EFFECT OF FEED SUPPLEMENTS ON SOME HAEMATOLOGICAL PARAMETERS IN THE BLOOD OF CALVES

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The objective of the present paper was to evaluate the dynamics of some haematological parameters in the blood of calves in a given agricultural enterprise in relation to the effect of selected feed supplements. In the first and second experiment the calves were divided into 3 groups – 2 experimental groups and 1 control group. The experimental groups received probiotic and prebiotic feed supplements to support active immunity according to a methodology: in the first experiment for 2 weeks after birth, in the second experiment for 3 weeks after birth, and the influence of climatic conditions on the health status of calves was evaluated. The acquired data and analyses were statistically evaluated and compared. The first experiment was conducted from August to November 2013, the second from November 2014 to January 2015.

Keywords: prebiotics, probiotics, calves, haematology

INTRODUCTION

Raising calves without their mothers in individual cubicles poses for calves a combination of emotional and nutritional stress that decreases their immunity response, changes the intestinal microflora equilibrium and therefore they are more vulnerable to a number of intestinal pathogens and their mortality may potentially increase (Grasso et al., 1999).

Immunity is the ability of the body to resist the pathogenic invasion. Insufficient immunity threatens the health and overall survival and so its maintenance and improvement are of primary importance (Patel et al., 2015). Appropriate development of the innate immune system is essential so that newborn calves would survive, especially when they face the pressure of infectious diseases that are responsible for high morbidity and mortality. In the first several months of life newborn calves have a weakened immune system because the function of granulocytes and their complete activity are low (Cervenak et al., 2009, Cortese, 2008) and the specific immunity of calves has not developed sufficiently yet (Boysen et al., 2006, Stefaniak et al., 2012).

In this aspect, probiotics are living microorganisms that have beneficial health effects on the modulation of intestinal microflora and strengthening of the host immunity, which appeared very important. Probiotics, along with their effector molecules, were proved to have immunoregulatory, anti-angiogenic, anti-allergic, anti-dermatic effects and others. Interactions of probiotics and cells of the immune system are vital for the mucosal tissue homeostasis and natural immunity (Patel et al., 2015). The better defence against viral infections, tumours and an improvement in the gastrointestinal barrier function were also confirmed as the effect of probiotics (Touchefeu et al., 2014, Vieira et al., 2013). Probiotics are non-pathogenic and belong to the original microflora in the gastrointestinal tract (GIT) in most animals while maintaining an effective balance between beneficial and harmful bacteria. One of the basic requirements is the ability to survive the effect of bile acid, conditions in GIT and the potential of adherence to the intestinal epithelium (Dunne et al., 2001). Prebiotics are defined as non-viable feed ingredients that have a beneficial health effect on the hosts associated with the modulation of microflora (FAO, 2007). The modulation of intestinal microflora by new feed supplements like probiotics and prebiotics that have a protective and supporting function in relation to the health status of animals brings about unique possibilities because it is an urgent problem in animal management (Gaggía et al., 2010). In calves these feed supplements proved an upward trend of positive effects on the intestinal microbial populations but only limited information about effects on immunity is available (Quezada-Mendoza et al., 2011).

Cattle are easily adaptable to temperatures at which they stay for a longer time. However, sudden changes in temperatures, mainly extreme changes, have negative impacts. In the youngest calves a sudden change in temperature by 2 °C or a sudden change in environmental conditions connected closely with temperature were found to be adverse (Šoch, 2005). High temperatures can lead to a decrease in immunity and to the transfer of maternal immunoglobulins to colostrum and can influence the ability of a newborn calf to absorb immunoglobulins (Brouček et al., 2008). Calves are born with very good functional thermoregulatory mechanisms (Davis & Drackley, 1998). The lower critical temperature is in the range of 9 to 15 °C at birth and in the first two weeks of life and it falls to the range from 0 °C to 10 °C in older calves (Phillips, 2010; Davis & Drackley 1998). The thermoneutral zone for calves is between 15 and 25 °C (Scanes, 2011; Schrama et al., 1992, 1993). Davis and Drackley (1998) reported the temperature of 26 °C as the upper boundary of the thermoneutral zone for calves.

