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The effect of feeding technology on the haematological parameters of young Cika and Simmental bulls - short communication

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ABSTRACT

Cika cattle are an indigenous breed in Slovenia, while the Simmental breed is a cosmopolitan breed. The fattening trial was prepared to investigate whether Cika bulls are suitable for beef production, and the Simmental bulls were kept for comparison. The aim of this study was to investigate if different feeding technologies affect the haematological parameters of Cika and Simmental bulls. Blood samples of 17 Cika and 19 Simmental young bulls were taken in tubes with EDTA. The number of erythrocytes (RBC), leucocytes (WBC) and platelets (PLT), and the values of haemoglobin (Hb), haematocrit (PCV), the mean corpuscular haemoglobin (MCH), the mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular volume (MCV) were measured with a haematological analyser ABC Vet. Differential white blood cells counts were also prepared. Data were analysed by the GLM procedure from the statistical package SAS/STAT regarding the breed, feeding technology and their interaction as fixed effects. In the blood of Cika bulls there was a significantly higher number of leucocytes as well as haemoglobin, haematocrit, MCV and MCH values than in the blood of Simmental bulls, while the number of platelets was higher in the blood of Simmental bulls. Different feeding technologies significantly affected the erythrocyte count, and MCV and MCH values, where pasture reared bulls had lower erythrocyte and higher MCV and MCH values compared to stable fattened bulls. In the differential white blood cell count of Cika bulls there was a significantly higher percentage of segmented neutrophils and a lower percentage of lymphocytes compared to Simmental bulls.

Key words: Cika, Simmental, feeding technology, haematological parameters

Introduction

Cika cattle are an indigenous breed (SIMČIČ et al., 2013) in Slovenia, while Simmental breed is a cosmopolitan breed widespread mainly in the European Alpine countries. In

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the 1950s there were about 80,000 Cika cattle, but their number decreased rapidly with crossbreeding and replacement with other breeds (ČEPON et al., 1999). A breeding program for Cika cattle was accepted in 2004 and updated in 2010 (ŽAN LOTRIČ et al., 2010). Nowadays, the milk yield of Cika is very low compared to modern cosmopolitan dairy breeds; therefore breeders mainly keep Cika in cow-calf systems for calf beef production. On June 1st, 2013 in Slovenia, the Cika population amounted to 3,097 animals, while the Simmental population was 209,516 animals in total.

The largest share of the Cika population is reared very extensively on small farms without the addition of any concentrates. In most cases farms with Cika cattle are kept at a very high altitude above sea level (SIMČIČ et al., 2010).

Cika cattle have a small to medium body frame. The coat colour of the animals is red to reddish, with a typical white streak along the back and a white patch spreading from the breast to the belly. The horns are short, dark and turned forward. The mucous membrane is pink coloured, while the hoofs are dark (SIMČIČ, 2008).

Some fattening trials were prepared to investigate if Cika bulls are suitable for beef production, where Simmental bulls were kept for comparison (SIMČIČ et al., 2010; ŽGUR et al., 2014). The effect of different feeding technologies was especially investigated, using two different feeding technologies (SIMČIČ et al., 2010; SIMČIČ et al., 2014).

In veterinary medicine, haematological examinations represent an effective tool in monitoring the health and nutritional status of animals (OTTER, 2013). With the exception of NEMI (1986), KLINKON (1992), WEISS and WARDROP (2010), who studied environmental effects on the haematological profile of beef cows during summer and winter time, according to our best knowledge there are no literature data investigating the effect of feeding technology. In previous studies, we investigated the blood parameters in indigenous Cika cattle in a very extensive rearing system compared to the intensive rearing high productivity cattle breeds (KLINKON et al., 2009; KLINKON et al., 2010). SIMČIČ et al. (2011) considering also the breeding area and the age of the Cika cows when the blood parameters were determined. Likewise, KLINKON et al. (2012) determined for the first time the blood parameters of Cika calves and bulls.

The aim of this study was to investigate whether different feeding technologies affect the haematological profile of Cika and Simmental bulls.

Materials and methods

This study included 36 bull blood samples. Seventeen Cika and nineteen Simmental young bulls were bought from different farms throughout Slovenia, at an average age of 248 days (Cika) and 168 days (Simmental). The bulls were housed at the Educational and Research Animal Husbandry Centre, Logatec, in a closed barn with multiple pens. The fattening period began in November 2010, and at first all the bulls were fed with the

same total mixed ration (TMR) based on grass silage, maize silage and sunflower meal. In May 2011, when the second period began, the young bulls of both breeds were divided into two sub-groups according to their live weight. Eight Cika and nine Simmental bulls continued with the same semi-intensive TMR (INT) feeding as in the first period. The second sub-group, with nine Cika and ten Simmental bulls, was put out to pasture for all day grazing with no additional concentrate until the beginning of October, when the 130 day long grazing season ended. After that, the third period began and all the bulls were again housed and received the same TMR as in the first fattening period. The bulls were slaughtered when they achieved an optimal weight, as evaluated by a beef cattle expert at an average age of 744 days (Cika) and 699 days (Simmental).

