



ORIGINAL ARTICLE

# Comparative milk and serum cholesterol content in dairy cow and camel



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**Abstract** In order to compare cholesterol contents in cow and camel milk in similar farming conditions, milk and blood of seven cows and seven camels maintained at normal diet at the middle of lactation were sampled at morning and evening, then after two weeks of keeping them at low protein diet. The cholesterol content in camel milk ( $5.64 \pm 3.18$  mg/100 g, SD) was not significantly lower than in cow milk ( $8.51 \pm 9.07$  mg/100 g, SD). Fat contents in cow milk were higher. Cholesterol/fat ratios were similar in the two species (camel:  $225 \pm 125$  mg/100 g fat; cow:  $211 \pm 142$  mg/100 g fat). The serum cholesterol concentration was significantly higher in cow ( $227.8 \pm 60.5$  mg/100 ml) than in camel ( $106.4 \pm 28.9$  mg/100 ml). There was a significant difference between morning and evening milking in milk fat compositions and concentrations in cholesterol. Fat levels increased in cow after two-week low energy-protein diet.

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## 1. Introduction

Cholesterol is a sterol commonly present in milk and meat products intended for human consumers. As the nutritionists claimed, for a long time, a relationship exists between high

blood cholesterol concentration and heart failure (Hofvendahl, 1971), and many medical advices push to reduce the cholesterol intake, even if the effect of cholesterol on health is not completely clarified (Parodi, 2009; Alabdulkarim et al., 2012).

Camel meat is known for its low cholesterol content (Kadim et al., 2008) making it a commercial argument by the promotion of the healthy image of this product on the meat market. Although everyone agrees on the low cholesterol level of camel meat compared to other species, yet the situation is controversial for camel milk. Many workers argue that camel milk contains less cholesterol than cow milk (Kamal and Salama, 2009; Raziq et al., 2008) while others reported the

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reverse (Gorban and Izzeldin, 1999; Konuspayeva et al., 2008). Elsewhere, the camel milk consumption is increasing compared with the consumption of cow milk, under the growing interest of consumers for “non-cattle milk” (Faye and Konuspayeva, 2012). The objective of the present paper was, thus, to compare the cholesterol contents in camel and cow milk produced under similar farming conditions and to assess the impact of low protein diet on the cholesterol concentration in milk and serum.

## 2. Materials and methods

### 2.1. Animals and milking

For the experiment, 7 Holstein cows (5–9 years old, average weight 420 kg) and 7 she-camels (6–12 years old, average weight 650 kg), belonging to the Conservation and Genetic Improvement Center, Kharj (Saudi Arabia), were used. The experimental camels were composed of different phenotypes (Waddah, Majahem and Homor) but belonging to the same genotype (Abdallah and Faye, 2012; Almathen et al., 2012) and were at approximately the middle stage of lactation. Cows were in the late lactation stage, after the peak of production. On an average, just before the experiment, the camel produced 6.6 liters/day and the cow 15.4 liters/day.

In the Center, the cows and the camels were milked twice a day by a milking machine (cow: Gascogne Melotte Lectron 612<sup>®</sup>; vacuum level 45 Kpa, 60 pulses/min, pulsation rate 50/50; camel: Boumatic<sup>®</sup>, vacuum level 50 Kpa, 60 pulses/min, pulsation ratio 60/40; in different milking parlors) at 7:00 and 16:00.

### 2.2. Diet

At the center, cows were given a daily ration of 15 kg of Rhodes grass hay (*Chloris gayana*), and 7.5 kg commercial concentrates (18% crude proteins, Table 1), while camels were provided 12 kg alfalfa (*Medicago sativa*) and 3 kg commercial concentrates each day (nutritive values in Table 2). All animals received in addition salt licks (100 g/day/animal) enriched in minerals and vitamins. Experimental animals were given low energy diet (concentrate decreased 50%, i.e., 1.5 kg for camel and 3.5 kg for cow) for 21 days after the collection of the first milk/blood samples. There were no refusals both for cows and camels. The quantity of milk expected according to the energy level with normal diet was 6.3 kg/day for camel and 9.9 kg/day for cow. With low-energy diet, these values were 5.3 and 7.2 kg/day respectively for camel and cow. The values based on the protein level of the diet were 9.8 and 18.3 kg/day with normal diet (camel and cow respectively) and 7.5 and 12.3 kg/day with low diet (camel and cow respectively) (Table 2).

### 2.3. Experimental design

The experiment included two steps for sampling:

- Milk and blood samples of each cow and camel were at the morning and afternoon milking at day 1. All animals received their normal diet described below. As it was the current diet, there was no need for an adaptation period.
- Milk and blood sampling of the same cows and camels at day 21 after two weeks of distribution of low-energetic diet is described below.

Finally, 56 milk samples and 56 blood samples were analyzed (28 cow samples and 28 camel samples for milk or blood).

**Table 1** Chemical composition of the commercial concentrate given to cows and camels.

Components	Values
Crude protein (%)	18.00
Crude fat (%)	3.00
Crude fiber (%)	6.00
Ash (%)	6.5
Salt (%)	0.70
Calcium (%)	1.00
Phosphorus (%)	0.60
Vitamin A (IU g <sup>-1</sup> )	20.0
Vitamin D (IU g <sup>-1</sup> )	3.0
Vitamin E (IU g <sup>-1</sup> )	15.0
Energy (ME kcal kg <sup>-1</sup> )	2780

**Table 2** Intake, dry matter (DM), energy (Milk forage Unit/, MFU/kg DM), protein value (PDIN, Digestible Protein in Intestine), minerals (Ca, P) and milk production expected by energy and protein in dairy cow and camel according to the distributed diet.

Components	Intake (kg/animal) (low diet)	DM (%)	Energy (MFU (kg DM <sup>-1</sup> ))	PDIN (kg DM <sup>-1</sup> )	Ca (%)	P (%)	Milk (Energy)	Milk protein
<i>Camel</i>								
Alfalfa	12	70	0.85	126	15	3.5		
Concentrate	3 (1.5)	93	1.2	145	10	6.0		
<i>Cow</i>								
Rhodes grass hay	15	90	0.6	75	6	3.5		
Concentrate	7.5 (3.5)	93	1.2	145	10	6.0		
<i>Normal diet</i>								
Total camel	15		10.5	1465	154	46	6.3	9.8
Total cow	22.5		16.2	2029	151	89	9.9	18.3
<i>Low-energy diet</i>								
Total camel	13.5		8.8	1262	140	38	5.3	7.5
Total cow	18.5		12.0	1487	113	67	7.2	12.3

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