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Factors affecting blood parameters of autochthonous Cika cattle

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ABSTRACT

Cika cattle is the only Slovenian autochthonous cattle breed, which has been preserved to the present days. The aim of this study was to determine the blood parameters of Cika cattle regarding the variability in phenotypes and age of Cika cattle. This study included 122 Cika cattle of two phenotypes (71 Cika and 51 Pinzgauer phenotypes) from different farms and regions of Slovenia. There were 108 cows and 14 sires for natural mating. The average age of sires at sampling were 2.0 years, the average age of cows at sampling was 8.6 years. Farms with Cika cattle were placed from 200 m to 1100 m above the sea level with an average altitude of 643.5 m. The number of erythrocytes (RBC), leucocytes (WBC) and platelets (PLT) and values of haemoglobin (Hb), haematocrit (Ht), the mean corpuscular haemoglobin (MCH) and the mean corpuscular haemoglobin concentration (MCHC) were measured with haematological analyser ABC Vet. Data were analysed by GLM procedure of statistical package SAS/STAT considering phenotype and sex as fixed effects as well as animal age as linear regression. Analysis of variance proved that the sex significantly affected almost all included blood parameters of Cika cattle except MCHC. The effect of age at the day of blood collecting affected the RBC, WBC, values of Hb and Ht, while the effect of phenotype affected only the MCHC.
(Keywords: cattle, Cika, autochthonous breed, blood parameters)

INTRODUCTION

Cika cattle is the only Slovenian autochthonous cattle breed, which has been preserved to the present days. On June 1st, 2009 the Cika population accounted 2159 animals. Considering phenotype the population of Cika cattle is very heterogeneous. However, all animals are divided in three different phenotype groups for the selection purposes. Only two groups were included in this study the Cika and the Pinzgauer phenotype. Cika phenotype includes animals of smaller autochthonous phenotype, while Pinzgauer phenotype includes larger animals with a high share of Pinzgauer genotype as a result of artificial insemination with the semen of Pinzgauer sires after the Second World War.

Cika cattle are usually reared extensively in the cow-calf system for beef production mostly. They are to a smaller extent still used for milk production in traditional regions for Alpine dairy-farming. The largest share of Cika population is reared very extensively on small farms without the addition of any concentrates. In most cases farms with Cika cattle are placed on very high altitude above the sea level. The animals are grazing in the summer and are fed by hay in winter time. About one third of the farms with Cika cattle have the organic farming production. Cika cattle are perfectly adapted to grazing in difficult

mountain environment, such as rough climatic conditions, meagre food resources and long distances to get to the summer pastures over 1000 m above the sea level. They have an excellent ability to exploit voluminous forage and the persistency to graze on steep mountain pastures. A lot of cows have high longevity (*Simčič, 2008*).

In veterinary medicine, haematological examinations present an effective tool in monitoring the health and nutritional status of animals. We investigated the blood parameters in autochthonous Cika cattle because of a very extensive rearing system compared to the intensive rearing high productive cattle breeds. The aim of this study was to establish the blood parameters of Cika cattle regarding to the variability in phenotypes, as well as ages and sex.

MATERIALS AND METHODS

This study included 122 Cika cattle. There were 108 cows and 14 sires for natural mating of two phenotypes; 71 Cika and 51 Pinzgauer phenotypes. The distribution of cattle by sex was not in equilibrium due to a low number of larger herds which use sires for natural mating. Most of the breeders had a low number of cows in the herd and they preferred artificial insemination.

There was also a great variability in cattle age. The average age of cows was 8.6 years at sampling. The youngest cow had 3.2 years, while the oldest 18.0 years. The average age of sires at sampling was 2.0 years, where the youngest sire had 1.0 year and the oldest 3.0 years. Sires used in herds and included in sampling were much younger than cows, because the breeders use a sire just for one or two years in a herd mainly to prevent inbreeding in small population of autochthonous Cika cattle. The Cika cattle breed are known for its longevity and this is the reason for a great variability in cow's ages.