Blood samples were taken in tubes with EDTA one day before the slaughter process from the coccygeal vein. Blood samples were stored immediately after sampling in a cold box (4 ºC) and transported to the laboratory within 4 hours. After that the analyses were performed. The number of erythrocytes (RBC), leucocytes (WBC) and platelets (PLT), and the values of haemoglobin (Hb), haematocrit (PCV), the mean corpuscular haemoglobin (MCH), the mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular volume (MCV) were measured by the haematological analyser ABC Vet (Horiba ABX, Montpellier, France). In addition, the differential white blood cells (segmented neutrophils, eosinophils, basophils, lymphocytes, monocytes and band neutrophils) were counted. Blood smears were stained using the panchromatic method of Pappenheim. However, basophils and band neutrophils were excluded from statistical analysis due to missing values.

Data were analysed by GLM procedure of statistical package SAS/STAT (2001) considering breed, feeding technology and their interaction as fixed effects (Model 1).

$$y_{ijkl} = \mu + B_i + T_j + BT_{ijk} + e_{ijkl} \quad [1]$$

Where:

y_{ijkl} = blood parameters (RBC, WBC, PLT, Hb, PCV, MCH, MCHC, segmented neutrophils, eosinophils, lymphocytes, monocytes);

B_i = breed; i = Cika, Simmental;

T_j = feeding technology; j = stable fattened, grazing;

BT_{ijk} = interaction between breed and feeding technology;

e_{ijkl} = residual.

Results and discussion

In the blood of Cika bulls (Table 1) there was a significantly higher number of leucocytes ($P<0.05$) as well as haemoglobin ($P<0.01$), haematocrit ($P<0.05$), MCV ($P<0.01$), and MCH ($P<0.01$) than in the blood of Simmental bulls, while the number

of platelets (P<0.01), was higher in the blood of Simmental bulls. The differences in values of erythrocytes and MCHC between breeds were not significant. GUPTA et al. (2007) determined lower numbers of erythrocytes (6.9 - 8.1 $\times 10^{12}$/L) and haemoglobin (93 - 102 g/L) in the blood of 24 Holstein Frisian bulls compared to the Cika and Simmental bulls in this study. Likewise, AENGWANICH et al. (2009) performed a haematological profile of crossbreed beef bulls in winter time in Thailand. They found a lower number of erythrocytes (6.43 ± 1.53 $\times 10^{12}$/L) as well as lower haemoglobin (106.8 ± 18.5 g/L) and MCHC values (301.5 ± 66.7 g/L). On the other hand, they found a higher number of leucocytes (13.11 ± 0.26 $\times 10^{9}$/L) and higher values of MCV (58.27 ± 13.80 fL) and MCH (17.57 ± 5.60 pg) compared to the Cika and Simmental bulls from this study.

Table 1. Haematological parameters of Cika and Simmental bulls

Effect		Haematological parameters (LSM ± SE)							
		E $\times 10^{12}$/L	L $\times 10^{9}$/L	PLT $\times 10^{9}$/L	Hb (g/L)	PCV (L/L)	MCV (fL)	MCH (pg)	MCHC (g/L)
Breed	CK	8.37 ± 0.20	9.66 ± 0.46	256.33 ± 62.55	141.0 ± 3.4	0.43 ± 0.01	51.45 ± 0.62	16.88 ± 0.22	327.6 ± 1.40
	SIM	8.20 ± 0.19	8.05 ± 0.43	563.19 ± 59.15	128.0 ± 3.2	0.39 ± 0.01	48.06 ± 0.59	15.66 ± 0.20	325.9 ± 1.30
	Sign.	n.s.	*	**	**	*	**	**	n.s.
Feeding technology	INT	8.65 ± 0.20	8.94 ± 0.46	323.44 ± 62.55	137.3 ± 3.4	0.42 ± 0.11	48.67 ± 0.62	15.93 ± 0.22	327.0 ± 1.40
	PAST	7.92 ± 0.19	8.77 ± 0.43	496.08 ± 59.14	131.8 ± 3.2	0.40 ± 0.01	50.84 ± 0.59	16.61 ± 0.20	326.6 ± 1.30
	Sign.	*	n.s.	n.s.	n.s.	n.s.	*	*	n.s.
Breed x feeding technology interaction	CK-INT	8.42 ± 0.29	10.20 ± 0.66	245.00 ± 91.13	139.9 ± 4.9	0.42 ± 0.02	50.13 ± 0.91	16.68 ± 0.31	332.3 ± 2.01
	CK-PAST	8.32 ± 0.28	9.12 ± 0.63	267.67 ± 85.82	142.2 ± 4.7	0.44 ± 0.01	52.78 ± 0.86	17.08 ± 0.30	323.0 ± 1.90
	SIM-INT	8.88 ± 0.28	7.68 ± 0.63	401.88 ± 85.82	134.7 ± 4.7	0.42 ± 0.01	47.22 ± 0.86	15.18 ± 0.30	321.7 ± 1.90
	SIM-PAST	7.52 ± 0.26	8.42 ± 0.59	724.50 ± 81.45	121.3 ± 4.4	0.37 ± 0.01	48.90 ± 0.81	16.15 ± 0.28	330.2 ± 1.80
	Sign.	*	n.s.	n.s.	n.s.	*	n.s.	n.s.	***
R^2		0.30	0.21	0.39	0.29	0.30	0.41	0.42	0.40