MATERIALS AND METHODS

Two experimental observations were conducted. Twenty experimental calves and ten control ones were included in each of the experiments. In both experiments the calves were divided into three groups: group 1 – Lactovita with the effective ingredient *Lactobacillus sporogenes*, as a probiotic, group 2 – Biopolym – a hydrolyzate of the brown seaweed *Ascophyllum nodosum*, as a prebiotic, and group 3 – control. The first blood samples were taken from day 3 to day 5 of age after birth in both experiments, the second blood samples were collected 21 days laterin the first experiment and 28 days later in the other experiment. The calves received bulk colostrum from day 4 to day 5 of age, then a milk replacer was administered and its formulation is shown in Table No. 1. From day 7 the calves received a solid starter that is produced by the agricultural enterprise concerned.

Tab. 1: The formulation of milk replacer

Analytical ingredients		Trace elements		Vitamins (per 1 kg)	
Crude protein	20 %	Potassium iodide	0.25 mg	Vitamin A	25 000 IU
Crude fibre	0 %	Cobalt	0.2 mg	Vitamin D_3	6 000 IU
Crude oils and fats	20 %	Manganese	30 mg	**Antioxidants**	
Crude ash	8 %	Copper	10 mg	BHT	150 mg
Calcium	0.80 %	Selenium	0.4 mg	**Preservative**	
Sodium	0.50 %	Iron	80 mg	Citric acid	1 000 mg
Phosphorus	0.70 %	Zinc	50 mg		

The calves of Lactovita group daily received *per os* 1 tablet.head^{-1}.day^{-1} that was dissolved in colostrum, and later in milk replacer. Biopolym was applied orally with colostrum and later with milk replacer at an amount of 5 ml.head^{-1}.day^{-1}. Both these groups were administered feed supplements from day 1 after birth. In the first experiment feed supplements were applied once a day for a fortnight, in the second experiment also once a day for 21 days. The control group received an unsupplemented diet.

Air temperatures in a calf-house were measured with LOGGER S 3631 data logging thermometers. The units of measurement were degrees Celsius (°C). The data logger was mounted in a protective case on the outside wall of the calf-house at a height of 1.5 m above the ground to prevent its damage.

All calves were kept in the same housing conditions. The quality of calf housing is reflected in the overall quality and profitability of cattle herd. The calf-house is surrounded by buildings on three sides, which causes insufficient lightening of the facility. The shortcomings of housing are compensated by skilled work of technicians and good care of calves by tenders.

RESULTS AND DISCUSSION

The mean values of measurements from the experiments were compared with the reference values of Bouda *et al*. (1983). Table 2 documents the obtained mean values of measurements with standard deviations.

Tab. 2: The values determined in the blood of calves (haemoglobin, haematocrit). The 1st and 2nd sampling of Lactovita, Biopolym and control groups

	Haemoglobin 1st sampling [$g.l^{-1}$]	*Haemoglobin 2nd sampling [$g.l^{-1}$]*	*Haematocrit 1st sampling [$l.l^{-1}$]*	*Haematocrit 2nd sampling [$l.l^{-1}$]*
Lactovita 1st experiment	89.45 ± 21.62	106.44 ± 10.96	0.22 ± 0.05	0.25 ± 0.05
Lactovita 2nd experiment	107.68±23.04	106.90 ± 9.64	0.25 ± 0.08	0.27 ± 0.05
Biopolym 1st experiment	102.04±15.01	108.60 ± 13.89	0.26 ± 0.04	0.25 ± 0.04
Biopolym 2nd experiment	86.53 ± 14.48	106.42 ± 16.50	0.22 ± 0.04	0.23 ± 0.05
Control 1st experiment	104.21±15.93	113.90 ± 16.24	0.28 ± 0.06	0.27 ± 0.05
Control 2nd experiment	97.69 ± 12.12	106.19 ± 9.26	0.24 ± 0.03	0.25 ± 0.04

Tab. 3: The values determined in the blood of calves (erythrocytes, leucocytes). The 1st and 2nd sampling of Lactovita, Biopolym and control groups.

