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PHENOTYPE POTENTIAL OF BUSHA IN MILK PRODUCTION

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Abstract: Autochthonous breed in Croatia became marginalized during the second half of the twentieth century due to their small production. Nowadays, genetic characteristics, good adaptability, traditional and other values of these breeds comes to the fore and becoming more challenging for breeders, especially in the organic production system. Sustainability of the breed is in close relationship with its economic affirmation. Busha is more suitable for milk rather than meat production due to her small body frame, therefore new information about milk yield and milk characteristics must be backbone for the future production expectations. The aim of this research was to estimate Busha's production potential, more precisely milk yield and its chemical composition. Average daily milk production was 7.06 kg/day while during the second month of lactation daily milk production was 9.01 kg. In the second month of lactation daily milk production ranged from 6.45 to 11.91 kg. Estimated average milk production in standard lactation was 2,154 kg while lactation potential of cows ranged from 1,520 of 2,805 $kg_{/305\ days}$. The average fat content was 4.15% and the average content of milk protein was 3.45%. The effect of the lactation stage on the content of fat, protein, lactose, and ash in milk of Busha was not observed. The lactation persistence from third to tenth month was 93.1%. The observed indicators of milk production and chemical composition of the milk are consistent with previous observations. Busha has good potential for milk production, especially in organic, traditional or extensive production.

Keywords: Busha, autochthonous breed, milk yield, chemical composition

Introduction

Busha is one of the autochthonous cattle breeds whose maintenance is carried out by direct support to the Busha breeders. The globalization and industrialization of animal production that prefer productive breeds of domestic animals caused marginalization of Busha because its economic competitiveness was observed primarily through the level of milk and meat production. Characteristics like fitness and adaptability have been neglected which are important for sustainable production. In economical and climatologically uncertain times that approaching, fitness and adaptability characteristics may be very important in optimizing phenotypes suitable for sustainable milk and meat production. Genes possessed by autochthonous breed may be of great importance in the selection and for target gene recombination. The FAO (2015) indicates that out of 1408 cattle breeds registered in the DAD-IS base, 184 (13.07%) have been lost, 171 (12.14%) is in a vulnerable status and only 285 (20.24%) is not in the any status of vulnerability. For the largest number of cattle

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breeds (768, 54.54%), threatens status is unknown (FAO, 2015). Since the inappropriate economic valorisation of local breeds has led to their neglect and disappearance, it is necessary to make their economic re-evaluation and polyvalent reaffirmation in order to achieve their self-sustainability. Busha is one of the breeds whose production characteristics should be objectively estimate and evaluate due to optimization of program for economic use.

In past centuries Busha, along with the Podolian cattle group, was the backbone of cattle production on the territory of today's Croatia. Frangeš (1903) states that at the end of the 19th century the proportion of Busha population exceeded 92% in the karst areas of the Kingdom of Croatia, Slavonia and Dalmatia. Busha remained dominant breed until the World War II when she counted more than a million animals, which was more than 50% of the cattle population (Ogrizek, 1941). Adametz (1895) publishes first scientific observations on Busha phenotype who he called "*Ilirian cattle*". He points to poor development of pigmented and hair-covered udder, short tits, and very small "*milky mirror*". Also, he suggests that during the lactation from 5 weeks to 5 months Busha produces 600-1,400 liters of milk. Adametz (1906, cit. Šic et al., 1994) suggests that Busha is more effective in milk production than Pinzgauer and Gray Tyrolean cattle regards to body mass (256 kg) and milk production (1,280 kg). Milk fat content (4.4-5.0%) is higher in Busha's milk than in milk from Pinzgauer and Gray Tyrolean cattle (3.7-4.0%). Morić (1932) points on high content of milk fat in milk from Busha (5.2%). Ogrizek (1941) observe that during lactation period of 6 to 8 months, they produce about 1,300 kg of milk with 4-6% milk fat. Šmalcelj (1956 cit., Puškaš et al., 1983) states that Busha annually can produce 800-2,000 liters of milk with 3.8-5.0% milk fat. Authors note significant variability in production regarding quantity and milk fat content, which indicates significant breeding disparity. During the second half of the 20th century, there are small numbers of scientific research of Busha phenotype, precisely because of her lower competitiveness. At that time the breeding principle was aimed at crossing of autochthonous cattle breeds with more productive and introducing foreign productive ones. Therefore, there are few reliable indicators which tell us about milk yield, which makes a certain problem in its reaffirmation. Therefore, the aim of the research was to determine milk yield and chemical composition during lactation in milk from Busha.

Material and Methods

The study was carried out on a sample of eleven cows of Busha breed located on one farm. Cows were tied during the night in the barn while during the day they were on pasture. Therefore, they have the same nutritional regimen. Daily milk production was determined according to the A_T methods during which milk samples for chemical and hygienic analysis were collected. Chemical analyses were carried out at the Central Laboratory for Milk Control in Križevci. The respective shares of dry matter, milk fat, milk protein and lactose were determined by the method of infrared spectrometry by Milkoscan FT120, followed by working instructions HRN ISO 9622:2001. The number of somatic cells (SSC) was determined by the fluoro-opto-electronic method according to the HRN ISO 13366-2:2007 norm. The results were processed using the SAS statistical package (SAS Institute, 1999).

