

## THE EFFECT OF SILICON DIOXIDE NANOPARTICLES AS FEED ADDITIVE ON HEALTH CONDITION AND IMMUNOLOGICAL PARAMETERS OF CALVES

*E. Szacawa*<sup>1</sup>, *K. Dudek*<sup>1</sup>, *D. Bederska-Łojewska*<sup>2</sup>, *U. Lisiecka*<sup>3</sup>, *D. Bednarek*<sup>1</sup>, *M. Pieszka*<sup>2</sup>  
ewelina.szacawa@piwet.pulawy.pl

<sup>1</sup>National Veterinary Research Institute,

Department of Cattle and Sheep Diseases, Puławy, Poland

<sup>2</sup>National Research Institute of Animal Production,

Department of Nutrition Physiology, Balice, Poland

<sup>3</sup>University of Life Sciences in Lublin, Department of Epizootiology and Clinic of Infectious Diseases, Lublin, Poland

In the initial stage of cattle breeding attention should be paid on immune system of calves. An increased sensitivity to bacterial and viral infections leads in consequence to economic losses in cattle industry. Published data indicate that the use of a silicon dioxide nanoparticles as feed additives have a destructive effect on bacterial cells, which leads to their death. Then the bacterial toxins are selectively bound in the gastrointestinal tract. Additionally a mixture of organic acids acidifying the digestive tract and gives an additional biocidal effect against pH-sensitive bacteria.

In the study six calves in the age 4–8 weeks of life were divided into two equal groups: experimental (E) and control (C). Calves from the E group were given feed additives which contained silicon dioxide nanoparticles with a mixture of protected organic acids which were added to milk replacer at the dose of 3000 mg per calf once a day for 7 weeks. The C group received milk replacer without additives in the same time. Behavioral observations were conducted daily; the amount of feed intake, rectal temperature, overall health and their weekly body weight gains were monitored. The blood samples were collected from animals once a week. White blood cells counts (WBC) with leukocyte differentiation (lymphocytes, monocytes and granulocytes) were examined in peripheral blood using veterinary blood analyzer (*Exigo, Boule Medical, Spånga, Sweden*). Immunophenotyping of lymphocyte subsets, i.e. T-cells (CD2<sup>+</sup>), Th (CD4<sup>+</sup>), Tc/s (CD8<sup>+</sup>) according to Beckman Coulter's Guide, phagocytic activity of granulocytes and monocytes and their mean fluorescent intensity (MFI) (*Phagotest, Glicotope Biotechnology GmbH, Berlin, Germany*) were analysed with the use of flow cytometer (*Epics XL, Beckman Coulter Inc., Brea, California, USA*).

The overall health condition of the animals was good, they had good appetite and it was better expressed in the group E. The body weight of animal was on average higher by 11 kg in the group E. The leukocyte subpopulation counts were similar in the both groups. The percentage of CD2<sup>+</sup>, CD4<sup>+</sup> and CD8<sup>+</sup> in the group E was similar to the control group. A mean percentage of phagocytic monocytes was similar in the C and E groups. In the 0 day of experiment, i.e. before the beginning of feed additives administration, the value for the E group was lower than for the C group ( $P < 0.05$ ). In E groups the values increased by 7 % and in C decreased by 4 % on 7 weeks of the study. The MFI of monocytes was similar for the both groups. The mean percentage of phagocytic granulocytes decreased by 5 % and by 14 % in E and C group respectively. The MFI of granulocytes decreased by 10 % and 20 % in the E and C group respectively on 7 weeks of the study.

There were examined overall body condition and nonspecific immunological parameters of calves. The obtained results were similar in the experimental and control group. Although the experimental animals were in better health condition and higher body weight gains. Further studies are needed to assess the protective role of examined feeding additives against bacteria on calves.

**Keywords:** CALVES, SILICON DIOXIDE NANOPARTICLES, IMMUNOPHENOTYPING, PHAGOCYtic ACTIVITY