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Chemical composition of fermented dairy products consumed in Bahrain

Abdulrahman O. Musaiger,[a]* Jalal A. Al-Saad,[b] Dabia S. Al-Hooti[b] & Zakaria A. Khunji[b]

[a]*Department of Food Sciences and Nutrition, Faculty of Agricultural Sciences, United Arab Emirates University, Al-Ain, United Arab Emirates*
[b]*Public Health Laboratory, Ministry of Health, Manama, Bahrain*

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Physical, proximate and mineral composition of 4 types of fermented dairy products commonly consumed in Bahrain were analysed. The findings revealed that acidity, total solids and solids not-fat were found to be higher in yoghurt and labenah (thick yoghurt) compared to low and full fat laban (diluted yoghurt). Moisture content was lower in labenah (77.0%) than other fermented dairy products (85.4–89.4%). Protein level was highest in labenah (7.6%) and lowest in low fat laban (3.2%). Sodium concentration ranged from 55.9 mg $100\,g^{-1}$ in low fat laban to 143 mg $100\,g^{-1}$ in labenah, while calcium content ranged between 120–167 mg $100\,g^{-1}$. In general, some chemical compositions of various types of fermented dairy products studied differed from the corresponding compositions reported in the literature. This can be attributed to type of milk used, method of preparation, type and proportion of starters and consumer preferences.

INTRODUCTION

The need for data on composition of foods consumed in the Arab Gulf countries, including Bahrain, has been emphasised by local, regional and international organizations (Musaiger and Miladi, 1996). Several studies were carried out on composition of foods and dishes in the Gulf (Musaiger and Sungpuag, 1985; Sawaya *et al.*, 1986; Al-Nagdy *et al.*, 1994); however, the composition of milk and dairy products has received little attention. The published literature on dairy foods in the region are only available from Saudi Arabia and are focused on traditional dairy products such as home-prepared cheese and diluted yoghurt (laban) (Al-Mashhadi *et al.*, 1986), goat milk (Sawaya *et al.*, 1984*a*), sheep milk (Sawaya *et al.*, 1984*b*) and camel milk (Mehaia *et al.*, 1995).

The consumption of milk, especially cow's milk and dairy products in the Arab Gulf countries, has increased dramatically during the past two decades. These products make an important contribution to the overall nutrient contents of the Gulf diet, and provide a wide range of essential nutrients. In Saudi Arabia for example, it was reported that dairy products contribute 64% of the Recommended Daily Allowances (RDA) for calcium, 49% for phosphorus, 30% for protein and 28% for vitamin A (Salji, 1986).

The aim of this study is to analyse the chemical composition of some fermented dairy products commonly consumed in Bahrain, namely laban (diluted yoghurt), yoghurt, and labenah (thick sour yoghurt).

MATERIALS AND METHODS

Sampling technique

Samples of fermented dairy products were obtained from four outlets. The main brands of these products, either local or imported, which are available in the market of Bahrain, were first identified. Two samples were obtained from each brand for each type of product. The products were selected in two stages (1) one sample of each product was obtained from the supermarkets; (2) after one month a second visit was made to the same supermarkets to select the second sample. This procedure was applied to include different batches of each product. Numbers of samples of each product depended on the numbers of brands available in the market. The total brands included were 21 and the total number of samples analysed was 48. The main products included in this study were laban (made from whole milk) and laben (low fat), yoghurt (made from whole milk) and labenah.

*To whom correspondence should be addressed.
Current address: Bahrain Centre for Studies and Research, P.O. Box 496 Manama, Bahrain.

Chemical analysis

Samples were purchased and sent directly to the Public Health Laboratory at the Ministry of Health, Bahrain, for analysis. Moisture, crude protein, crude fat and ash contents of milk and dairy products were determined according to the standard methods of AOAC (1984). Protein was calculated using the factor NX 6.38. Carbohydrates were calculated by difference. Energy was then obtained using conversion factors for protein, carbohydrates and fat (4, 4 and 9 kcal g^{-1}, respectively).

Lactose was determined by iodometric titration method using chloramine (Martin, 1979). Total acidity, pH, total solids and solids-not-fat (SNF) were determined according to the Saudi Arabian Standard for Physical and Chemical Analysis of Milk (SASO, 1977).

