the main ingredients (MSNF, commercial stabilizer, and yogurt culture) on yogurt quality. The formula recommended by a local dairy company for yogurt production (2.5% MSNF, 0.6% commercial stabilizer, and commercial yogurt culture) was followed. Camel milk produced a thin, flowing, and very soft yogurt. Then, CM was boiled for 30 min in a water bath to inactivate the antimicrobial agents. El Agamy (2000) reported that heating CM at 100°C for 30 min resulted in complete loss of antimicrobial agents. The boiled CM did not produce a firm yogurt, indicating that antimicrobial agents present in CM had no effect on firmness of the yogurt. Yogurt prepared using higher levels of MSNF (3.75 and 5%), commercial stabilizer (0.9 and 1.2%), or double the amount (2x) of the commercial yogurt culture produced thicker but not firm yogurt. Different levels of colloids/stabilizers (gelatin, CMC, and ALG) and Ca were used to prepare CM yogurt. Addition of CMC had no significant effect on yogurt texture, whereas the addition of gelatin, ALG, or Ca improved yogurt texture. Schmidt et al. (2001) reported that gelatin and native wheat starch produced firmer yogurts compared with modified starch, because modification decreased retrogradation limiting gel formation. The textural characteristics of soy yogurt were improved by the addition of alginate (Yadav et al., 1994) and the structure of fruit yogurt improved by the addition of gelatin (Celik and Bakirci, 2003). The body and texture of yogurt should be firm, smooth, uniform, and free of lumps. Textural defects of cultured dairy products include weak body, wheying-off, and lumpiness (Tamime and Robinson, 1999). Increasing the gelatin and ALG level up to 1% produced firm yogurt, whereas the addition of 1.5% reduced yogurt firmness. These findings agree with those of Kumar and Mishra (2004) who reported that increasing the addition of gelatin beyond 0.4 to 0.6% decreased the textural characteristics and acceptability of mango soymilk fortified yogurt.

Table 1. Levels of gelatin (G), alginate (ALG) and calcium (Ca), pH, and acidity in camel milk yogurts

Treatment	Gelatin, %	Alginate, %	Calcium, %	pH	Acidity, % lactic acid
G1	0.5	—	—	4.30 ± 0.03 ^a	0.98 ± 0.03 ^a
G2	0.75	—	—	4.43 ± 0.02 ^a	1.09 ± 0.02 ^a
G3	1	—	—	4.34 ± 0.01 ^a	1.10 ± 0.01 ^a
ALG1 + Ca1	—	0.5	0.05	4.32 ± 0.02 ^a	0.99 ± 0.03 ^a
ALG1 + Ca2	—	0.5	0.075	4.43 ± 0.04 ^a	1.04 ± 0.02 ^a
ALG1 + Ca3	—	0.5	0.1	4.32 ± 0.02 ^a	1.12 ± 0.02 ^a
ALG2 + Ca1	—	0.75	0.05	4.28 ± 0.03 ^a	1.08 ± 0.02 ^a
ALG2 + Ca2	—	0.75	0.075	4.36 ± 0.01 ^a	1.02 ± 0.03 ^a
ALG2 + Ca3	—	0.75	0.1	4.51 ± 0.04 ^a	1.14 ± 0.02 ^a
ALG3 + Ca1	—	1.0	0.05	4.36 ± 0.02 ^a	1.12 ± 0.04 ^a
ALG3 + Ca2	—	1.0	0.075	4.42 ± 0.02 ^a	1.14 ± 0.05 ^a
ALG3 + Ca3	—	1.0	0.1	4.50 ± 0.02 ^a	1.16 ± 0.08 ^a

^aMeans for pH and acidity within a row with different superscript letters differ ($P \leq 0.05$).

