

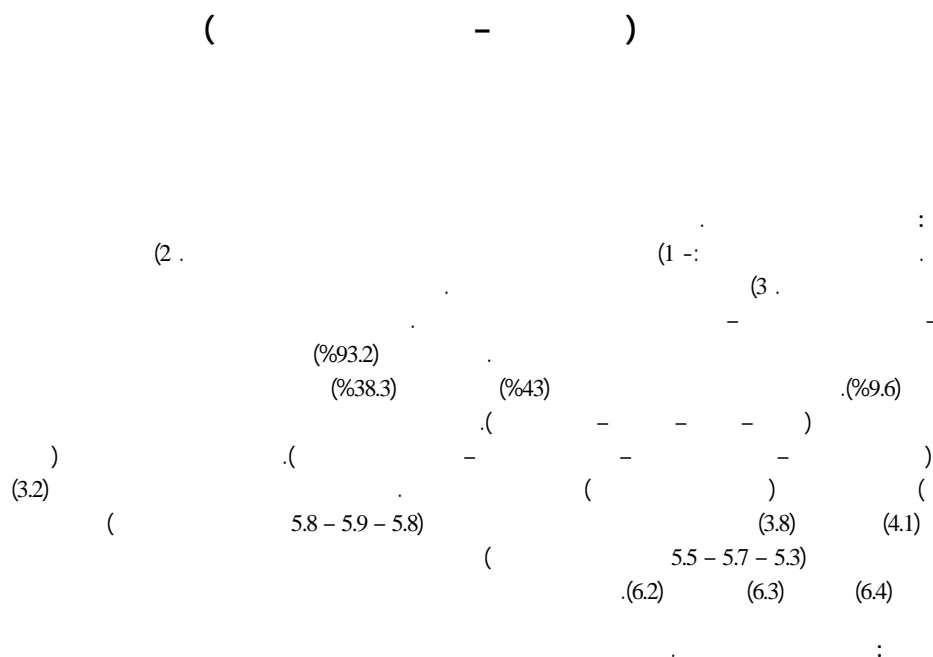
## Acceptance of camel milk among elementary school students in Al Ain city, United Arab Emirates

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**Abstract:** Milk is an important food for children. Although camel is the dominant animal in the U.A.E., camel milk is not commercially available. The objectives of the study were to investigate: 1) consumption of milk and dairy products among elementary school students, 2) hedonic rating for sensory characteristics and overall acceptance of camel milk, and 3) effect of flavor on acceptability of camel milk. A questionnaire was designed to provide information on milk and dairy products consumption, milk flavor preference and willingness to participate on a milk tasting test. The questionnaire was distributed to 470 students (boys and girls, grades 4, 5 and 6) at elementary schools (public and private) in Al Ain. Most of the students (93.2%) drink cow milk and only few (9.6%) drink camel milk. Most of the participants drink chocolate (43%) and strawberry-flavored (38.3%) milk. Besides milk, most of the participants consume other dairy products (yogurt, liquid yogurt, cheeses and ice-cream). A panel of 173 students was selected to evaluate the milk samples (fresh cow milk, dried cow milk, fresh camel milk and chocolate-flavored camel milk). Seven-point hedonic scale (smiling faces) was used for rating the color, aroma, taste, texture, and overall acceptance of the milk. Camel milk had the lowest ratings for taste (3.2), aroma (4.1), and overall acceptance (3.8) compared to the fresh cow milk (5.8, 5.9, and 5.8, respectively) and dried cow milk (5.3, 5.7 and 5.5, respectively). Flavoring camel milk with chocolate enhanced all the attributes of the milk specially the taste (6.4), aroma (6.3) and overall acceptance (6.2).

**Key Words:** acceptance, camel, milk, students, and flavoring.



## Introduction

The camel (*Camelus dromedarius*) is an important domestic animal for people who live in hot and arid countries. Camel can survive in an environmental conditions which are difficult for other domestic

livestock. In the Gulf region, during the pre-oil period, the camel was the main source of food (meat and milk), together with fish and dates. Camel milk contains all essential nutrients and has similar composition to cows' milk (Abu-Lehia, 1987 and Yagil, 1987). Camel milk has

lower lactose content (Elamin and Wilcox, 1992) and higher levels of potassium, magnesium, iron, copper, manganese, sodium, and zinc than cows' milk (Sawaya et al., 1984; Gorban and Izzeldin, 1997). The fat globules of camel milk are smaller than cows' milk (MA, 1995). The level of vitamin C in camel milk is three times higher than that of cow milk (Farah et al., 1992). Camel milk is consumed fresh or converted to *oggtt*, a dry fermented product, (Al-Ruqaie et al., 1989). Because of the nature of the camel, its milk has different sensory characteristics. Due to the socio-economic changes in the region, camel milk is not commercially available. The objectives of the study were to investigate: 1) consumption of milk and dairy products among elementary school students, 2) hedonic rating for sensory characteristics and overall acceptance of camel milk, and 3) effect of flavor on acceptability of camel milk.

