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A study on determination of physicochemical properties of sheep and camel milk reared in arid zone of Rajasthan

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Abstract
Milk is highly nutritious and supplies body building proteins, bone forming minerals, healthful vitamins and provide energy giving lactose and milk fat. Sheep milk has high nutritional value and high concentrations of proteins, fats, minerals, and vitamins as compared to the milk of other domestic species. The high levels of protein, fat, and calcium make it an excellent matrix for cheese production. Sheep milk proteins are also important sources of bioactive ACE inhibitory peptides and antihypertensive peptides. They can protect and control microbial infections against non-immune diseases. The activity of these biofunctional peptides is based on their composition and sequence of amino acids. Camel milk is unique in terms of having low fat (1.5-3%) and low protein (2.5%). Camel milk is known for its medicinal properties, which are widely exploited for human health. The low quantity of β-casein and the lack of β-lactoglobulin are linked to the hypo-allergic effect of camel milk. Other components such as lactoferrin, immunoglobulin, lysozyme or vitamin C were reported to play a central role in the determination of these properties. In the present investigation an attempt was made to evaluate the physicochemical properties of sheep and camel milk as well as admixture of sheep and camel milk.

Keywords: Determination, physicochemical, sheep, camel milk

Introduction
At present, India is the world's largest milk producer now reaching a level of about 163.7 million tones with an annual growth rate of 5.53%. Out of the total production 46% milk is consumed in liquid form; 54% is utilized for manufacturing of different milk products and 3% is utilized for channa and paneer production.

The physicochemical and nutritional characteristics of sheep milk can be advantageous for the manufacture of products containing prebiotic ingredients and probiotic bacteria, which are major categories in the functional food market. The high protein and overall solid contents of sheep milk make it particularly appropriate for cheese and yoghurt making. Sheep milk contains one and half times more protein than cow milk (up to 6-7%), and has more A, B1 and B12 vitamins. Sheep milk is an important attribute of food of many nations in Europe Asia and the Middle East. Mostly the milk products such as yogurt, kefir, cheese, butter are made from sheep milk. It also has simple lipids (diacylglycerols, monoacylglycerols, and cholesterol esters), complex lipids (phospholipids), and liposoluble compounds (sterols, cholesterol esters, hydrocarbons) Sheep colostrum is also higher in basic nutrients than cow colostrum in the early postpartum 2 period: fat 13.0% and 5.1% protein 11.8% and 7.1%, lactose 3.3% and 3.6%, minerals 0.9% and 0.9% total solids 28.9% and 15.6% respectively.

Camel milk is unique in terms of having low fat (1.5-3%) and low protein (2.5%). Camel milk is known for its medicinal properties, which are widely exploited for human health, as in several countries from the ex-Soviet Union and developing countries. Camel milk is considered to have anticancerous, hypo-allergic and antidiabetic properties. A high content in unsaturated fatty acids contributes to its overall dietary quality. The low quantity of β-casein and the lack of β-lactoglobulin are linked to the hypo-allergic effect of camel milk. Other components such as lactoferrin, immunoglobulin, lysozyme or vitamin C were reported to play a central role in the determination of these properties.

Material and Method

Physicochemical properties of Sheep and camel milk

Fresh sheep milk was collected from CSWRI- Central Sheep and Wool Research Institute Bikaner and fresh camel milk was collected from camel dairy maintained at ICAR-NRC on Camel, Bikaner. All samples were collected manually in sterile bottles and were kept under chilled condition till further use. Milk samples were analyzed for pH, SNF, fat, protein, lactose etc. using Milkoscan at Department of Livestock Products Technology, College of Veterinary and Animal Science, Rajasthan University of Veterinary and Animal Sciences, Bikaner (Rajasthan), The mean values of physicochemical properties of fresh sheep and camel milk has been presented in Table 1.

Result and Discussion

The overall compositions of sheep and camel milk was revealed that the sheep milk had higher concentrations of protein, fat and solid not fat (SNF) compared to camel milk and mixed milk.

The fat content of sheep, camel and mixed milk (30% sheep milk and 70% camel milk) was 7.59 ± 0.30, 3.27 ± 0.24 and 4.87 ± 0.18 respectively, SNF content of sheep milk was 8.43 ± 0.22, for camel milk it was 7.46 ± 0.26, and for mixed milk it was 7.57 ± 0.21. Protein content of sheep, camel and mixed milk was 3.29 ± 0.18, 2.49 ± 0.18 and 2.50 ± 0.16 respectively whereas lactose content of sheep, camel and mixed was 4.49 ± 0.18, 3.85 ± 0.22 and 4.14 ± 0.22 respectively. The freezing point and pH of sheep, camel and mixed milk was -0.55 ± 0.08, -0.46 ± 0.03, -0.47 ± 0.06 and 6.24 ± 0.17, 6.64 ± 0.21, 6.40 ± 0.10 respectively.

The dromedary camel milk protein contents range from 2.15 to 4.90% as per Konuspayeva *et al.* (2009) whereas the fat level of the dromedary camel varies from 1.2 to 6.4% as reported by Haddadin *et al.* (2008) [3] and Konuspayeva *et al.* (2009). In the manufacturing of dairy products pH plays a significant role in determining the end product quality. The pH of camel milk ranged between 6.5 to 6.7 as reported by (Khaskheli *et al.* 2005) [4].

Table 1: Physico-chemical properties of sheep and camel milk

Physico-chemical Properties	Sheep milk (Mean ± SE)	Camel milk (Mean ± SE)	Sheep and Camel milk (Mean ± SE)
Fat %	7.59 ± 0.30	3.27 ± 0.24	4.87 ± 0.18
SNF %	8.43 ± 0.22	7.46 ± 0.26	7.57 ± 0.21
Protein %	3.29 ± 0.18	2.49 ± 0.18	2.50 ± 0.16
Lactose %	4.49 ± 0.18	3.85 ± 0.22	4.14 ± 0.22
Freezing Point (^{0}C)	-0.55 ± 0.08	-0.46 ± 0.03	-0.47 ± 0.06
pH	6.24 ± 0.17	6.64 ± 0.21	6.40 ± 0.10

In general the present study showed a wide variation in the gross composition of camel milk. The results obtained for camel milk were in agreement with studies of Tak (2017) [7], Singh (2017) [6], and Devi (2018) [1]. This variation was concluded to be partly due to the inherited capabilities of the animals and/or attributed due to various seasonal and environmental factors as well as stage of lactation, age and number of calving. In addition, the feed and water quality and quantity available to the animals also play an important role (FAO, 1982) [2].

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