Minerals were measured by wet-ashing as described in Osborne and Vooget (1978). Concentrations of minerals were determined by Atomic Absorption Spectrophotometer (Phye Unicam, Pu 9095). Data are presented as an average value and range for each parameter.

RESULTS

Physical characteristics of fermented dairy products consumed in Bahrain are presented in Table 1. The acidity, pH and lactose were almost similar for the four types of fermented dairy products studied. However, some variations were observed in the total solids and SNF. As expected, acidity was highest in labenah and so was the total solids.

There were no significant differences in the moisture, protein and carbohydrate contents between the two types of laban. Fat level was lowest in low fat laban (1.3 g 100 g^{-1}) and highest in labenah (7.4 g 100 g^{-1}). Consequently energy value decreased as percentage of fat decreased in these products. Although, yoghurt was made from whole cow's milk, the protein, fat and carbohydrate levels (4.3, 3.9 and 5.5 g 100 g^{-1}, respectively) were higher than that reported for cow's milk. This is mainly due to the low content of moisture in yoghurt compared to milk. Protein level was lowest in low fat laban (3.2 g 100 g^{-1}) and highest in labenah (7.6 g 100 g^{-1}), as shown in Table 2.

With the exception of Na, K, Ca and P, the levels of other minerals (K, Fe, Cu, Mn, Zn and Mg) were very similar in the fermented dairy products studied (Table 3). The highest level of Na was found in labenah (143 mg 100 g^{-1}), while the lowest was in low fat laban (55.9 mg 100 g^{-1}). The level of calcium ranged from 120 mg 100 g^{-1} in low fat laban to 167 mg 100 g^{-1} in yoghurt made from whole cow's milk, while the phosphorus level ranged from 101 mg 100 g^{-1} in full fat laban to 141 mg 100 g^{-1} in labenah.

DISCUSSION

An attempt was made to compare the chemical composition of various brands of fermented dairy products included in the study. We found that there are differences between the brands and this is particularly true for the total solids, fat and some mineral contents. Among the minerals, sodium, potassium, phosphorus and calcium were more variable than other minerals (Table 3). These variations in chemical composition between the same kinds of fermented dairy products can be attributed to several factors such as method of preparation, type and proportion of starters used and consumer preferences.

In general, two types of starters are usually used in the preparation of fermented dairy products in Bahrain, namely *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. The proportions of these starters are different from one factory to another, and this may instigate differences in the qualities of fermented dairy products.

Laban is traditionally prepared from cow's milk in the Gulf countries. It is an accompanying drink at lunch, and also at other meals. It is usually consumed with dates, but sometimes it is added to rice. Recently laban has been produced in pasteurized form by most dairy factories in the region. Our chemical analysis of

Table 1. Mean and range of components (%) of fermented dairy products consumed in Bahrain

Components	Dairy products			
	Laban (whole milk)	Laban (low fat)	Yoghurt (whole milk)	Labenah
Acidity	0.81 (0.6–1.1)	0.82 (0.8)	1.00 (0.8–1.2)	1.20 (0.6–1.7)
pH	4.5 (4.2–4.9)	4.4 (4.3–4.6)	4.3 (4.1–4.5)	4.1 (4.0–4.3)
T. solids	11.8 (11.1–13.1)	10.6 (9.7–11.5)	14.6 (11.5–19.2)	23.0 (15.2–21.4)
SNF	8.8 (8.1–10.7)	9.3 (8.6–10.1)	10.7 (8.3–13.4)	15.6 (8.0–13.4)
Lactose	3.7 (3.3–4.2)	3.7 (3.7)	4.0 (3.6–4.4)	3.7 (3.4–4.4)

Table 2. Mean and range of proximate components (%) of fermented dairy products consumed in Bahrain