Cika cattle were housed in different farms and regions throughout Slovenia with altitude ranging from 200 to 1100 m above the sea level. Cika breed is known as a low production breed like other autochthonous cattle breeds. This breed is kept very extensively, the base forage being grazing in the summer and hay in the winter time, without supplemented concentrates. The exact production level in the farms was not estimated because of too much missing data (they are mostly used for cow-calf system).

Blood samples were taken in the spring in year 2008 from the tail vein in evacuated tubes with EDTA. The number of erythrocytes (RBC), leucocytes (WBC) and platelets (PLT), and the values of haemoglobin (Hb), haematocrit (Ht), the mean corpuscular haemoglobin (MCH) and the mean corpuscular haemoglobin concentration (MCHC) were measured with haematological analyser ABC Vet (Horiba ABX, Montpellier, France).

Data were analysed by GLM procedure of statistical package SAS/STAT (*SAS,* 2001) considering phenotype and sex as fixed effects and animal age as linear regression (model 1). Pre-analysis had shown that the effect of farm altitude did not significantly affect the investigated blood parameters.

$$y_{ijk} = \mu + T_i + S_j + b_I(x_{ijk} - \bar{x}) + e_{ijk} \quad (1)$$

Where:

y_{ijk} = blood parameters (RBC, WBC, PLT, Hb, Ht, MCH, MCHC);
T_i = phenotype; i = Cika, Pinzgauer;
S_j = sex; j = sire, cow;
x_{ijk} = age at blood samples collecting, months;
e_{ijk} = residual.

RESULTS AND DISCUSSION

The average values of haematological variables in Cika cattle included in this study (*Table 1*) were within reference intervals used for cattle. The differences in blood parameters between Cika and Pinzgauer phenotype of Cika cattle were not significant except for the mean corpuscular haemoglobin concentration (MCHC) (*Table 2*). The animals of smaller Cika phenotype had in average 5.36 g/L higher MCHC compared to the larger animals of Pinzgauer phenotype. *Mayrhofer et al.* (1976) studied haematological variables of 750 Pinzgauer cattle in Austria and established very similar mean values as in Pinzgauer phenotype of Cika in this study (*Table 1*). They ascertained mean number of RBC 6.54×10^{12}/L, WBC 7.03×10^{9}/L, mean value of Hb 114 g/L and Ht 0.34 L/L. Some animals of Pinzgauer phenotype of Cika cattle still have large part of Pinzgauer genotype as a result of artificial inseminations of Cika cows with the semen of Pinzgauer sires from Austria after the Second World War.

Table 1

Blood parameters of Cika cattle by phenotypes and sex

Blood parameter	Phenotype (LSM±SE)		Sex (LSM±SE)	
	Cika (n=71)	Pinzgauer (n=51)	Sires (n=14)	Cows (n=108)
RBC$\times10^{12}$/L	6.42 ± 0.13	6.33 ± 0.18	6.95 ± 0.26	5.81 ± 0.08
WBC$\times10^{9}$/L	8.14 ± 0.29	7.51 ± 0.39	8.46 ± 0.58	7.20 ± 0.18
PLT$\times10^{9}$/L	266.32 ± 24.82	264.07 ± 33.85	209.61 ± 49.85	320.78 ± 15.26
Hb (g/L)	118.39 ± 2.36	115.11 ± 3.22	122.35 ± 4.73	111.15 ± 1.45
Ht (L/L)	0.34 ± 0.07	0.34 ± 0.01	0.36 ± 0.01	0.32 ± 0.05
MCH (pg)	18.65 ± 0.20	18.56 ± 0.27	18.17 ± 0.39	19.04 ± 0.12
MCHC (g/L)	350.13 ± 1.49	344.77 ± 2.03	344.60 ± 3.00	350.30 ± 0.92

n: number of samples, LSM: least square means, SE: standard error

Sex of animals significantly affected all investigated blood variables except MCHC value (*Table 2*). Similar results were established also by *Klinkon et al.* (2009). In the research of *Mayrhofer et al.* (1976) the sex influenced significantly only the value of Ht. In sires in this study higher mean values of RBC, WBC, Hb and Ht and lower mean values of MCH, MCHC and PLT were measured compared to cows. Similarly, *Stark et al*. (1978) also found higher values of Hb in Friesian bulls compared to Friesian cow blood samples from the United Kingdom. *Klinkon* (1992) established higher values of Hb and RBC and lower values of MCH in bulls in comparison to cows in Slovenia. *Straub* (1981) reported that bulls have 1.0 to 1.5×10^{12}/L greater number of RBC than cows. However, in this study the lower number of included sire blood samples should be considered. The whole population (2159 animals) of autochthonous Cika cattle is reared by 412 breeders with an average number of 2.2 cows per herd. The number of herds with more than five Cika cows was 26 and just in some of them a sire was reared for natural mating. All the above mentioned factors are the reason for such low number of included sires in the blood sampling.

