

## MILKING CHARACTERISTICS OF ISTRIAN AND LITTORAL DINARIC DONKEY BREEDS

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### Abstract

Istrian and Littoral Dinaric donkey are autochthonous breeds which habitat primarily in the Mediterranean part of Croatia. During the second half of the 20<sup>th</sup> century they have lost primary function as working animals, which led to breeds suppression. Nowadays these two breeds are in the status of endangered ones. One of the possibilities for their economic re-affirmation is launching the program for production and processing donkey's milk. The aim of the study was to determine the possibility of milk production of Istrian and Littoral Dinaric jennies in terms of quantity and chemical composition. Istrian jennies produce 745.4 mL/milking while Littoral Dinaric produce 317.8 mL/milking. Milk from Littoral Dinaric jennies contained a significantly higher proportion of milk fat and proteins. There were no significant differences in the content of lactose, dry matter, number of somatic cells and microorganisms in milk between these two breeds. Considering the potential for milk production and milk quality, we believe that both breeds are suitable for integration in the programs for milk production, thus enabling for both population to be economically sustainable. It is necessary to develop production technology and markets, with special emphasis considering quality of donkey milk and safety of consumers.

**Key words:** *autochthonous breeds, chemical composition, donkey milk, utilisation*

### Introduction

Conservation of autochthonous breeds of domestic animals in recent decades has been imposed as one of the important demands in global and national animal production. Safety of food production in the future may considerably depend on cumulative adaptability preserved in autochthonous, today often neglected breeds. Based on past experience, analysis and assumptions for development of environment for food production FAO set a new strategic guidelines for the protection of animal genetic resources in the Global Plan of Action for Animal Genetic Resources, accepted in Interlaken in 2007 (FAO, 2007).

Donkeys are one of the important species of domestic animals, particularly adapted to areas with small amount of rainfalls and scarce vegetation. Such areas are now found in the Mediterranean countries of Europe, Middle East, Asia and Africa. Today 193 donkey breeds are registered, of which 29% breeds in Europe, 24% breeds in Near East, 17% breeds in Asia and Pacific, 14% breeds in Africa, 13% in Latin America and the

Caribbean, and 3% breeds in the area of North America (FAO, 2014). Preserved genetic diversity of donkeys in Europe reflects the efforts of preserving all existing breeds as well as more complete inventory of the donkey breeds in the field. In Croatia in the area of the Mediterranean and sub-Mediterranean climate zones three autochthonous donkey breeds are preserved, Littoral Dinaric, North-Adriatic and Istrian donkey. In the past these breeds played an important role in the cultivation of small agricultural lands, transport of goods and people, especially in the Dinaric and insular areas in Croatia.

Littoral Dinaric donkey has the largest population size, mainly distributed in central and southern Mediterranean part of Croatia, although it can be found in other areas. Because of small body frame and small body weight it belongs to a group of small donkeys in the world. On the contrary, Istrian donkey is a breed with larger body frame and larger body mass. It is assumed that in the origin of Istrian donkey some Italian breeds were involved, while breeds with smaller body frame, mostly from Southeast Europe, participated in shaping of Littoral Dinaric donkey. Ivanković et al. (2000) report that Littoral Dinaric donkey has withers height 97 cm and body weight 93 kg, while the Istrian donkey is considerably more developed, with withers height of 124 cm and body weight of 218 kg.

Social and economic changes that took place during the second half of the 20<sup>th</sup> century, especially agriculture industrialization and depopulation of rural areas, caused the reduction in demand for working animals like donkeys. Their number during mentioned period was notably reduced. If we consider reproductive aspect, all breeds were neglected (due to reduced necessity for young animals). In the middle nineties of the 20<sup>th</sup> century the interest for donkey breeds as genetic heritage was initiated and breed inventory was made. In terms of breeds preserving, relatively small population size and poor reproductive activity of the population were troubling. In recent years some efforts are taken to find new models of economic utilization of donkeys in order to save the breed from extinction, to improve reproduction, to preserve the identity of the region and to improve food offer. Milk production of autochthonous donkey breeds is one of the favorable opportunities because it is based on regular reproduction. Although in Croatia tradition of donkey milk production does not exist, in times of insufficient medical care and protection, it was often used in small quantities as a *functional food* (drug) in the rehabilitation of various health disorders, particularly in the treatment of diseases of the respiratory system. Such traditional knowledge is still present in the population, and is often used as functional food in the treatment of some diseases of the immune, circulatory, respiratory, and other systems nowadays. Due to the market demand a small number of donkey farms for milk production were established in Croatia. Such farms try to achieve economic sustainability, but they also increase chances for long-term conservation of autochthonous breeds. Since there is very little knowledge about the potential of autochthonous donkey breeds in milk production, the aim of this research was to determine milk yield and chemical milk composition of Littoral Dinaric and Istrian breed.