Proximate composition	Dairy products			
	Laban (whole milk)	Laban (low fat)	Yoghurt (whole milk)	Labenah
Moisture	88.2 (86.9–88.9)	89.4 (88.5–90.3)	85.4 (80.8–88.5)	77.0 (73.6–84.8)
Protein	3.5 (2.5–4.6)	3.2 (2.9–3.5)	4.3 (3.0–4.7)	7.6 (6.9–8.0)
Fat	3.1 (2.5–4.3)	1.3 (1.2–1.4)	3.9 (2.4–6.8)	7.4 (6.2–8.0)
Ash	0.8 (0.7–0.9)	0.7 (0.71–0.73)	0.9 (0.7–1.1)	1.0 (0.9–1.3)
Carbohydrates	4.4 (3.3–5.7)	5.4 (4.9–5.9)	5.5 (5.4–6.6)	7.0 (4.4–7.4)
Energy (kcal)	60 (46–80)	46 (42–50)	74 (55–106)	125 (101–134)

Table 3. Mean and range of mineral contents (mg 100 g^{-1}) of fermented dairy products consumed in Bahrain

Mineral	Dairy products			
	Laban (whole milk)	Laban (low fat)	Yoghurt (whole milk)	Labenah
Na	81.0 (43–144)	55.9 (46–66)	75.0 (61–105)	143 (120–213)
K	132 (102–162)	146 (145–147)	129 (69–l87)	96 (106–124)
Fe	0.2 (0.1–0.3)	0.3 (0.1–0.4)	0.3 (0.1–0.4)	0.2 (0.2)
Cu	0.01 (0.01)	0.01 (0.01)	0.04 (0.01–0.09)	0.02 (0.01–0.1)
Mn	0.02 (0.01–0.02)	0.01 (0.01–0.02)	0.03 (0.01–0.05)	0.02 (0.02)
Zn	0.5 (0.4–0.6)	0.05 (0.5–0.6)	0.6 (0.4–1.0)	0.6 (0.5–0.7)
Mg	11.9 (11.0–14.0)	10.9 (10.0–11.6)	13.4 (12.1–17.5)	15.3 (14.8–17.5)
Ca	128 (114–154)	120 (117–123)	167 (150–174)	147 (128–169)
P	101 (85–116)	104 (103–106)	117 (98–141)	141 (125–147)

laban was compared with that reported for laban locally produced in Saudi Arabia (Al-Mashhadi, 1986). The laban consumed in Bahrain had higher levels of acidity, pH, total solids, lactose, fat and ash than the laban locally produced in Saudi Arabia. These differences can be attributed to the method of preparation of both labans, as the Saudi data were based on traditional methods for producing the laban, while our data are based on laban produced by dairy plants. Comparison of mineral contents of laban between the two studies was not possible because of absence of information on mineral composition in the Saudi study.

The yoghurt available in Bahrain had higher contents of fat, ash, P, Ca, Fe, Zn, Mg and Mn than the yoghurt available in Egypt (Dagher, 1991), but lower levels of moisture, protein and lactose. Again these chemical differences are mainly due to the method of preparation of yoghurt in both countries. When we compared our chemical analysis for yoghurt with that for yoghurt available in the U.K. (plain yoghurt, whole milk), the yoghurt available in Bahrain had higher percentages of moisture, fat and iron, whereas all other nutrients were found to be higher in the UK yoghurt (Holland *et al*., 1989).

Labenah is a yoghurt that has been strained to separate its whey component, usually by straining the yoghurt through cloth bags for several hours. This concentration process allows further fermentation by the lactic acid bacteria resulting in a modified flavour of the final product (Dagher, 1991). Salt is commonly added to labenah to give its special taste. This explains the high level of sodium in this product compared to other fermented products.

Protein, fat, ash and energy levels were found to be lower in labenah consumed in Bahrain than labenah consumed in other Arab Middle East countries (Dagher, 1991). However, the levels of calcium, phosphorus and iron were compared favourably with our results.

In general, chemical compositions of laban, yoghurt and labenah consumed in Bahrain differed from the composition reported in the literature. This was particularly true for fat, ash, protein and some minerals. This means that more attention should be paid to the nutritional composition of traditional foods and dishes consumed in each country in the Gulf, including Bahrain. Information on proximate and mineral analyses of fermented dairy products available in this study would be helpful for food scientists, nutritionists and public health workers interested in nutritive values of local foods. Further investigations on composition of other traditional dairy products, such as cheese and dairy sweets, are highly recommended, in order to provide adequate data on food composition in this part of the world. Chemical determination should be expanded to include fatty acid profile and cholesterol content of local foods, as these components are important from the public health point of view.

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