

## Donkey milk chemical composition and the influence of lactation

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**Abstract.** Donkey milk is an appreciated food due to its benefits it brings to the human body. Lactation has a major quantitative and qualitative influence of donkey milk. The fat content varies depending on lactation as follows: from  $0.78 \pm 0.06$  to  $2.38 \pm 0.13\%$  in the L1 and L4 respectively. Lactose ranges as follows:  $6.68 \pm 0.02$  to  $6.76 \pm 0.02\%$  from L1 to L4. Protein shows the highest value in the lactation 1, with an average of  $1.86 \pm 0.04\%$ , and lowest in lactation 2 with an average of  $1.72 \pm 0.02\%$ .

**Key Words:** *Equus Asinus*, milk, lactation, fat, protein, lactose.

**Introduction.** The chemical composition of donkey milk is very similar to that of breast milk, so it is used for infant (Table 1). There is a drawback of this type of milk that is obtained in an amount that is reduced and the number of existing herds is reduced. Donkey milk contains antimicrobial components. Donkey milk components play an important role in improving the protection for newborns and toddlers. Especially for children who are allergic to other types of milk (Mubarak et al 2012).

Table 1  
The physico-chemical composition of milk from different species (gm/dL) (Swar 2011)

Parameter	Species	Donkey	Buffalo	Cow	Human	Mare
Fat		2.0	6.6	3.9	3.6	2.1
Protein		1.5	0.6	3.3	1.2	1.7
Lactose		6.3	4.7	4.3	6.4	6.2

Knowing the chemical composition of donkey milk is very important because milk is of economic interest, it can be used in pharmaceutical industry for the various products designed especially for people suffering from allergies. The composition of donkey milk is influenced by the stage of lactation as in other animal species (Doreau & Boulot 1989; Giosué et al 2008).

The milking technique in donkeys is the traditional one (manual) because of the reduced capacity of the mammary gland. Therefore, both the donkey milk and milk products shows a higher cost price. Donkey milk is an appropriate alternative in cases when some children exhibit allergies to different species milk, very often when they consume cow milk (Polidori & Vincenzetti 2013).

The donkey milk main quality lies in its nutritional characteristics and especially because of its use in treating a variety of diseases. Due to the chemical composition and sensory properties, donkey milk is considered one of the most complete foods.

Breastmilk is the ideal food for the newborn child to develop immunity. There are some situations where this is not possible and when needed substitution of breast milk formulas. Donkey milk is such an alternative.

The aim of this study was to analyze the physical and chemical composition of donkey milk under the influence of lactation.

**Material and Method.** The studied biological material is represented by a total of five individuals considered for each lactation. The studied donkeys were located in Băbuț village, Cluj County. The animals benefited by the same feeding regime. Milking was performed manually, once a day in the morning in the spring months (March, April, May). Milk samples were collected individually in sterile containers (5 samples of milk/individual/lactation). Samples were stored at 4°C until physicochemical analysis was performed. Lactoscan device was used to determine physical and chemical parameters (fat, protein, lactose, water content, pH). The data were interpreted statistically using t test and were highlighted, media, and minimum and maximum variability for fat, protein, lactose, water content and pH.

**Results and Discussion.** Data from recorded from the donkeys we studied are in accordance with those reported in the literature. Following are the results of physicochemical analysis of donkey milk according to lactation. In Table 2, 3, 4, 5 are presented the results of physicochemical analysis of donkey milk lactation 1-4. The average fat content of the donkey milk vary depending on lactation as follows: the highest content of the fat was recorded in lactation 4 with an average of  $2.38 \pm 0.13\%$  and the lowest concentration in lactation 1, with an average content of  $0.78 \pm 0.06\%$ .

Table 2

The mean values, variability and minimum and maximum values for physical-chemical indices of donkey milk in lactation 1

<i>Parameter</i>	<i>Lactation 1</i>		
	<i>X±sx</i>	<i>V%</i>	<i>min-max</i>
Fat %	0.78±0.06	16.72	0.60-0.90
Protein %	1.86±0.04	5.06	1.75-1.96
Lactose %	6.68±0.02	0.81	6.67-6.80
Water content	88.56±0.30	0.76	87.51-89.32
Ph	7±0.04	1.43	6.9-7.1

Table 3

The mean values, variability and minimum and maximum values for physical-chemical indices of donkey milk in lactation 2

<i>Parameter</i>	<i>Lactation 2</i>		
	<i>X±sx</i>	<i>V%</i>	<i>min-max</i>
Fat	1.70±0.07	9.20	1.61-1.90
Protein	1.72±0.02	1.61	1.69-1.75
Lactose	6.72±0.02	0.66	6.68-6.73
Water content	86.19±0.77	2.00	84.77-89.32
Ph	6.8±0.07	2.20	6.70-7.1

Table 4

The mean values, variability and minimum and maximum values for physical-chemical indices of donkey milk in lactation 3