## **Materials and methods**

### **Panel**

Four hundred and seventy students from seven elementary schools participated in the study. The particular schools chosen were selected for being at different locations in Al Ain (inner city and semi-rural schools). Schools included boys and girls, private and governmental (public) schools. Grade 4, 5, and 6 students were selected to answer a questionnaire that was designed to provide demographic information and frequency of milk and dairy products consumption, milk flavor preference and willingness to participate on a milk tasting test.

### **Milk Samples**

Commercial pasteurized, homogenized full cream cow milk (Al Ain Dairy Farm, Al Ain, UAE) and dried milk (Anchor

instant full cream milk) were obtained from local supermarkets. The dried milk was hydrated according to the direction supplied by the manufacturer (New Zealand Milk Product Company) with pure natural mineral water (Masafi). Camel milk was obtained from local farms, boiled for several minutes and refrigerated.

### **Preparation of chocolate camel milk**

Chocolate camel milk was prepared using chocolate syrup (Nestle). Preliminary trials were conducted to prepare chocolate flavor-camel milk similar to the commercial chocolate flavor-cow milk. Chocolate syrup (100 g) and sugar (40 g) were added to camel milk (one liter), mixed very well and refrigerated.

### **Consumer Acceptance Test**

A panel of students (173) was recruited from the participants who answered the questionnaire. Criteria for selection were: 1) not allergic to milk, 2) drink milk everyday, and 3) willingness to participate on the milk tasting test. Students from four schools were selected to evaluate the milk samples (fresh cow milk, reconstituted dried cow milk, fresh camel milk and chocolate-flavored camel milk). Because the children had not participated in consumer acceptance tests, they were instructed on how to evaluate the milk samples and use the ballot. The tasting tests were done at the schools using interview techniques. To help children feel more secure with the researchers they were taken out of their classroom in group of three and sat at separate tables to be interviewed and taste the milk samples. Milk samples were presented to consumers in white plastic cups coded with three-digit random numbers. Water was provided for cleansing the palate between samples. Smiling faces 7-points hedonic scale, with 1 = dislike very much and 7 = like very

much, was used for rating color, aroma, taste, texture, and overall acceptance of the milk (Chen et al., 1996).

### Statistical Analysis

Frequencies and means were obtained using statistical Analysis System (SAS Institute Inc., 1995). Sensory data were analyzed using the General Linear Model (GLM) procedure. The Least Significant Differences (LSD) were used to determine significant differences between means among milk samples.

## Results and discussion

### Demographic Characteristics of Participants

Data describing the demographic characteristics of participants is presented in Table 1. Of four hundred and seventy respondents 88% were between 9 – 12 years old and 10% were age 13 or older. Sixty three percent were Emarati and 37% were not Emarati residing at UAE. Most of students were from governmental schools (88%) and 56% were girls. Number of participants was evenly distributed among the school grades (4, 5, and 6).

**Table 1. Demographic characteristics of participants (n= 470)**

Demographic	%Responding
<b>Age (yrs)</b>	
8	1.9
9	14.3
10	28.3
11	28.5
12	16.6
13	7.0
14	3.4
<b>Nationality</b>	
Emirati	62.6
Non-Emirati	37.4
<b>Gender</b>	
Male	43.8
Female	56.2
<b>School</b>	
Government	87.9
Private	12.1
<b>Grade</b>	
Four	33.0
Five	31.3
Six	35.7

### Participants' Milk Consumption Habits

Table 2 shows participants' milk consumption habits. Most of the participants (94%) drink milk and 85% drink cow milk. Eighty percent of the children, who drink cow milk, drink fresh milk and 20% drink reconstituted milk (dried milk). Twenty four percent got raw milk directly from the farm and 76% purchased pasteurized milk from

supermarkets. Seventy four percent of the students drink milk in the morning and 19% drink milk at night. Only 11% of the children drink milk at the school. Most of the participants drink chocolate flavored milk (43%) and strawberry (38%) flavored milk. Only 9.6% of the participants were familiar with camel milk.

## Milk and Dairy Products Consumption

Table 3 shows frequencies of milk and dairy products consumption. Beside consumption of regular and flavored milk participants consumed yogurt, liquid yogurt, chesses and ice-cream. Milk was clearly consumed more frequently than any of the other dairy products. Seventy-two percent of the participants drink milk every day and 33% drink milk several times/day. Forty-three percent drink flavored milk and

consume yogurt every day and at least 35% do not consume them. The consumption of liquid (drinking) yogurt was low (only 32%) and 54% do not consume it. Fifty five percent of the children consumed white cheese every day and 50% consumed processed cheese (sliced and triangle cheese). Ice cream had a high consumption rate among children, with 62% consumed ice cream at least once/day.