CK - Cika, SIM - Simmental, INT - stable reared, PAST - pasture reared, E - erythrocytes, L - leucocytes, PLT - platelets, Hb - haemoglobin, PCV - haematocrit, MCH - mean corpuscular haemoglobin, MCHC - mean corpuscular haemoglobin concentration, MCV - mean corpuscular volume, LSM - least square means, SE - standard error, R^2 - coefficient of determination. * P<0.05; ** P<0.01; *** P<0.001; NS - not significant.

Table 2. Differential white blood cells count of Cika and Simmental bulls

Effect		Differential white blood cells count (LSM ± SE)			
		Segmented neutrophils (%)	Eosinophils (%)	Lymphocytes (%)	Monocytes (%)
Breed	CK	67.03 ± 2.43	3.95 ± 0.59	25.99 ± 2.53	2.49 ± 0.46
	SIM	58.21 ± 2.30	3.23 ± 0.55	35.62 ± 2.39	3.31 ± 0.46
	Sign.	*	n.s.	**	n.s.
Feeding technology	INT	62.87 ± 2.43	4.34 ± 0.59	29.60 ± 2.53	3.29 ± 0.49
	PAST	62.37 ± 2.30	2.84 ± 0.55	32.01 ± 2.39	2.51 ± 0.43
	Sign.	n.s.	n.s.	n.s.	n.s.
Breed x feeding technology interaction	CK-INT	71.63 ± 3.54	4.13 ± 0.85	20.88 ± 3.68	2.88 ± 0.66
	CK-PAST	62.44 ± 3.33	3.78 ± 0.80	31.11 ± 3.47	2.11 ± 0.63
	SIM-INT	54.11 ± 3.33	4.56 ± 0.80	38.33 ± 3.47	3.71 ± 0.71
	SIM-PAST	62.30 ± 3.16	1.90 ± 0.76	32.90 ± 3.29	2.90 ± 0.59
	Sign.	*	n.s.	**	n.s.
R^2		0.29	0.18	0.28	0.09

CK - Cika, SIM - Simmental, INT - stable reared, PAST - pasture reared, LSM - least square means, SE - standard error, R^2 - coefficient of determination; * P<0.05; ** P<0.01; *** P<0.001; NS - not significant.

Feeding technology (Table 1) significantly affected the erythrocyte count (P<0.05), MCV (P<0.05), and MCH (P<0.05) values, where pasture reared bulls had lower erythrocyte counts and higher values of MCV and MCH. The effect of grazing or pasture keeping was surprisingly significant, even when the grazing season lasted only 130 days and finished on average 230 days prior to slaughter.

The environmental effect on the haematological profile of beef cows has also been studied (NEMI, 1986; KLINKON, 1992; WEISS and WARDROP, 2010); the lowest PCV, RBC and Hb values were found during April through June and the highest values during the winter and fall months. No changes were seen in RBC and WBC counts in cows kept at a constant temperature, but a significant decrease occurred in cows kept at the fluctuating day and night temperatures that occur on pastureland. Similar variations were also observed in this study. SHAFFER et al. (1981) also found differences in the haemoglobin values in the blood of Holstein (10.35 g/100 mL), Guernsey (10.95 g/100 mL), Jersey (10.76 g/100 mL) and Brown Swiss (9.70 g/100 mL) dairy cows. However, all studied haemoglobin values in cows were lower than the values found in the bulls in this study.

