

## Chapter 2

# Camel Milk Composition and Nutritional Value

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### ABSTRACT

*If gross composition of camel milk is roughly comparable to cow milk, fine composition shows significant differences explaining potential health benefit for regular consumers. The main particularities of camel milk are (1) better atherogenicity index thanks to its higher proportion of mono-unsaturated and polyunsaturated fatty acids compared to other milks, (2) different proportion of caseins than cow milk leading to difficult clotting, (3) lack of  $\beta$ -lactoglobulin, often responsible for cow milk allergy, (4) slightly higher concentration in antibacterial and immunity support proteins with higher bio-activity than in other milk, (5) presence of WAP (whey acidic protein) and PGRP (peptidoglycan-recognition protein) not available in cow milk, (6) probable efficient insulin for supporting better glycemia regulation, (7) better metabolization of lactose leading to lower intolerance in consumers, (8) richness in sodium and iron compared to other milks, and (9) contrasted values of vitamins (less vitamins B, high quantity of vitamins C and D). This chapter explores camel milk composition and nutritional value.*

### INTRODUCTION

The gross composition of camel milk has been investigated for more than one century. Indeed, the first available reference in the literature regarding this milk is that of Barthe in 1905 (Barthe, 1905). However, the number of references remains modest compared to that regarding cow milk. In a meta-analysis of the camel milk composition published in 2009 (Konuspayeva, Faye & Loiseau, 2009a), an almost comprehensive list of 82 references only was explored. For the last 10 years, the number of references increased significantly, in relation to the growing interest for camel milk in the world (Faye, 2018). Such growing interest is partly associated with the dietetic or medicinal values attributed to this milk. This

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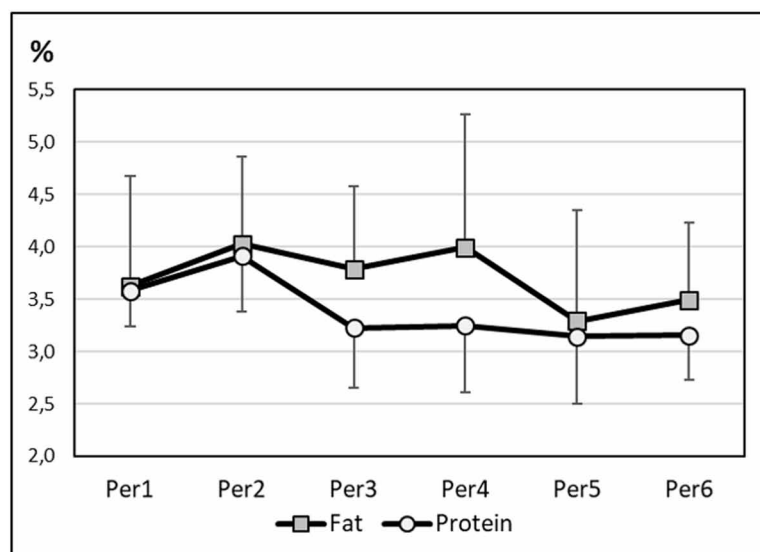
aspect discussed in other chapters of the present book. In the present chapter, the comprehensive list published in 2009 completed with some recent publications regarding the gross composition, while a second part is discussing the variation factors of this milk composition. In a last part, the particularities of camel milk in its fine composition is explored and compared with other milk of dairy species.

## THE GROSS COMPOSITION OF CAMEL MILK

The compilation of 121 references published between 1905 and 2019 gives a mean and standard deviation of  $3.68 \pm 1.00$  for percentage of fat matter,  $3.28 \pm 0.59$  for total protein,  $4.47 \pm 0.66$  for lactose and  $0.81 \pm 0.19$  for ash with dry matter varying between 8.25 and 16.70% (mean =  $12.2 \pm 1.62\%$ ). To assess the average changes in this gross composition throughout the century, the references were gathered into 6 periods: per1 (1905-1960, 6 references), per2 (1961-1980, 12 references), per3 (1981-1990, 23 references), per4 (1991-2000, 32 references), per5 (2001-2010, 18 references), and per6 (2011-2019, 30 references). If lactose and mineral content doesn't change significantly across periods, there is a significant difference in fat matter and total protein (and consequently in dry matter percentage) according to the time of analysis, with a regular decrease of protein content and a maximum of fat in the period 1991-2000 (figure 1).

Such variation could be explained by the changes in the analytical methods used (Konuspayeva et al., 2009a), but could be also linked to the increasing references based on data from intensive camel farm where a certain degradation of fat and protein concentration in milk is observed (Benmohamed, Siboukeur & Ehoud, 2018). However, the variability is also observed according to origin of the camel milk samples. In the compilation of our 121 references, 15 were issued from Central Asia, 20 from South Asia, 24 from Middle East, 27 from East Africa, 27 from North Africa, 1 from West Africa and 1 from Europe,

Figure 1. Changes (mean  $\pm$  SD) in fat matter ( $\square$ ) and total protein ( $\circ$ ) in camel milk at different periods between 1905 and 2019 based on the compilation of 121 references



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