Results and Discussion

Average daily milk production was 7.06 kg with daily span production 3.04-11.91 kg (Table 1). Daily milk production in the second month of lactation was the highest (9.01 kg/day; Table 2) and was within the range 6.45-11.91 kg (data not shown). Estimated lactation potential of cows in this research was ranged from 1,520 to 2,805 kg in standard interval of lactation. Based on the obtained production lactation potential, the average lactation potential of Busha is estimated to be 2,154 kg in standard lactation. This result is in concordance with some previous observations. Adametz (1895) suggests that during the lactation from 5 weeks to 5 months Busha produces 600-1,400 liters of milk and Šmalcelj (1956 cit., Puškaš et al., 1983) estimated that Busha annually can produce 800-2,000 liters of milk.

Table 1 Chemical composition and hygienic parameters of Busha milk

Parameter	$\bar{x}$	SD	MIN	MAX
Milk yield (kg/day)	7.06	1.79	3.04	11.91
Dry matter (%)	13.40	0.430	12.65	14.81
Non-fat dry matter (%)	9.26	0.160	8.94	9.49
Lactose (%)	4.79	0.108	4.59	4.94
Fat (%)	4.15	0.381	3.62	5.44
Fat (kg/day)	0.293	0.084	0.21	0.51
Protein (%)	3.45	0.107	3.21	3.73
Protein (kg/day)	0.244	0.064	0.18	0.42
Ash (%)	1.02	0.078	0.85	1.15
SCC (.000/mL)	89.03	63.2	17	216

$\bar{x}$ – average value; SD – standard deviation, MIN – minimum, MAX – maximal

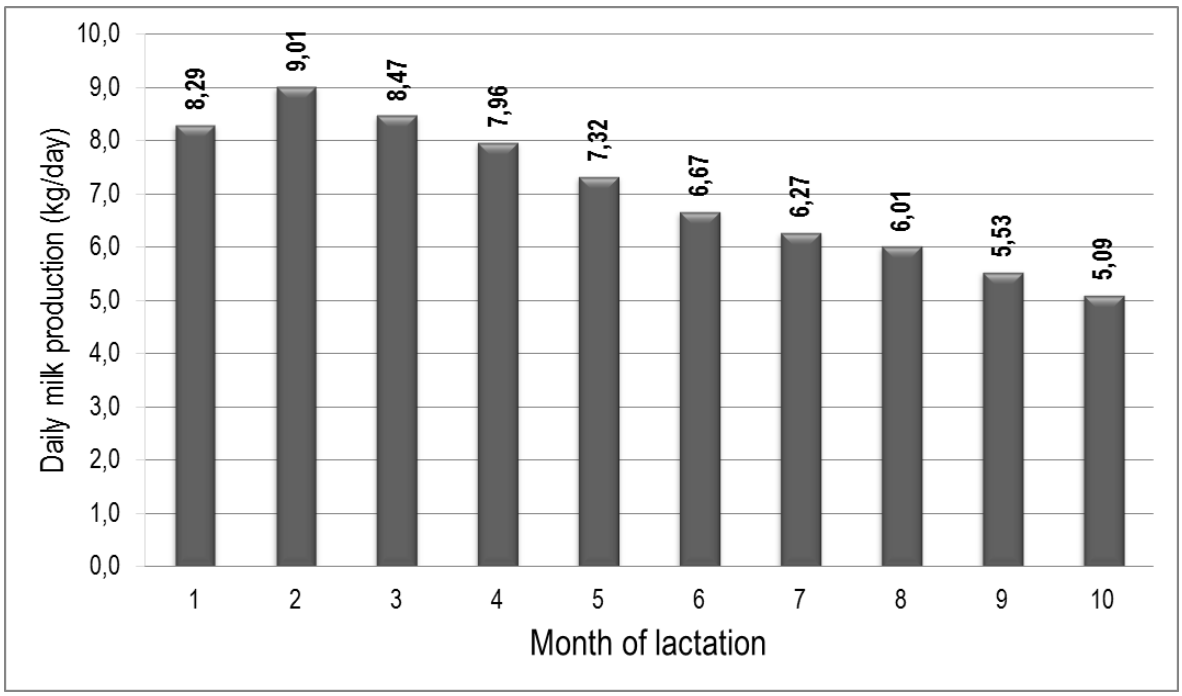
The content of milk fat in Busha milk was 4.15% and the average daily fat production was 0.293 kg / day (Table 1). The content of milk fat is significantly more variable than the other milk components and ranged from 3.62% to 5.44% (Table 1). It was observed that the content of milk fat is largely conditioned by an individual phenotype than, for example, the influence of the lactation stage, which is a characteristic of selection of low-profited breeds. Namely, highly conserved high genetic variability and low genetic pressure favour reservation of higher levels of phenotypic variability. Adametz (1906, cit. Šic et al., 1994) in Busha's milk observes relative higher fat content (4.4-5.0%) than in Pinzgauer and Gray Tyrolean cattle breeds (3.7-4.0%). Morić (1932) points on high content of fat in milk from Busha (5.2%), Ogrizek (1941) report share of fat in Busha milk from 4.0 to 6.0% and Šmalcelj (1956 cit., Puškaš et al., 1983) observe share of milk fat 3.8-5.0%. Conducted research confirms that the share of milk fat is slightly higher in relation to the milk fat content of commercial breeds of cattle in Croatia (Simmental, 4.04%, Holstein, 3.97%, Brown Swiss, 4.00%, CAA, 2016).