Based on the results of the preliminary studies, a 3² factorial design using 3 levels of ALG (0.5, 0.75, and 1%), 3 levels of Ca (0.05, 0.075, and 0.1%), and 3 levels of gelatin (0.5, 0.75, and 1%) was used to prepare yogurt samples (Table 1).

pH and Acidity

As shown in Table 1, the pH and acidity values for the entire yogurt samples were similar. The pH ranged from 4.3 to 4.5 and titratable acidity ranged from 0.98 to 1.16% as percentage of lactic acid. Previous reports indicated that lactose content was responsible for the coagulum formation. Alvarez et al. (1998) reported that diafiltered milk containing less than 2% lactose produced yogurt with soft coagulum, whereas milk containing at least 2% lactose formed a coagulum. Although the acidification rate of lactic acid bacteria may vary with the type of milk, similar results were reported for mixtures of cow and goat milk (Vargas et al., 2008) and in garris, a Sudanese traditionally fermented camel milk (Suliman et al., 2006).

Although Kumar and Mishra (2004) reported that the acidity of mango soymilk fortified yogurt was significantly affected by the addition rate and type of stabilizers, Singh and Muthukumarappan (2008) reported that there was no statistical difference in the acidity of control and calcium-enriched fruit yogurts. Results from this study indicated that the addition of gelatin, ALG, and Ca did not affect the pH or the titratable acidity of the yogurts.

Sensory Profiling

Twelve yogurt samples [3 containing gelatin (0.5, 0.75, and 1%) and 9 containing a combination of ALG (0.5, 0.75, and 1%) and Ca (0.05, 0.075 and 0.1%)] were prepared and evaluated by the trained panel. A commercial yogurt sample was used as a reference sample. The intensities of the reference sample were 9.4, 9.0, 8.8, 9.2, and 8.2 for firmness, smoothness, sourness, body, and flavor, respectively. The mean values of sensory attributes of CM yogurts are presented in Table 2. Sensory results indicated that yogurt samples had

Table 2. Mean values for the sensory attributes¹ of yogurt made from camel milk containing gelatin, alginate (ALG), and calcium (Ca) (n = 5)

Yogurt sample ²	Firmness	Smoothness	Sourness	Body	Flavor
G1	7.2 ± 1.3 ^c	8.6 ± 1.2 ^a	7.4 ± 1.0 ^a	7.0 ± 1.2 ^c	8.2 ± 1.3 ^a
G2	7.4 ± 1.2 ^c	8.4 ± 1.4 ^a	7.2 ± 1.2 ^a	7.4 ± 1.2 ^c	7.9 ± 1.2 ^a
G3	8.8 ± 1.1 ^a	8.8 ± 1.0 ^a	7.6 ± 1.4 ^a	8.4 ± 1.1 ^a	8.0 ± 1.1 ^a
ALG1 + Ca1	6.8 ± 1.3 ^c	8.0 ± 1.2 ^a	7.0 ± 1.1 ^a	7.2 ± 1.3 ^c	7.8 ± 1.3 ^a
ALG1 + Ca2	7.2 ± 1.1 ^c	8.2 ± 1.3 ^a	7.2 ± 1.4 ^a	7.4 ± 1.1 ^c	8.0 ± 1.2 ^a
ALG1 + Ca3	8.0 ± 1.2 ^b	8.6 ± 1.0 ^a	7.6 ± 1.2 ^a	8.0 ± 1.2 ^b	8.2 ± 1.2 ^a
ALG2 + Ca1	7.8 ± 1.2 ^{bc}	8.4 ± 1.1 ^a	7.4 ± 1.2 ^a	7.6 ± 1.2 ^{bc}	7.8 ± 1.2 ^a
ALG2 + Ca2	9.2 ± 0.9 ^a	8.6 ± 1.2 ^a	7.8 ± 1.2 ^a	8.6 ± 0.9 ^a	8.2 ± 1.0 ^a
ALG2 + Ca3	8.4 ± 1.1 ^b	8.4 ± 1.0 ^a	7.6 ± 1.3 ^a	8.6 ± 1.1 ^a	8.4 ± 1.1 ^a
ALG3 + Ca1	8.2 ± 1.1 ^b	8.2 ± 1.3 ^a	7.2 ± 1.2 ^a	8.1 ± 1.1 ^b	8.2 ± 1.1 ^a
ALG3 + Ca2	8.8 ± 1.0 ^a	8.6 ± 1.0 ^a	7.4 ± 1.0 ^a	8.6 ± 1.0 ^a	8.4 ± 1.0 ^a
ALG3 + Ca3	9.0 ± 0.8 ^a	8.8 ± 1.2 ^a	7.5 ± 1.4 ^a	8.8 ± 1.0 ^a	8.2 ± 0.8 ^a

^{a-c}Means within a column followed by different superscript letter differ ($P \leq 0.05$).