## **Materials and methods**

The study included 28 jennies from three farms (Pula, Imotski, Ivanić Grad), of which eight were Istrian, and 18 jennies from Littoral Dinaric breed. Jennies were kept in the whole day free housing system. Meal was primary pasture and concentrate in the amount of about one kg/day (a mixture of corn and barley; 50:50). Each jenny was subjected to two control manual milking during June and July in 2013. Three hours before milking foals were separated (physically) from the mothers to avoid milk suckling. After milking, the amount of milk was measured and milk samples for chemical and hygienic analysis

were taken. The samples were immediately frozen at -20°C and stored till chemical analysis was performed. Chemical composition is determined by infrared spectrophotometry according to HRN ISO 9622:2001. With fluoro-opto-electronic method according to HRN EN ISO 13366-2:2007/Ispr.1: 2007 the number of somatic cells account (SCC) is determined. Quantitative determination of the number of microorganisms in the milk (BCC) is done using epifluorescent flow cytometry method, according to IDF 161A:1995. The results were processed using the GLM procedures of the SAS statistical package (SAS Institute, 1999).

## **Results and discussion**

Research has shown that the Istrian jennies produce significantly higher amount of milk ( $p<0.001$ ) compared to Littoral Dinaric (745.38 vs. 317.83 mL/milking). This result is expected if we consider relation between the size of the body frame and body mass (218 vs. 93kg) partly. Given the amount of milk produced in one milking, we can conclude that their potential is beneficial, especially of Istrian jennies. Salimei and Fantuz (2012) observed (based on several studies: Alalbiso et al., 2009; Chiofalo et al., 2004; Guo et al., 2007; Ivanković et al., 2009) significant variability in the amount of milk at hand milking ( $466\pm 260$  mL/milking), in relation to the machine milking ( $772\pm 148$  mL/milking). Introduction of machine milking in the regular procedure is acceptable to farmers after organisation of market conditions considering donkey's milk, and establishing continuity of demand. Taking into account that jennies in the regular milking procedure could be milked four times per day, the amount of milk of mentioned breeds would be sufficient for its sustainable production. Average values and chemical composition of donkey's milk are shown in Table 1.

**Table 1.** *Chemical composition and hygienic parameters of Istrian and Littoral-Dinaric donkey milk*

Traits	Istrian donkey		Littoral-Dinaric donkey		Significance level
	Mean	St.dev.	Mean	St.dev.	
Milk yield (mL/milking)	745.38	302.23	317.83	154.81	***
Dry matter (%)	8.44	0.321	8.55	0.570	ns
Lactose (%)	5.92	0.305	5.85	0.419	ns
Fat (%)	0.42	0.112	0.59	0.151	**
Protein (%)	1.47	0.194	1.63	0.248	*
SCC	10.600	2.200	9.500	1.900	ns
BCC	2.600	1.250	6.240	2.460	ns

\*\*\*  $P<0.001$ ; \*\*  $P<0.01$ ; \*  $P<0.05$ ; ns – not significant

Milk dry matter and lactose in researched donkey breeds did not differ significantly. Furthermore, significant differences in the number of SCC and BCC in the milk between breeds are not observed. Milk of Littoral-Dinaric jennies contain higher amount of milk fat content ( $P<0.01$ ) and milk protein ( $P<0.05$ ) compared to the milk of Istrian jennies (0.59 vs. 0.42%, 1.63. vs. 1.47%). Compared to previous studies (Guo et al., 2007; Piccione et al., 2008; Alalbiso et al., 2009; Chiofalo et al., 2004; Ivanković et al., 2009) observed content of milk fat is much lower, while content of milk protein does not differ significantly. The number of SCC and BCC is very small, which is in agreement with previous studies. This can be explained by frequent milking or frequent suckling of foals, which prevents longer retention of milk in the udder as well as short teats canal of udder.

In addition, donkey milk contains certain substances that inhibit the growth of microorganisms (lysozyme, lactoferrin), which prevents their significant growth in the udder. The amount of lysozyme is almost twenty times higher, while the amount of lactoferrin is almost three times higher in jennie's than in cow's milk (Salimei and Fantuz, 2012).

There was a significant negative correlation between milk yield and fat content ( $P<0.05$ ), i.e. milk yield and protein content ( $P<0.01$ ). Knowing the physiology of the synthesis and milk releasing the observed correlation is understandable, as well as observed positive correlation between milk fat and milk protein content ( $P<0.01$ ; Table 2).

**Table 2.** Correlation coefficients of donkey milk composition components

	Dry matter	Lactose	Fat	Protein	SCC	BCC
Milk yield	-0.196	-0.022	-0.361*	-0.419**	0.564**	-0.324
Dry matter		0.875**	0.455**	0.673**	0.072	0.063
Lactose			0.169	0.239	0.150	0.052
Fat				0.603**	0.171	0.451*
Protein					-0.131	0.051
SCC						0.761**

\*\*  $P<0.01$ ; \*  $P<0.05$

Positive correlation between milk yield and SCC as well as SCC and BCC microorganisms is observed ( $P<0.01$ ). This indicates that the majority of milk yield is actually synthesized and deposited in mammary cisterns and canals, and only a small portion of milk is synthesized during the second phase of the milking.

## Conclusion

This research indicates favorable potential of Littoral Dinaric, and especially Istrian jennies for milk production. The interest of the farmers is determined by market conditions, i.e. by the continuity of demand for donkey milk. There is the need to establish processing units that could process donkey milk into nutritional products or cosmetic products. Since the production technologies were undeveloped, it is necessary to improve them and introduce a machine milking as standard procedure on larger dairy farms. Development of such programs, with richer offer of different dishes raises the sustainability of endangered donkey breeds, enriches the tourist offer and maintains the overall biodiversity of the area. It is necessary to adopt health norms for milk safety and continue to research the effects of donkey milk on consumer's health.

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