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Blood profile in cows from small farms with low productivity

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ABSTRACT

The aim of the study was to analyse the results of haematological and biochemical examinations of blood in cows from farms with low rearing intensity. The results of blood examinations from 51 cows were analysed. The cows originated from different small farms from south east part of Slovenia. In blood samples haematological and different biochemical variables were measured. The results were evaluated regarding the normal values for cattle. The descriptive statistics and percentage of cows deviating from normal values for investigated variables were calculated. The mean values of investigated variables were inside reference interval for cattle except the portion of eosinophils which was above the reference value. In 16.7% of cows haemoglobin concentration and in 31.0% haematocrit value was below the reference value. In 55.6% of cows eosinophilia was ascertained. The results of biochemical examination show that 45.2% of cows had a concentration of total serum protein, 28.8% a concentration of urea and 35.5% a concentration of serum iron below the reference value. Some deviations were observed also regarding the mineral status. The results indicate inappropriate diet of these cows and in many cases possible infestation with parasites. Better care in parasite control and a well balanced diet would increase production in such herds.
(Keywords: cows, blood, haematology, biochemistry, low intensity of production)

INTRODUCTION

Extensive rearing of cattle is used predominantly in suckling cows systems and for beef production. Different studies investigated growth of extensively reared cattle (*Marino et al.,* 2009; *Pavlik et al.,* 2009; *Lewis et al.,* 1990). Some studies researched also the pasture based milk production systems (*Cavestany et al.,* 2005). Small farms usually produce milk and rear calves. Their productivity is quite low and the diet is forage based with low quantities of concentrates. In regions where the intensive farming is not possible they are important for the preservation of cultivated landscape.

The blood examinations like haematological and clinical chemistry profile are a valuable diagnostic tool for the evaluation of nutritional and health status of cattle. There are some blood metabolites which are related to the nutritional status of the cattle, they represent animal response to the nutrition. Blood variables related to protein status include total serum proteins and urea. Urea levels, in relation to nutrition vary according to protein content, protein degradability, non protein nitrogen and energy of the diet (*Park et al.,* 2002; *Russel et al.,* 2007). Phosphorus has no direct mechanism of regulation, although calcium regulating hormones directly affect its blood concentration. Calcium and phosphorus have important bone reserves, while the magnesium reserve is low and has no primary hormonal response for the compensation (*Martens and Schweigel,* 2000; *Larsen et al.,* 2001).

The present study intended to establish a mutual connection between the relevant blood variables and potentially valuable background information about the cows from small farms with low production intensity. For this purpose we analysed the results of haematological and biochemical analyses of blood in cows from small farms.

MATERIALS AND METHODS

In the present study the results of haematological and biochemical examination of blood samples from 51 cows, predominantly of combined breeds (Brown Swiss, Simmental) which were sent to our clinical laboratory were analysed. The cows originated from different small farms, with low production intensity and pasture – mowing system, from south east part of Slovenia. This is a karst region where intensive farming is not possible.

Haematological variables; red blood cell count (RBC), haemoglobin concentration (Hb), mean corpuscular volume (MCV), haematocrit (PCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), number of platelets (PLT) and white blood cell count (WBC) were measured with a haematological counter ABC Vet (ABX, France). A differential white blood picture was also estimated by the examination of Giemsa stained blood smears. In blood serum samples biochemical variables; total serum protein (TSP), urea, calcium (Ca), inorganic phosphorus (iP), serum iron (Fe), magnesium (Mg), sodium (Na), potassium (K) and chlorine (Cl) were measured with the biochemical analyser Daytona (Randox). Beta carotene concentration was measured photometrically by the Yudkin method (*Yudkin,* 1941).

The data were processed using the statistical program SPSS (Ver 15.0) (*SPSS,* 2006). For the investigated variables the descriptive statistics were calculated. The individual data were checked regarding the reference intervals and the percentage of cows (samples) deviating from normal values for the investigated variables were calculated.

RESULTS AND DISCUSSION

Regarding the anamnestic data problems with parasites occurred in 15 herds and in 14 herds there were fertility problems.

The mean values of investigated haematological variables were inside reference interval for cattle except the percentage of eosinophile granulocytes which was above the reference value (*Tables 1 and 2*). By checking individual data it was established that 55.6% of cows had the percentage of eosinophils above the reference value (*Table 3*). Eosinophilia could be associated with parasitic invasion or with allergic reactions (*Jazbec,* 1990; *Kramer,* 2006). In investigated cows it was most likely connected with endoparasites which corresponds with the anamnestic data although the parasite status was not directly determined in our study. In 16.7% of cows Hb concentration and in 31.0% PCV value was below the reference value. Low values of Hb and PCV indicate anaemia which can be attributed to parasitic invasion and/or some deficits in nutrition.

By checking the results of the biochemical examination it was established that in 45.2% of cows the concentration of TSP and in 28.8% the concentration of urea was below reference value. The concentration of TSP in cows is associated with proteins (amino-acid supply) available in the diet and also with animal's health status; globulins are increased by inflammation which can contribute to the increase in TSP concentration (*Whitaker,* 1997). The urea concentration in blood and milk is influenced by protein content and protein / energy ratio in the diet (*Oltner and Wiktorsson,* 1983). The results in investigated cows indicate insufficient protein supply and/or failure to provide a balanced diet.

