

Effect of prebiotic and probiotic supplements to increase live weight of calves in the diet

Luboš Zábranský*, Naděžda Kernerová, Eva Petrášková, Anna Poborská,
Miloslav Šoch, Martin Kantor, Josef Kučera
University of South Bohemia in České Budějovice, Faculty of Agriculture,
Department of zootechnical sciences, Czech Republic

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Probiotics and prebiotics are effective to modulate optimal conditions in gastrointestinal tract inhabited by diverse microbial population. Probiotics regulate and modulate gut microbial population thus reducing the risk of diarrhea. Positive effect on growth is confirmed. The aim of this study was to evaluate the effect of probiotic (*Lactobacillus sporogenes*) and prebiotic (*Ascophyllum nodosum*) supplements on weight gain in calves. Forty new-born Holstein calves were randomised to control and experimental group. In the experimental group, *Lactobacillus sporogenes* and *Ascophyllum nodosum* were added first to colostrum and then to milk replacer, calves in the control group were fed with colostrum and milk replacer only. The weight gains of animals were found out during the whole experiment. Evidence of animal health and diarrhea was monitored. In the end of experiment, the body weight gains in experimental calves were by 14.4% higher compared to control but without statistical significance ($P > 0.05$). Probiotic and prebiotic treatment tended to diminish diarrhea. The health benefits of monitored treatment were noticed in experimental group.

Keywords: calf, dietary supplements, nutrition, health

1 Introduction

The healthy gastrointestinal tract of animals in herd is the basis for the prosperous breeding. In ruminants, many different kinds of microbial communities are inhabited in the rumen and intestines. These native microorganisms have important functions in nutrition digestion and health status of the host. The high quality of herd influences milk and meat production. Strengthening beneficial microorganisms is very important in calves immediately after the birth. Young animals face various diseases. Diarrhea is the main cause of morbidity and mortality in calves during their early life (Uyeno et al., 2015). This serious health issue has multi-factorial nature involves multiple pathogens, co-infection, environmental factors and feeding during the calving period (Cho and Yoon, 2014). A poorly developed immune system is the cause of reduced immunity (Niggemman, 2006). Weak and sick calves grow slower or even lose weight. These are the reasons for strengthening the resistance against pathogens and other negative conditions. The first antibodies in calves come from colostrum, the first natural food of new-born calves. It is important that the intestinal mucus contains enough of them. Then the calves have sufficient protection against infection from the environment (Renaud et al., 2019). Colostrum contains a large number of biologically active substances, such as insulin, insulin-like growth factors (IGF), growth hormone, prolactin, thyroid hormones, cortisol and some other substances (Sanei et al., 2012). Its quantity received is the most important in nutrition and is a fundamental aspect for health and post-natal development of new-born calves (Blum 2006).

Probiotics are defined as the living microorganisms administered in a sufficient number to survive in the intestinal ecosystem. These ingested microorganisms have a positive effect in the prevention and treatment of a specific

*Corresponding Author: Luboš Zábranský, University of South Bohemia in České Budějovice, Studentská 1668, 370 05 České Budějovice, Czech Republic; e-mail: zabransky@zf.jcu.cz

pathologic condition. Probiotics are widely used as natural additives to force immune response and overall health (Socol et al., 2010).

Unlike antibiotics, which are used to treat the opportunistic pathogenic flora, probiotics do not diminish natural gut protective flora (Timmerman et al., 2005).

The population of beneficial microbes used as probiotics belong to lactobacillus and bifidobacterium family (Vrese and Schvezenmeir, 2008).

The animals can be supplemented with prebiotics in feed too. Prebiotics are defined as substrates that are selectively used by host microorganisms, providing a health benefit to the host (Cangiano et al., 2020). These substrates are served as nutrients for beneficial microflora. Prebiotic oligosaccharides are used. Mostly, *Fructooligosaccharides* and *Galactooligosaccharides* are functional component of nutrition. These prebiotic oligosaccharides help the growth of healthy bacteria and their better colonization in the digestive tract (Rastall and Maitin, 2002). The objectives of this study were to evaluate the effect of probiotic (*Lactobacillus sporogenes*) and prebiotic (*Ascophyllum nodosum*) supplements on the weight gains in calves.

2 Material and methods

Forty Holstein new-born calves from the same dairy cows herd were involved in the experiment. The treated group including 20 calves was tested on the effect of probiotic (*Lactobacillus sporogenes*) and prebiotic (*Ascophyllum nodosum*) as a natural additives. The other 20 calves were controls. The young animals were separated and weaned from mothers on the first day within 3 hours after birth. Calves were bred during the whole experiment, from the first day to day the 28, in individual littered boxes. For the first four days, all calves received only colostrum and breast milk *ad libitum* three times a day from a nipple bucket. The milk replacer was fed from day 5. The daily amount 4.5 kg was divided into 3 portions. The starter mixture and alfalfa hay were available *ad libitum* until weaning.