Parameter	Lactation 3		
	$X \pm sx$	V%	min-max
Fat	2.09±0.07	8.02	1.88-2.30
Protein	1.75±0.02	1.77	1.74-1.79
Lactose	6.74±0.02	0.51	6.72-6.80
Water content	84.32±0.79	2.08	82.77-87.51
Ph	6.90±0.06	2.27	6.70-7.10

Table 5

The mean values, variability and minimum and maximum values for physical-chemical indices of donkey milk in lactation 4

Parameter	Lactation 4		
	$X \pm sx$	V%	min-max
Fat	2.38±0.13	12.04	2.20-2.58
Protein	1.78±0.03	3.21	1.72-1.88
Lactose	6.76±0.02	0.54	6.71-6.79
Water content	87.51±1.34	3.41	82.77-89.56
Ph	7.10±0.02	0.69	7.08-7.2

The maintenance of the animals, influence the both, quantitative and qualitative characteristics of the milk production. Regarding the amount of protein, it remains within the breed-specific, in proper conditions maintenance of the animals. Normal milk is obtained from healthy donkeys after colostral period. The fat of the donkey milk is the most important ingredient which is used in various cosmetics, because of the content of polyunsaturated fatty acids (Temuujin et al 2006). It should be underlined the donkey milk importance for the cosmetic industries. Figure 1 shows the average values for fat content of the samples depending on lactation. The fat content in milk increases with the number of lactations, showing the highest values in lactation 3 and 4.

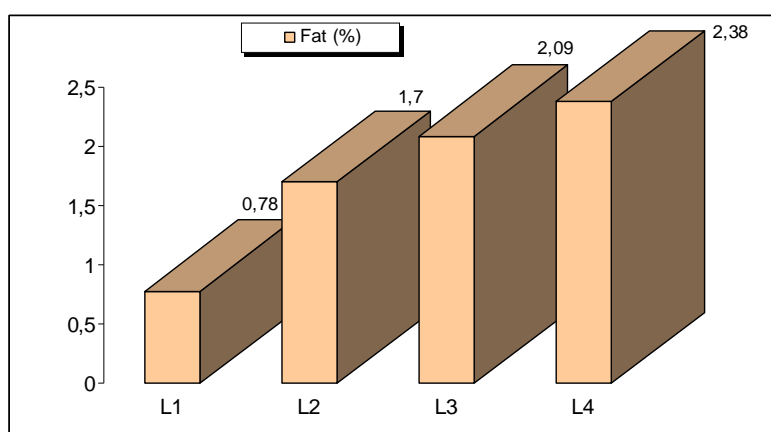


Figure 1. Mean values for fat of milk L1-L4.

Figure 2 shows the average values for protein per lactation. Average values are 1.5% protein in, values comparable with the mare milk (Swar 2011). Among chemical parameters of donkey milk, the protein is not the most important parameter. The protein content of donkey milk follow a counter pattern toward fat content. While fat concentration increases lactation the protein amount is the highest in the first lactation

and then decreases dramatically for the second lactation and with a slight increment with lactations (age).

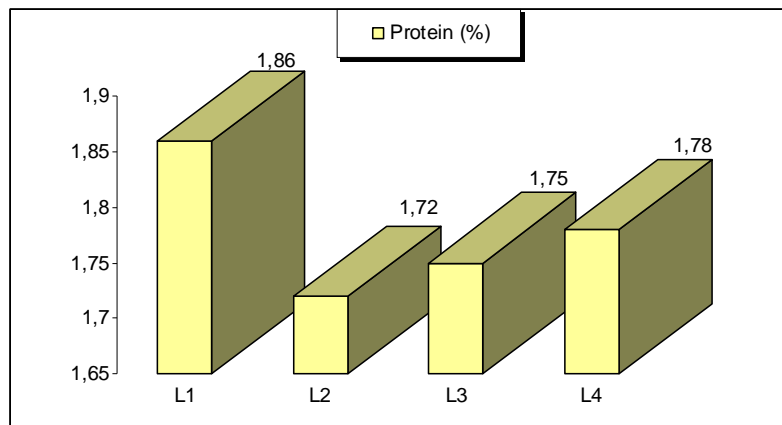


Figure 2. Mean values for protein of milk L1-L4.

The most significant parameter of donkey milk in terms of tonnage is lactose (Swar 2011). Lactose has a special role in the diet especially for young's favoring the assimilation of calcium and phosphorus in the body. If the cheese preparation about 90% of lactose passes into the whey (Rotaru & Ognean 1998). The lactose content depending on lactation as it shown in Figure 3. It can be seen that in lactation 3 and 4 the studied donkeys presented the highest values 6.74 and 6.76%.

