

Efficacy of a spore-forming bacteria (*Bacillus coagulans*) on the health of weaning Holstein Friesian female calves

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Bacillus coagulans is a lactic acid-producing and spore-forming bacterium. This combination makes this spore-forming bacteria a unique probiotic in animal nutrition and its beneficial effects can be attributed to several modes of action. In particular, the safety and efficacy of *Bacillus coagulans* DSM 32016 (Technospore®), when used as a zootechnical additive for piglets (suckling and weaned), other growing Suidae, chickens for fattening, other poultry for fattening and ornamental birds were attested by the Panel on Additives and Products or Substances used in Animal Feed (FEEDAP) in 2020. The study aimed to evaluate the efficacy and effects of *Bacillus coagulans* DSM 32016 administration on the health of young Holstein Friesian female calves. After birth, the animals were housed in individual boxes with free access to water. A total number of 20 calves were randomly divided into 2 homogeneous groups on the basis of body weight from the seventh day of life (0 d of trial) until 63 days of age (56 d of trial). Control group was fed with a standard milk replacer (MRP) plus concentrate and treated group was fed MRP and concentrate supplemented with 1×10^9 CFU/kg *Bacillus coagulans* DSM 32016. Withers height, length (from withers to the base of tail), hip width, chest width and girth were registered on day 0, 28 and 56 on trial to perform morphological evaluations. The following samples were collected: colostrum for IgG content, feces (0, 28 and 56 days on trial) for *Cryptosporidium* spp analysis and fecal microbiota characterization by 16S rRNA-gene sequencing. Blood samples were also collected at 0, 28 and 56 days on trial for haematological, metabolic parameters (NEFA, BHB and glucose) and antioxidant capacity (OXY-Adsorbent test) assessments. The morphological evaluations revealed that on day 56 on trial the treated animals registered a higher wither height if compared to control calves (94.44 ± 4.92 cm vs 89.38 ± 1.81 cm; $p < 0.05$). The value of IgG monitored in the first milking colostrum (6 to 12 hours) were above 50 mg/ml with a positive immune transfer to calves. Haematological and metabolic parameters did not show any differences between treated and control. Results revealed that the gut microbiota was dominated by *Firmicutes*, *Bacteroidetes*, *Actinobacteria*, and *Proteobacteria* phyla which together made up for 95% of all microbes. As in similar previous studies consumption of *Bacillus coagulans* was able to increase population of *Lactobacillus* and *Bifidobacterium*, probiotic microorganisms in the gut. On day 14 of trial a slight difference was highlighted in terms of point prevalence of *Cryptosporidium* spp. in favour of the treated group (40%) in comparison to control (45%). The administration of *Bacillus coagulans* significantly affected the antioxidant capacity. Serum antioxidant capacity was significantly ($p < 0.05$) enhanced after 63d (439.77 ± 81.90 control vs 546.16 ± 116.20 $\mu\text{mol HClO/ml}$ treated). The results obtained confirmed the positive effect of *Bacillus coagulans* administration in supporting calves at weaning.