Table 1 Composition of the starter mixture

Crushed wheat	20%
Crushed barley	15%
Whole maize grains	10%
Whole oat grains	19.5%
Extracted rapeseed meal	15%
Extracted soybean meal	15%
Tetravit (vitamin-mineral premix)	5%
Calcium	0.5%

The plastic buckets used for feeding were fitted in the boxes at a height of 40 cm above the ground. The drinking water was available to calves during the whole experimental period. The experiment was conducted from June 2020 to August 2020. The calves in experimental group with probiotics and prebiotics received orally 1 g *Lactobacillus sporogenes* (4.1×10^7 CFU/g). The daily dose 5 ml of brown seaweeds hydrolyzate was added to colostrum and milk replacer from the first to the fourteenth day of age. Feed supplements were presented to the calves once a day in the experimental group. All the supplements were administered to the experimental groups during the first fourteen days of the experiment. In the control group, the calves received a feed ration without feed supplements. Daily milk replacer input of 4.5 kg was divided into three doses, starter mixture and alfalfa hay were available *ad libitum*. All calves were observed from birth to day 28 of their age.

The data were analyzed using a General Linear Model ANOVA (four ways with the interactions) of the statistical package STATISTIC 12.

3 Results and discussion

The influence of probiotic and prebiotic supplements on the body weight gain of Holstein calves during the first 24 days of age were investigated. The differences between groups were observed. The experimental group achieved

higher gains in weight especially in the 1st and 4th week after birth as Table 2 and Figure 1 demonstrate. In the end of the experiment, average body weight gain of calves in the experimental group was higher by 14.4% than in the control group. The average gain in weight in 28 days from birth was 18.52 kg in the experimental group and 16.27 kg in the control group during the same time period. The results suggest the positive effect of probiotics and prebiotics on the digestive tract. The probiotic and prebiotic substances contained in the feed ration of the experimental group demonstrably increased the live weight gain. A number of studies are described which report the positive effect of the use of probiotic feed supplements on the health and live weight gain of calves (Zhang et al., 2016; Raabis et al., 2019; Renaud et al., 2019). These results agree with the findings of Timmerman et al. (2005) and Frizzo et al. (2010). Morrell et al. (2008) demonstrated in his study that selected species of probiotic strains have a positive effect on the health of calves and can be also applied as diarrhea prevention. The low mortality and morbidity rate of new-borns are noticed when probiotics were included in the diet. According to Gaggia et al. (2010) the positive effect of probiotics and prebiotics in both groups with healthy and stressed animals was demonstrated. This effect was demonstrated not only on ruminants, but also on pigs and poultry.

Table 2 Weight gain during the first 4 weeks after birth

	Ø Weight gain 1 st week (g)	Ø Weight gain 2 nd week (g)	Ø Weight gain 3 rd week (g)	Ø Weight gain 4 th week (g)
Experimental group	4,752.62	3,821.52	4,125.68	5,235.74
Control group	4,145.85	3,658.88	3,959.82	4,483.65

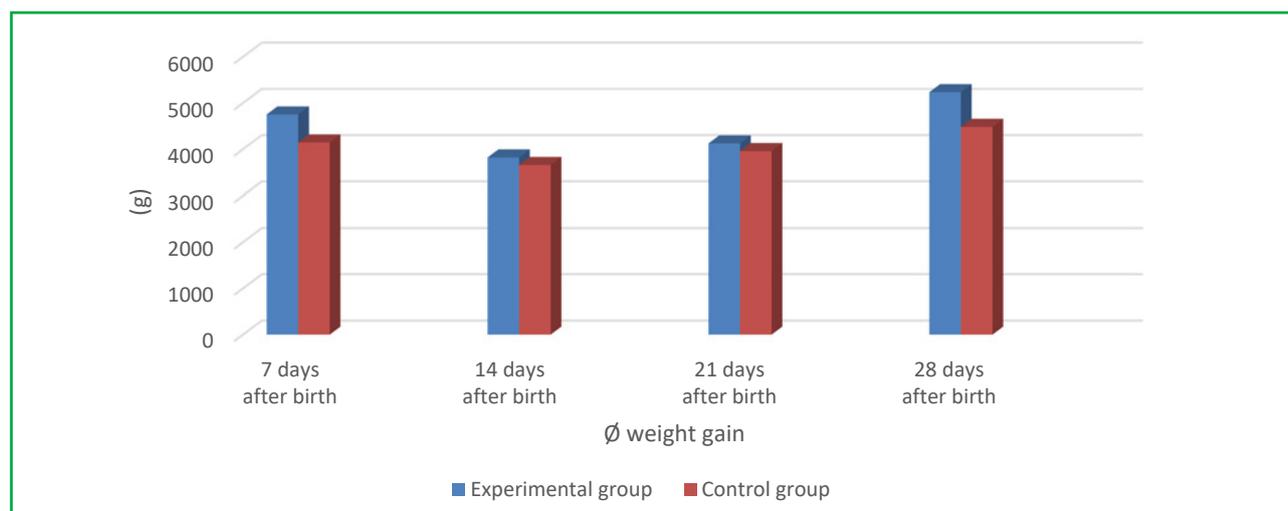


Figure 1 Weight gain during the first 4 weeks after birth

4 Conclusions

The effect of probiotic and prebiotic feed supplements was not statistically proven, but the results indicate a positive effect on the increase in live weight gain. If probiotics and prebiotics are included in the feed ration, a positive effect on health, increased immunity and better weight gain can be expected.

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