Table 1

Descriptive statistics of haematological variables

Variable	n	Mean	SD	Min.	Max.
RBC×10^{12}/L	42	6.23	1.03	3.87	8.87
Hb g/L	42	103.2	17.5	58.0	142.0
MCV fL	42	49.6	5.6	37.0	62.0
PCV L/L	42	0.31	0.05	0.17	0.42
WBC×10^{9}/L	42	8.26	4.01	3.60	22.0
PLT×10^{9}/L	42	398.5	205.4	3	1042
MCH pg	38	16.65	1.96	11.80	20.90
MCHC g/L	38	335.7	9.9	295.0	355.0
Segmented neutrophils %	27	36.2	21.7	6.0	83.0
Eosinophils %	27	12.4	9.6	0.0	39.0
Basophils %	27	0.1	0.3	0.0	1.0
Lymphocytes %	27	49.3	18.0	11.0	84.0
Band neutrophils %	27	0.2	0.5	0.0	2.0
Monocytes %	27	1.7	2.6	0.0	11.0

Table 2

Descriptive statistics of biochemical variables

Variable	n	Mean	SD	Min.	Max.
TSP g/L	31	70.26	8.36	54.10	96.20
Urea mmol/L	51	2.90	1.84	0.47	10.03
Ca mmol/L	51	2.33	0.26	1.48	2.77
iP mmol/L	51	2.06	0.52	0.91	3.31
Na mmol/L	16	142.1	1.9	139.0	145.0
K mmol/L	16	5.66	0.79	4.69	7.29
Cl mmol/L	11	99.2	4.9	90.0	106.0
Fe µmol/L	31	22.12	7.99	5.00	38.10
Mg mmol/L	26	1.16	0.26	0.72	1.77
Carotene gama%	19	573.4	313.3	138.0	1357.0

In 35.5% of cow serum iron was below the reference value. Adult cattle normally receive enough iron with forage (*Jazbec,* 1990) so it is not very likely that low serum iron was a consequence of iron deficit in the diet. Low serum iron was more possibly related to the parasitic invasion and chronic blood loss due to parasites.

In 31.6% of cows the concentration of carotene was below the normal value. Ruminants receive carotene predominately with green forage (grass) but in grass silage and in hay the content of carotene can decline especially when mistakes were made during the preparation (*Jazbec,* 1990). Deficit of carotene can have a negative influence on fertility (*Rakes et al.,* 1985; *Dirksen et al.,* 2006) what was reported in anamnestic data of some cows.

Some deviations were observed also regarding the mineral status; in 31.4% of cows the concentration of Ca was below the normal value, the concentration of iP was in 13.7% below and in 31.4% above the reference range, and in 43.7% the concentration of

K was above the reference value. Hyperkalaemia could be caused by potassium excess in the diet; it could be established also by acidosis (*Carlson,* 2002). Because the studied cows were from farms with low production intensity and they were fed predominantly with forage, it is more likely that hyperkalaemia was caused by potassium excess. In relation to nutrition the observed deviations in mineral status could be attributed to the inappropriate content of minerals in the diet and/or to unsuitable ratio between them. Periparturient period, age of animals and acidosis can also have an influence on the concentration of Ca and iP (*Jazbec,* 1990; *Herdt,* 2000). These deviations could have a negative influence on production, fertility, and health of cows.

Table 3

Percentage of cows (samples) deviating from the reference values

Variable	n	Below ref. value (%)	Above ref. value (%)	Reference range
RBC×10^{12}/L	42	9.5	4.8	5.0–8.5
Hb g/L	42	16.7	2.4	90.0–140.0
MCV fL	42	2.4	4.8	40–60
PCV L/L	42	31.0	4.8	0.28–0.38
WBC×10^{9}/L	42	14.3	16.7	5.0–10.0
PLT×10^{9}/L	42	14.3	4.8	200–800
MCH pg	38	5.3	0	14.0–24.0
MCHC g/L	38	0	2.6	260.0–350.0
Segmented neutrophils %	27	33.3	25.9	25–45
Eosinophils %	27	0	55.6	1-10
Basophils %	27	0	0	0–2
Lymphocytes %	27	33.3	18.5	45–65
Band neutrophils %	27	0	0	0–2
Monocytes %	27	0	3.7	0–8
TSP g/L	31	45.2	9.7	70.0–80.0
Urea mmol/L	51	28.8	3.8	1.66–6.66
Ca mmol/L	51	31.4	0	2.25–2.99
iP mmol/L	51	13.7	31.4	1.61–2.25
Na mmol/L	16	0	0	135–157
K mmol/L	16	0	43.7	4.2–5.8
Cl mmol/L	11	0	0	90.0–108.8
Fe µmol/L	31	35.5	0	21.0–45.0
Mg mmol/L	26	0	26.9	0.69–1.23
Carotene gama%	19	31.6	0	>400

Source: *Jazbec*, 1990

CONCLUSIONS

The results of haematological and biochemical examinations indicate that the major problems in investigated cows were parasitic invasion and unbalanced diet, having a negative influence on health status, fertility and productivity of these cows. Therefore, if better care would be given to parasite control and to the composition of the diet the

production in such herds would be improved and more profitable. Data from the present study provide a rough assessment of the situation in small herds. For a more accurate assessment higher number of animals should be investigated and a precise anamnestic data about herds included.

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