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Effect of probiotics, prebiotics and synbiotics on the productivity and health of dairy cows and calves

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ABSTRACT

In the interest of animal health as well as future consumers, natural additives are increasingly being given to animals, such as probiotics, prebiotics and synbiotics. Defined as "natural growth promoters" stimulate growth and proper functioning of the body, which primarily affects the health of individuals as well as the productivity and consequently the quantity and quality of the products they receive. These formulations can be administered to both adult and young adult subjects. For dairy cows, the use of probiotic and prebiotic formulas contributes to an increase in milk yield and a reduction in the risk of mastitis. In calves formulation increases the resistance to diseases of the digestive system, which increases the weight gain of young individuals. Probiotics, prebiotics and synbiotics are substances that can replace antibiotics in the treatment and prevention of many diseases in cattle.

Keywords: probiotics, prebiotics, synbiotics, dairy cow production, calves healthy

1. INTRODUCTION

In recent years we have seen a continuous increase in the intensity of animal production. Farmers are primarily geared towards achieving good production outcomes and products of animal origin that will be attractive to consumers because of their nutritional, dietary and health benefits. At present, consumers are also looking for organic food or organic feed additives, which guarantees them a high nutritional quality. It is also important for the current intensification of animal production to create the conditions for maximizing the use of animal

feed by minimizing excreta with faeces, thus reducing environmental pollution. The threat posed by the emergence of antibiotic-resistant strains has led to the ban on antibiotic growth promoters (ASWs) in the EU in 2006. This has forced the search for alternatives to these dangerous feed additives. It is very important that the newly selected additives meet basic expectations, ie: meeting the animal feed requirements, improving the value of animal welfare and the characteristics of materials and compound feedingstuffs, and should also prevent or reduce the harmful effects of animal waste on the environment.

The aim of this article is to present the effects and effectiveness of probiotic, prebiotic and synbiotic preparations in feeding dairy cows and calves on their production and health outcomes. The work was based on a review of current national and foreign literature.

2. CHARACTERISTICS OF PROBIOTICS

Probiotics are products containing either live or dead micro-organisms and the substances they produce. In the digestive tract of animals, they contribute to the stabilization of microbial populations and to increased enzymatic activity in this system, thus having a positive effect on the development of the animals. These include suitably selected, naturally occurring gut bacteria, which are ingested from the feed and thus inhibit or partially inhibit the growth of pathogenic microorganisms, thereby improving the digestion and utilization of feed components (Grela 2006, 338-344).

Probiotic microorganisms to be used in ruminant nutrition must meet certain conditions (Grela et al., 2013, 311-335):

- be able to live in low stomach pH and show resistance to bile acids,
- have a beneficial effect on the animal's organism,
- have the ability to adhere to intestinal epithelial cells, and permanently or periodically colonize the gastrointestinal tract,
- have the ability to sustain under unfavorable storage and living conditions in the digestive tract.

Probiotics consist of one or more strains of microorganisms that can be administered to animals in the form of powder, tablets, granules or paste (Nowak et al., 2010, pp. 5-19). Microorganisms that are used in the manufacture of preparations should be isolated from the animals of the same species in which they are to be used so that the resulting microbial material can adapt to the conditions that are most likely to occur in the digestive tracts of certain animal species (Mizak et al. 2012,736-744). Probiotics are used for the production of probiotics. *Lactobacillus* spp., *Leuconostoc* spp., *Streptococcus* spp., *Saccharomyces* spp. and endospores (*Bacillus* spp., *Clostridium* spp.) (Grela and Semeniuk 1999, 222-228). The use of probiotics in animal nutrition is very extensive. They can be administered to almost all species and technology groups. It is recommended primarily for young animals that are most at risk of stress caused by many environmental factors (Grela and Semeniuk 1999, pp. 225-226). Probiotics can be used in calves, adult cattle, and dairy cows in ruminants. The use of probiotics in young ruminants contributes to the accelerated development of the stomach, which in turn leads to an increase in the rate of growth of the animals. Adding probiotics to feed for dairy cows leads to an increase in their milkiness and to improved nutrient utilization, due to the stabilization of bacterial microflora in the rumen (Semeniuk et al., 2008, 140).

3. CHARACTERISTICS OF PREBIOTICS

Prebiotics have nutrients that stimulate growth and development, beneficial intestinal microflora in the animal's digestive tract, while suppressing harmful pathogenic bacteria from the body (Semeniuk et al 2008, 148-150). The requirements that must be met by the substances included in the prebiotics are: resistance to digestion by gastric enzymes, lowering the pH of the digestive tract, modifying the biological composition of the colon, and stimulating the conversion of microbial flora in the digestive system leading to the development of bacteria of the *Lactobacillus* and *Bifidobacteriu*. Substances with a prebiotic effect are certain peptides, proteins and fats and oligo- and polysaccharides (Swennen et al., 2006, 459-468). In animal feeds, the most commonly used formulations are mannanooligosaccharides, fructooligosaccharides and transgalactooligosaccharides.

The positive effects of prebiotics on the animal body include, among others. To compete with pathogenic bacteria, to reduce the pH of the stomach contents and thereby to create unfavorable conditions for the development of pathogenic micro-organisms and to absorb harmful pathogens and toxins they produce on their intestinal surfaces. Mannooligosaccharides (MOS) are most commonly used in animal prebiotic production. These substances are produced by surface yeast cell walls. Currently, many researchers are involved in the use of oligosaccharides, which are often a feed additive for young animals. Undoubtedly, they have a beneficial effect on animal health and production results. Studies have shown that the addition of prebiotics to feed has inhibited the development of pathogenic microorganisms in the digestive tract, as well as a decrease in the amount of *E. coli* that are the main pathogens causing diarrhea in animals (Grela et al, 2013, 165-172).