**Table 2. Milk consumption characteristics of participants (n= 470)**

Consumption Characteristic	%Responding
<b>Do you drink milk?</b>	
Yes	94.2
No	5.8
<b>Milk source</b>	
Cow	85.0
Camel	9.6
Goat	5.4
<b>Milk kind</b>	
Fresh	80.4
Dried	19.6
<b>From where you get milk?</b>	
Market	76.2
Farm	23.8
<b>Time of drinking milk</b>	
Morning	74.5
Night	19.3
Other time	6.2
<b>Do you drink milk at the school?</b>	
Yes	10.9
No	89.1
<b>Do you drink flavored milk?</b>	
Yes	78.5
No	21.5
<b>What flavor?</b>	
Chocolate	43.0
Strawberry	38.3
Other flavors	18.7

**Table 3. Frequencies of milk and dairy products consumption (n=470)**

Consumption	Milk	Flavored milk	Yogurt	Liquid yogurt	White cheese	Sliced cheese	Triangle cheese	Ice-cream
> One time/day	33.0%	16.1%	15.3%	11.5%	28.3%	17.7%	28.9%	42.2%
One time/day	38.9%	26.4%	27.2%	20.6%	26.8%	22.1%	22.3%	21.0%
1 to 5 times/wk	13.8%	21.7%	18.6%	13.8%	16.1%	16.8%	17.5%	20.0%
Rarely	14.3%	35.8%	38.9%	54.1%	28.7% <sup>^</sup>	43.3%	31.2%	16.8%

### Consumer Acceptance Test

Mean hedonic ratings for appearance, color, taste, texture, aroma, and overall acceptability of camel milk are presented in Table 4. Camel milk had similar ratings for appearance, color, and texture which were slightly lower compared to fresh cow milk. Camel milk had the lowest ratings for taste (3.2), aroma (4.1), and overall acceptance (3.8) which were significantly lower compared to the fresh and dried cow milk (5.3 – 5.9). This was expected since camel milk had lower lactose content (Elamin and

Wilcox, 1992) and higher levels of potassium, magnesium, iron, copper, manganese, sodium, and zinc than cows' milk (Sawaya et al., 1984; Gorban and Izzeldin, 1997). Flavoring camel milk with chocolate enhanced all the sensory attributes of the milk. Chocolate flavored camel milk had similar sensory characteristics which were slightly higher but not significantly different compared to fresh or dried cow milk. The taste (6.4), aroma (6.3) and overall acceptance (6.2) ratings of chocolate flavored camel milk were significantly higher compared to plain camel milk.

**Table 4. Mean hedonic ratings for appearance, color, taste, aroma and overall acceptance of camel milk (n=173)<sup>1</sup>**

Milk	Mean Hedonic Ratings					
	Apperance	Color	Taste	Texture	Aroma	Overall Acceptance
Fresh camel milk	5.7a <sup>2</sup>	5.8a	3.2b	4.7b	4.1b	3.8b
Fresh cow milk	6.2a	6.1a	5.8a	5.7ab	5.9a	5.8a
Dried cow milk	5.9a	6.0a	5.3a	5.3ab	5.7a	5.5a
Flavored camel milk	6.1a	6.1a	6.4a	6.0a	6.3a	6.2a
LSD	0.78	0.46	1.32	1.20	0.97	0.86

<sup>1</sup>7-point hedonic scale (smiling faces) was used with frown face (1) = dislike very much and smile face (7) = like very much.

<sup>2</sup>Means within a column not followed by a common letter are significantly diferent ( $P \leq 0.05$ ).

## Conclusions

Participants consumed milk and dairy products every day. Children were not familiar with camel milk, since it was not commercially available. Camel milk had different taste and aroma (lower lactose content and higher salt content) compared to cow milk which affected its acceptance. Flavoring camel milk with chocolate enhanced the sensory quality of the milk. Participants found the sensory attributes of chocolate flavored camel milk to be very acceptable.

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## References

- Abu-Lehia, I. H. 1987. Composition of camel milk. *Milchwissenschaft* 42:368.
- Abu-Ruqaie, I. M., H. M. El-Nakhal, and A. N. Wahdan. 1989. Improvement in the quality of dried fermented milk product, *oggtt. J. Dairy Res.* 54:429.
- Chen, A. W., A. V. A. Resurreccion, and L. P. Paguio. 1996. Age appropriate hedonic scales to measure food preferences by young children. *J. of Sensory Studies.* 11:141.
- Elamin, F. M., and C. J. Wilcox, 1992. Milk composition of Majaheim camels. *J. dairy Sci.* 75:3155.
- Farah, Z., R. Rettenmaier, and D. Atkins. 1992. Vitamin content of camel milk. *Int. J. Vit. Nutr. Res.* 62(1):30.
- Gorban, A. M. S., and O. M. Izzeldin. 1997. Mineral content of camel milk and colostrum. *J. Dairy Res.* 64:471.
- MA, M. 1995. The fat globule size distribution camel, goat, ewe, and cow milk. *Michwissenschaft- Milk Sci. Int.* 50(5):260.
- SAS. 1995. Statistical Analysis System User's Guide, Version 6 SAS Institute, Inc., Cary, NC.
- Sawaya W. N., J. K. Khalil, A. Al-Shalhat, and H. Al-Mohammad. 1984. Chemical composition and nutritional quality of camel milk. *J. Food Sci.* 49:744.
- Yagil R. 1987. Camel milk. A review. *Int. Sci.* 2:81.