¹A 10-cm line scale was used anchored at each end with low intensity and high intensity. Control yogurt made from cow milk was used as a reference (intensities for firmness, smoothness, sourness, body and flavor were 9.4, 9.0, 8.8, 9.2, and 8.2, respectively).

²Sample G1 = 0.5% gelatin; G2 = 0.75% gelatin; and G3 = 1% gelatin. Sample ALG1 = 0.5% alginate; ALG2 = 0.75% alginate; and ALG3 = 1% alginate. Sample Ca1 = 0.05% calcium; Ca2 = 0.075% calcium; and Ca3 = 0.1% calcium.

Table 3. Sensory quality and acceptability¹ of yogurt made from camel milk (n = 33)

Yogurt	Appearance	Color	Firmness	Smoothness	Sweetness	Sourness	Flavor	Acceptability
Cow milk	7.3 ± 1.0 ^a	7.9 ± 0.9 ^a	7.2 ± 1.1 ^a	7.2 ± 1.2 ^a	6.6 ± 1.2 ^a	6.4 ± 1.3 ^a	7.0 ± 1.0 ^a	7.0 ± 0.9 ^a
Camel milk	4.6 ± 1.3 ^c	7.1 ± 0.9 ^a	3.6 ± 1.3 ^c	4.7 ± 1.2 ^b	5.1 ± 1.3 ^b	5.2 ± 1.2 ^b	4.5 ± 1.2 ^b	4.3 ± 1.3 ^c
G3 ²	6.7 ± 1.1 ^b	7.1 ± 1.1 ^a	6.0 ± 1.2 ^b	6.8 ± 1.3 ^a	5.2 ± 1.1 ^b	5.3 ± 1.3 ^b	5.0 ± 1.1 ^b	5.5 ± 1.2 ^b
ALG2 + Ca2 ³	7.4 ± 0.9 ^a	7.6 ± 1.0 ^a	7.2 ± 1.1 ^a	7.0 ± 1.2 ^a	6.1 ± 1.2 ^{ab}	6.0 ± 1.1 ^a	6.1 ± 1.1 ^a	6.8 ± 1.2 ^a

^{a-c}Means within a column followed by different superscript letter differ ($P \leq 0.05$).

¹A 9-point hedonic scale was used with (1) = dislike extremely and (9) = like extremely; mean ± standard deviation.

²G3 = camel milk yogurt containing 1% gelatin.

³ALG2+Ca2 = camel milk yogurt containing 0.75% alginate + 0.075% Ca.

similar intensities for smoothness, sourness, and flavor. Firmness intensities were increased significantly with increasing gelatin, ALG, and Ca levels except for the medium ALG or Ca levels. Addition of 0.1% Ca when using 0.75% ALG or 1% alginate when using 0.075% Ca decreased firmness intensities. It was reported that addition of 0.6% gelatin lowered the sensory scores of mango soymilk fortified set yogurt (Kumar and Mishra, 2004). Yogurt containing 0.75% ALG + 0.075% Ca had the highest firmness rating (9.2), whereas yogurt containing 1% gelatin had a firm texture (8.8) with characteristics of a gel.