Table 2 Chemical composition of Busha milk thorough first four month of lactation

Month / Parameter	I $\bar{x} \pm SD$	II $\bar{x} \pm SD$	III $\bar{x} \pm SD$	IV $\bar{x} \pm SD$
Milk yield (kg/day)	8.29 ± *2.11*	9.01 ± *1.76*	8.47 ± *2.01*	7.96 ± *1.94*
Fat (%)	4.20 ± *0.33*	4.06 ± *0.49*	4.08 ± *0.35*	4.16 ± *0.22*
Fat (kg/day)	0.348 ± *0.08*	0.366 ± *0.07*	0.346 ± *0.07*	0.331 ± *0.09*
Protein (%)	3.44 ± *0.08*	3.42 ± *0.11*	3.41 ± *0.08*	3.47 ± *0.12*
Protein (kg/day)	0.285 ± *0.05*	0.308 ± *0.03*	0.289 ± *0.04*	0.276 ± *0.05*
Ash (%)	1.09 ± *0.05*	1.02 ± *0.08*	0.99 ± *0.05*	0.97 ± *0.09*
SCC (.000/mL)	24.4 ± *15.14*	54.5 ± *13.98*	98.4 ± *22.4*	140.4 ± *9.84*

$\bar{x}$ ± SD – average value and standard deviation

The content of protein in milk was 3.45% and was ranged from 3.21 to 3.73% (Table 1). Variability of protein content was expected to be significantly lower than the variability of milk fat content, lactose or ashes. No significant effect of lactation stage on the protein content in milk was established. The average content of lactose in milk was 4.79% with range from 4.59 to 4.94%. No significant effect of the lactation stage on the level and variability of lactose content in milk were noticed. Also, there was no significant effect of the lactation stage on the ash content in milk whose average content was 1.02%. From this results it can be concluded that the milk from Busha are richer in the share of mineral substances than milk of commercial cattle breeds what needs to be more thoroughly explored and analysed. The observed low number of somatic cells in Busha milk (89 thousand/mL) points on high milk quality and good health of udder.



Graph 1 Average daily levels of milk production in Busha during standard lactation

Due to the amount of daily milk production Busha as well as most other cattle breeds reach the maximum in the second month of lactation (Table 2; Graph 1). Most authors suggest that cows make maximum production between the fourth and seventh weeks of lactation, which is consistent with the results from this study. In the third and subsequent months of lactation follows continuous decrease in daily milk production (Graph 1). It was observed that the amount of produced cow's milk during the first month of lactation is about 92% compared to the second month in which the milk production was at its maximum. From the third to the tenth month of lactation, the average decline in quantity of produced milk per month is 93.1% and ranges from 91% (6 month of lactation) to 96% (eight months of lactation; Graph 1). Results from the present study indicate that the Busha cow have favourable lactation persistence.

Table 3 Correlation coefficient between some components of Busha milk

	Lactose (%)	Fat (%)	Protein (%)	Ash (%)	SCC
Milk yield (kg/day)	0.079	-0.157	-0.324	-0.052	0.084
Lactose (%)		-0.335	-0.049	-0.201	-0.431*
Fat (%)			0.233	0.239	0.235
Protein (%)				-0.054	-0.001
Ash (%)					-0.142

* $P<0.05$

Given the observed correlation coefficients, significant negative correlation was observed only between the content of lactose and somatic cell count in Busha milk (-0.431; $P<0.05$). Other correlation values of investigated components of milk phenotype were not significant.

Conclusion

Busha as one of the autochthonous cattle breeds has been economically and scientifically neglected for a number of decades. The conservation programs which need to be based on economic reaffirmation should be based on the characteristics of the breed phenotype. This research suggests that Busha has a moderate potential in milk production. Although the average daily milk production is relatively low (7.06 kg/day) it is possible to profiled Busha herds to higher milk yield by selection cows with higher production, primarily due to preserved genetic (and productive) variability. For modesty in terms of keeping, feeding, and management, Busha is suitable for organic, traditional and extensive milk production.

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