4. CHARACTERISTICS OF SYNBIOTIC

Apart from probiotic and prebiotic preparations, there are synbiotic preparations resulting from the combined action of pro- and prebiotics. According to Roberfroid [1998, p.197-202], synbiotics can be defined as "a mixture of probiotics and prebiotics that are beneficial to the host by increasing the survival and deposition of viable microbiological nutritional supplements in the gastrointestinal tract by selectively stimulating growth and / or stimulating metabolism of one or Limited amount of beneficial bacteria health ". Their joint action on the animal body is much more effective than the use of probiotics or prebiotics alone.

5. EFFECTIVENESS OF THE USE OF PROBIOTICS, PREBIOTICS AND SYNBIOTICS IN FEEDING RUMINANTS

The use of probiotics in adult cattle is limited due to the degradation of most of these rumen formulations and must therefore be administered in a suitably protected form (Callaway et al 2008, 217-222, Nowak et al 2010, 124- 128).

The effects of probiotics are largely dependent on the substances they contain, so supplementation with different probiotic formulations can produce divergent results. Nocek and Kautz (2006, 260-266) demonstrated the effect of probiotics on the performance of dairy

cows, giving a daily increase of 2 g / day / probiotic yeast and 2 strains of *Enterococcus faecium* Milk production by 2.3 kg.

Similarly, in studies by Chiquette et al. (2008, 3536-3543) showed that the addition of a probiotic preparation in the form of freshly isolated *Prevotella bryantii* strains had no effect on milk yield and increased milk fat content from 3.5% to 3.9% of the evaluated cows. In turn Yosuda et al. (2007, p. 205-208) in their experience fed a Holstein-Friesian milk cow, consisting of lyophilized strains of *Lactobacillus casei* (1.0×10^7 CFU) and 5% Dextran (glucose polymer) in this preparation g / cow / day). As a result of their research they found that supplementation of feed with this preparation increased the resistance of animals to adverse environmental conditions (high temperature and humidity). They also showed an increase in the milk yield of cows from the research group during the summer, without changing the daily milk production in cows during the winter. According to the authors, this effect was influenced by Dextran. The cows evaluated also showed a decrease in the number of somatic cells, a decrease in the incidence of mastitis, and a positive effect on the microflora of the gastrointestinal tract and a greater resistance to infectious diseases.

Probiotics and prebiotics have found a wider use in calf prophylaxis. There are a number of studies to investigate the effects of probiotic and prebiotic preparations on the immunity of young calves. The effectiveness and appropriateness of the use of such formulas is assessed on the basis of weight gain, feed intake and utilization and, above all, health.

In the studies of Mokhber-Dezfouli et al. Calves were given a probability consisting of *Lactobacillus*, *Bifidobacterium bifidum*, *Enterococcus faecium*, *Streptococcus thermophilus* and two types of *Aspergillus oryzae* and *Candida pinotopesti* at 25 g / body / day. As a result of the addition of this preparation to milk, during the 90 days of the study, the final weight gain of calves from the test group was increased by 7 kg over the control group. The calves tested showed higher disease resistance, particularly diarrhea.

The effect of prebiotics on calf health has been investigated among others by Heinrichs et al. (2003, 4064-4069). The study was based on the comparison of rearing results of calves divided into three groups: control, breastfeeding with antibiotic (neomycin and oxytetracycline) and fed with premixed milk (MOS). As a result of the studies, it was found that suitable faecal structure was found in calves fed with antibiotic or prebiotic milk. Calves receiving milk with manooligosaccharides had a higher feed intake than those fed with antibiotic and control milk. In addition, resistance to diseases in animals whose dietary intake was supplemented with an antibiotic or prebiotic supplement was at a similar level, much higher than in the control group. As a result, it can be said that prebiotics are a good alternative to antibiotics in rearing calves.

Calf rearing also uses synbiotics, a mixture of probiotics and prebiotics. The combination of the probiotic (*Streptococcus faecium*) and the prebiotic (MOS) affects the increase in feed intake and the improvement of faecal structure in calves (Morrison et al., 2010, 222-229).

Similarly, Roodposhti and Dabiri (2012, 1255) studied the effect of synbiotic consisting of probiotic bacteria and two types of fungi and prebiotic substance (*Saccharomyces cerevisiae* cell wall polysaccharide) on daily growth of calves, *E. coli* in faeces and IgG immunoglobulin content in blood. The study was conducted for 8 weeks, giving calves from the control group 1 g probiotics and 4 g prebiotic. As a result of the experiment, it was found that the addition of synbiotics to milk resulted in an increase in daily calves growth, a

decrease in the number of pathogenic *E. coli* bacteria in faeces by 5%, and an increase in antibody production by calves by 0.120 mg / ml.

Similar conclusions have been made by Marcondes et al. (2016, 1555-1560). By performing experiments on 32 Holstein Californian calves, the average daily gain in the study group was 97 g higher than in the control group, with a final weight of 4kg. In addition, improved milk calf digestibility and improved digestive system health have been demonstrated.

6. CONCLUSIONS

The increase in production intensity, and the ban on the use of feed antibiotics, make it necessary to introduce into feeds substances that will be able to maintain high animal health. The use of probiotics, prebiotics and synbiotics increases the productivity of the animals, increases the production and improves the quality of raw materials from animals, and above all protects the animals from the harmful effects of pathogens. Thus, the introduction of these substances into compound feeds has many benefits and is often comparable to the use of antibiotics.

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