The age of animals had statistically significant influence on the number of RBC and WBC, as well as on Hb and Ht values. The values of variables were decreased by animal age. The number of RBC decreased in average for 0.04×10^{12}/L per year, WBC for 0.19×10^{9}/L per year, the value of Ht for 0.23 L/L per year and Hb for 0.08 g/L per

year. *Klinkon et al.* (2009) found that in Cika cows the number of RBC and WBC as the values of Hb and Ht decreased with age while the number of PLT and the values of MCH and MCHC increased. Likewise, *Stark et al.* (1978) determined decreased values of RBC by age in Friesian bulls. Influence of age on the values of haematological parameters of cattle species was ascertained also in other studies (*Feldman et al.,* 2006; *Mammerickx et al.,* 1978; *Klinkon,* 1992; *Mayrhofer et al.,* 1976). The general trend is that RBC, Hb and PCV values are high at birth and decline with age over the first 6 months to 1 or 2 years of life, although considerable differences are found in values reported by various investigators. By 2 to 4 years of age various red cell parameters tend to increase slightly and then stabilize. However, RBC counts may continue to decline for 5 to 6 years of age before becoming stabilized, while Hb and PCV may remain constant irrespective of age (*Straub*, 1981; *Klinkon,* 1992) On the other hand, *Ciaramella et al.* (2005) determined haematological profile of 100 Mediterranean buffalos ranging in age from two to 14 years. They found decreased values of RBC, WBC and Hb by ages similar to Cika cattle in this study. However, all haematological values obtained were comparable with the normal values in adult cattle.

Table 2

Analysis of variance for blood parameters of Cika cattle by GLM

Blood parameter	n	p-values			R^2
		Phenotype	Sex	Age	
RBC	122	ns	<0.0001	0.0303	0.27
WBC	122	ns	0.0436	<0.001	0.29
PLT	122	ns	0.0384	ns	0.04
Hb	122	ns	0.0284	0.0368	0.15
Ht	122	ns	0.0161	0.0478	0.15
MCH	122	ns	0.0401	ns	0.11
MCHC	122	0.0038	ns	ns	0.11

n: number of samples, R^2: coefficient of determination

Proportion of variability explained with the model 1 (*Table 2*), was the highest and similar for the WBC and RBC. Very similar coefficients of determination (R^2) were at values of Hb, Ht, MCH and MCHC. The lowest proportion of variability explained had PLT. The effects included in the model 1 were the most accurate and known. On the other hand, there were a lot of effects which are very difficult to determine and estimate. One of them was the effect of the breeder and consequently rearing and feeding technology on the farm. Also the production level and reproduction status of animals were not known. The large part of non estimated effects could explain lower coefficients of determination.

Although the breed has an effect on the values of haematological variables (*Feldman et al.,* 2006; *Klinkon,* 1992; *Mayrhofer et al.,* 1976), there were the values of haematological variables established in Cika cattle within reference intervals used for the interpretation of result in clinical pathology (*Jazbec,* 1990; *Feldman et al.,* 2006).

CONCLUSIONS

Irrespective of the fact that Cika cattle is an autochthonous and low productive breed the established values of haematological variables were within reference intervals used for

cattle which were prepared on the basis of cattle from larger population of widely used cattle breeds. Despite the well known differences in body shape between Cika and Pinzgauer phenotype there were no significant differences in blood parameters with the exception of the MCHC value. Sex of animals influenced significantly all investigated blood variables except MCHC value. The age of animals had a significant influence on the number of RBC and WBC as also on values of Hb and Ht. The values of mentioned variables were decreased by the animal age.

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