Consumer Test

Yogurts containing 1% gelatin, 0.75% ALG + 0.075% Ca, and controls (made from cow milk and CM) were prepared for a consumer test. Hedonic ratings of sensory attributes and acceptability are reported in Table 3. The control yogurt made from CM had the lowest ratings for all the sensory attributes. The ratings for all the attributes were <5 on a 9-point scale except for color (7.1) and sourness (5.2). The CM control yogurt was not acceptable and had the lowest acceptability score (4.3), which was significantly different compared with other yogurts. Addition of gelatin to CM improved the appearance, firmness, smoothness, and acceptability ratings significantly, but had no effect on color, sweetness, sourness, and flavor ratings. Addition of 0.75% ALG + 0.075% Ca to CM improved the ratings for all sensory attributes. Camel milk containing 0.75%

ALG + 0.075% Ca had significantly ($P \leq 0.05$) higher ratings for appearance, firmness, sourness, flavor, and acceptability compared with yogurt containing 1% gelatin. Kumar and Mishra (2004) reported that mango soymilk fortified yogurt stabilized with gelatin was more acceptable than yogurt stabilized with sodium alginate. Results from this study indicated that yogurts made from camel milk containing 0.75% ALG + 0.075% Ca had similar sensory ratings and acceptability to cow's milk yogurt.

Flavored Yogurt

The most acceptable CM yogurt containing 0.75% ALG + 0.075% Ca was flavored with 15% fruit concentrates [cherry, strawberry, peach + apricot + mandarin, and date paste + date syrup (2:1)]. Sensory quality and acceptability scores of fruit-flavored camel milk yogurts containing 0.75% ALG + 0.075% Ca are shown in Table 4. Although yogurt flavored with peach + apricot + mandarin had the highest ratings for all the sensory attributes, it was not significantly different from the yogurts flavored with cherry, strawberry, or date paste + date syrup. Camel milk yogurts flavored with cherry, strawberry, peach + apricot + mandarin, or date paste + date syrup were acceptable to consumers.

CONCLUSIONS

Although rheological tests are needed to confirm these results, sensory results indicated that the addition

Table 4. Sensory quality and acceptability¹ of fruit-flavored yogurts made from camel milk (n = 33)

Fruit	Appearance	Color	Firmness	Smoothness	Sweetness	Sourness	Flavor	Acceptability
Cherry	6.5 ± 1.0 ^a	6.6 ± 1.1 ^a	6.7 ± 1.2 ^a	6.6 ± 1.3 ^a	7.0 ± 0.8 ^a	6.4 ± 1.3 ^a	6.1 ± 1.2 ^a	7.0 ± 1.2 ^a
STRW ²	6.9 ± 1.2 ^a	6.8 ± 1.2 ^a	6.6 ± 1.2 ^a	6.4 ± 1.3 ^a	6.3 ± 1.2 ^a	6.5 ± 1.3 ^a	6.2 ± 1.3 ^a	6.8 ± 1.3 ^a
DP ³	6.5 ± 1.1 ^a	6.5 ± 1.3 ^a	6.7 ± 1.1 ^a	6.2 ± 1.2 ^a	7.0 ± 1.3 ^a	6.0 ± 1.4 ^a	5.8 ± 1.4 ^a	6.6 ± 1.3 ^a
P+A+M ⁴	7.1 ± 1.0 ^a	7.0 ± 1.0 ^a	7.1 ± 0.9 ^a	7.0 ± 1.1 ^a	7.2 ± 1.0 ^a	6.6 ± 1.4 ^a	6.3 ± 1.2 ^a	7.2 ± 1.1 ^a

^aMeans within a column followed by different superscript letter differ ($P \leq 0.05$).

¹A 9-point hedonic scale was used with (1) = dislike extremely and (9) = like extremely; mean ± standard deviation.

²STRW = camel milk yogurt flavored with strawberry concentrate.

³DP = camel milk yogurt flavored with date paste + date syrup (2:1).

⁴P+A+M = camel milk yogurt flavored with peach + apricot + mandarin concentrate.

of 0.75% sodium alginate + 0.075% calcium chloride produced acceptable CM yogurt similar to cow's milk yogurt. Flavoring CM yogurt with different fruits also produced acceptable yogurts. Our results show that acceptable CM yogurt can be produced by using appropriate formulation and processing techniques. This will ultimately benefit CM producers as it will enable them to make use of surplus camel milk.

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