	Erythrocytes 1st sampling [$T.l^{-1}$]	*Erythrocytes 2nd sampling [$T.l^{-1}$]*	*Leucocytes 1st sampling [$G.l^{-1}$]*	*Leucocytes 2nd sampling [$G.l^{-1}$]*
Lactovita 1st experiment	4,58± 0,73	5,41 ± 0,78	7,81 ± 3,26	9,32 ± 1,46
Lactovita 2nd experiment	5,21± 1,32	5,65 ± 0,76	8,29 ± 3,30	9,18 ± 2,80
Biopolym 1st experiment	5,04± 0,70	5,77 ± 1,11	7,68 ± 1,69	8,01 ± 2,84
Biopolym 2nd experiment	4,40± 0,90	5,17 ± 1,06	6,66 ± 1,45	8,35 ± 1,63
Control 1st experiment	5,29± 0,90	5,81 ± 0,92	8,58 ± 3,02	8,45 ± 2,02
Control 2nd experiment	5,01± 0,55	5,48 ± 0,55	6,09 ± 1,59	8,14 ± 2,13

A low haemoglobin level was measured in the first experiment in the first blood sampling of Lactovita group, and in the second experiment in the first sampling of Biopolym group. The remaining values in both experiments and samplings were in the range of reference values reported by Bouda *et al.* (1983). According to Vrzgula *et al*. (1990) a decrease in blood haemoglobin may result from anaemia, hydraemia, haemoglobinuria or dietary protein deficiency.

A decreased haematocrit value was found out for the most part in the 1st sampling of all groups besides the second experiment in Lactovita group and the first experiment in the control group. In the 2nd sampling a decreased value was measured in both experiments. According to Heidarpour *et al.* (2008) lower haematocrit values in calves by 28 days of age may be due to iron deficiency in the blood.

The erythrocyte count was decreased in all groups. According to Vrzgula *et al.* (1990) a decrease in the erythrocyte count may be caused by anaemia, haemoglobinaemia, and dietary deficiency of Fe, Cu, Co and proteins. Hrković *et al.* (2014) stated that the red blood cell count and haemoglobin concentration in calves are maintained within physiological values only if the feed contains a sufficient amount of iron.

The leucocytes were in the range of normal values in all measurements reported by Bouda *et al*. (1983) and Lumsden *et al*. (1980); a low value was measured only in the 1st sampling of the second experiment in the control group. Leucopoenia is a decreased white blood cell count in the blood.

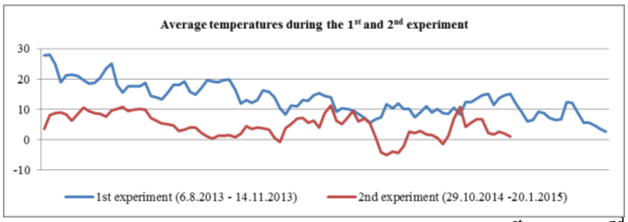

Figure 1: Average temperatures during the 1st and 2nd experiment

During the first experiment, which was conducted from August to November 2013, the average outdoor temperature was 11.5 °C and during the second experiment (November 2014 – January 2015) it was 5 °C. Even though at the beginning of the first experiment the average temperatures were above 27 °C, these elevated temperatures were not found to influence the health status of calves, as reported by Doležal (2010).

CONCLUSION

The investigation of the effects of probiotics and prebiotics (Lactovita, Biopolym) on haematological parameters in the blood showed certain trends of the studied values of blood parameters in the blood of calves compared to the control group.

However, no statistically significant difference between the control and experimental groups was observed in any of the studied parameters; therefore it is to conclude that in these experiments these substances did not have a significant effect on the dynamics of microelements in the blood of calves from 3 to 30 days of age. Although some values were moderately increased, the effect of these ingredients on the dynamics of haematological values was not found out. The influence of climatic conditions on the health status of calves was not proved during the experiments.

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