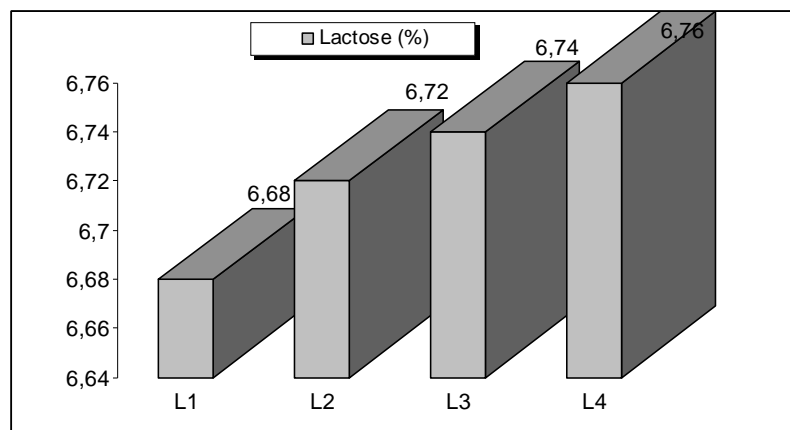


Figure 3. Mean values for lactose of milk L1-L4.

The lower water content in the donkey milk is recorded in lactation 3 with an average of  $84.32 \pm 0.79\%$ , and the highest in lactation 1, with an average of  $88.56 \pm 0.30\%$  (Figure 4).

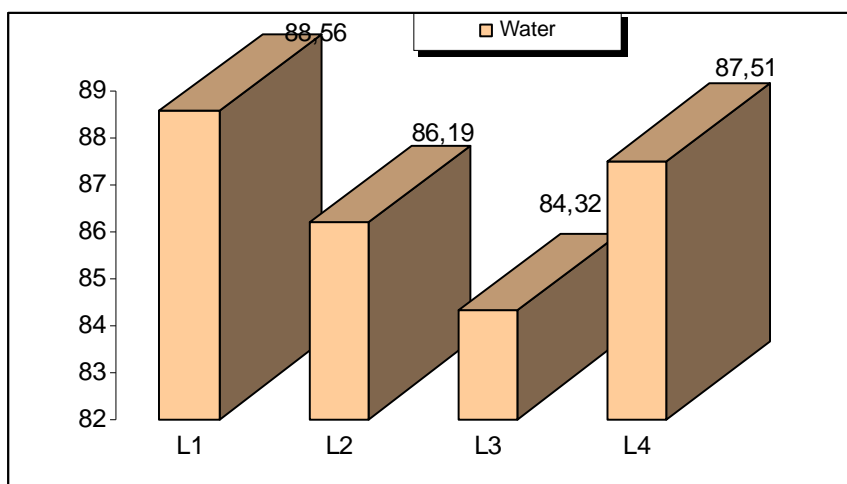


Figure 4. Average values for water from donkey milk in lactation L1-L4.

The average values for pH of the donkey milk are shown in Figure 5. These values are consistent with those published by Swar (2011). If we consider the pH value of the donkey milk is very much similar to breastmilk (Swar 2011).

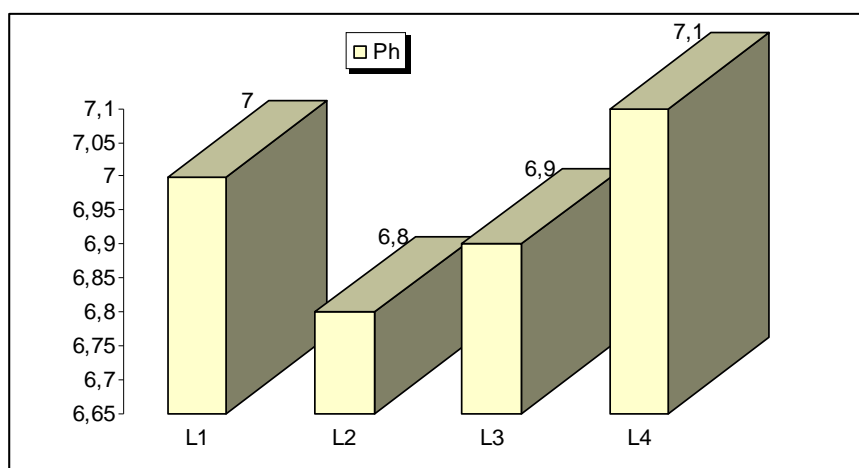


Figure 5. Mean values for pH of donkey milk L1-L4.

**Conclusions.** The donkey milk is low in fat and rich in lactose and protein. The studied donkey milk parameters (average values) are in accordance with those reported by the literature. The study concludes that the donkey milk physico-chemical parameters are influenced by lactation. The lactose in donkey milk was found to present the highest values and ranges as follows:  $6.68 \pm 0.02\%$  to  $6.76 \pm 0.02\%$  in L1 and L4. The fat behaves like lactose, showing the highest values in L4 and lowest in L1. Only the protein content was found to range the highest value in the first lactation.

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