The breed - feeding technology interaction significantly affected the erythrocyte count ($P<0.05$), PCV ($P<0.05$) and MCHC ($P<0.001$) value (Table 1). The highest erythrocyte count was in the blood of the intensively fattened, stable reared Simmental bulls, while the lowest was in the pasture reared Simmental bulls. PCV was the highest in the blood of pasture reared Cika bulls, but the lowest in pasture reared Simmental bulls.

The differential white blood cell count of Cika and Simmental bulls (Table 2) included only the percentage of segmented neutrophils, eosinophils, lymphocytes and monocytes due to a zero or very low percentage of basophils and band neutrophils. In the blood of Cika bulls, there was a significantly higher percentage of segmented neutrophils ($P<0.05$) and a lower percentage of lymphocytes ($P<0.01$) compared to Simmental bulls. The differences in the percentage of eosinophils and monocytes between breeds were not significant.

GUPTA et al. (2007) performed differential white blood cell count in the group of 24 Holstein Frisian bulls. They found a higher percentage of eosinophils (6.8 - 9.9 %), lymphocytes (43.0 - 48.4 %) and monocytes (7.8 - 10.1 %) compared to the Cika and Simmental bulls in this study.

Different feeding technology did not have a significant effect on the differential white blood cell count included, while the interaction between breed and feeding technology significantly affected the segmented neutrophil ($P<0.05$) and lymphocyte ($P<0.01$) percentage (Table 2). GUPTA et al. (2007) performed differential white blood cell count in a group of 24 Holstein Frisian bulls. They found a higher percentage of eosinophils (6.8 - 9.9 %), lymphocytes (43.0 - 48.4 %) and monocytes (7.8 - 10.1 %) compared to the Cika and Simmental bulls in this study.

In conclusion, different feeding technologies significantly affected the erythrocyte count, and MCV and MCH values, where pasture reared bulls had a lower number of erythrocytes and higher values of MCV and MCH, compared to stable fattened bulls. In the differential white blood cells count of Cika bulls there was a significantly higher percentage of segmented neutrophils and a lower percentage of lymphocytes compared to Simmental bulls. The information gained in this study will help to improve the accuracy of assessment of the health and nutritional status of animals reared in extensive conditions, especially in cow - calf systems.

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KLINKON, M., D. KOMPAN, M. SIMČIČ: Utjecaj tehnologije hranidbe na hematološke pokazatelje kod bikova cika i simentalske pasmine. Vet. arhiv 85, 227-234, 2015.

SAŽETAK

Cika je autohtona pasmina goveda u Sloveniji, dok je simentalska rasprostranjena diljem svijeta. Tijekom istraživanja, organiziran je pokusni tov kako bi se utvrdila prikladnost bikova pasmine cika za proizvodnju junećeg mesa. Bikovi simentalske pasmine poslužili su za usporedbu. Cilj je bio istražiti je li različite tehnologije hranidbe utječu na hematološke pokazatelje kod bikova cika i simentalske pasmine. Uzorci krvi od 17 cika i 19 simentalskih bikova prikupljeni su u epruvete uz dodatak EDTA. Uz pomoć ABC Vet. analizatora utvrđen je broj eritrocita, leukocita, trombocita, te vrijednosti hemoglobina, hematokrita (engl. PCV), prosječni sadržaj hemoglobina u eritrocitima (engl. MCH), prosječna koncentracija hemoglobina po eritrocitu (engl. MCHC) i prosječni obujam eritrocita (engl. MCV). Također su utvrđene i razlike u tipu i broju leukocita. Podatci su analizirani pomoću GLM postupka statističkog programa SAS/STAT uz uvažavanje pasmine, tehnologije hranidbe i njihove interakcije kao fiksnih učinaka. U krvi bikova pasmine cika ustanovljen je signifikantno veći broj leukocita te veće vrijednosti za hemoglobin, hematokrit, MCV i MCH u odnosu na krv bikova simentalske pasmine. Istovremeno, broj trombocita bio je veći u krvi bikova simentalske pasmine. Različite tehnologije hranidbe signifikantno su utjecale na broj eritrocita, te vrijednosti MCV i MCH, pri čemu su pašno uzgojeni bikovi u odnosu na bikove uzgojene u staji imali manji broj eritrocita i veće vrijednosti MCV odnosno MCH. Razlike u tipu i broju leukocita pokazale su da bikovi pasmine cika, u usporebi s bikovima simentalske pasmine, imaju signifikantno veći postotak segmentiranih neutrofila i manji postotak limfocita.

Ključne riječi: cika, simentalska pasmina, tehnologija hranidbe, hematološki pokazatelji