Effect of the feed additive ProVetin on the development of foals

Regina Ivannikova¹*, Ekaterina Smirnova¹, Gulnora Navruzshoeva¹, Anna Pavlova², and Ivan Kalinin³

¹Federal State Budgetary Educational Institution of Higher Education "Moscow State Academy of Veterinary Medicine and Biotechnology - MVA named after K.I. Skryabin", 23, Akademik Scriabin St., Moscow, 109472, Russian Federation
²Federal State Budgetary Educational Institution of Higher Education "Lugansk State Agrarian University named after K.E. Voroshilov", 1, Artyomovsky district, Lugansk, 291008, Lugansk People's Republic
³State Autonomous Institution "Moscow State Zoological Park", 1, Bolshaya Gruzinskaya, Moscow, 123242, Russian Federation

Abstract. The article presents the results of the effect of the feed additive Protein containing bacteria strains Bacillus subtilis, Saccharomyces cerevisiae, Trichoderma reesei on the dynamics of growth and development of foals. As a result of the conducted studies, it was found that the feed additive has a positive effect on the body of foals whose mothers received ProVetin during foaling. The weight of foals of the experimental group at birth was 6.7% higher compared to the control group. Further introduction of a feed additive into the diet of foals in the postnatal period also had a beneficial effect, which contributed to higher growth rates – at the age of 3 months, the live weight of the experimental group of foals receiving daily feed additive was 6.3% greater than in the control group; at 6 months – 6.5% more.

1 Introduction

The efficiency of animal husbandry directly correlates with the quality of feed, the optimal ratio of proteins, fats, carbohydrates, macro- and microelements, vitamins and other vital components in the diet. To prevent diseases, preserve horses, and increase their productivity, vaccinations, deworming are carried out, antibiotics and other chemotherapy drugs are often used. Most of them have a negative effect on the body of animals, often causing dysbiosis. The use of antibiotics significantly disrupts the microbial balance in the intestines of young animals and poultry. After their cancellation, the process of restoring the microflora to its optimal state takes place within a certain time. During this period, not only the normal physiological rhythm of digestion is disrupted in horses, but also the body's resistance and productivity decrease. Uncontrolled use of antibiotics, which are slowly excreted from the body, leads to their accumulation, which often significantly reduces the quality of livestock products.

* Corresponding author: regiotf@yandex.ru
In addition, with the widespread use of antibiotics, a serious problem has arisen in the fight against resistant forms of pathogenic microorganisms in the treatment of animals and humans [1, 4].

In order to ensure the environmental safety of food products, the use of antibiotics in the cultivation of farm animals and the production of livestock products is prohibited in the countries of the European Union. Therefore, all over the world, including Russia, there is an active development and implementation of safe, effective probiotic drugs as an alternative to antibiotics. Probiotic preparations contain living micro-organisms and substances of microbial origin (metabolites) capable of correcting the function of normal intestinal microflora with a natural method of administration. Normal intestinal microflora prevents the activation of pathogenicity factors in gram-negative intestinal microorganisms and inhibits the growth of their numbers. In addition, these drugs have pronounced antagonistic properties against opportunistic microorganisms. Currently, drugs containing live biffdo-lactobacilli, as well as spore-forming aerobic bacteria, which really have a positive effect on the health and productivity of animals, are used as probiotics.

The resistance of pathogens to antibiotics is developing much faster than the discovery of new antimicrobial compounds. Reports of multidrug-resistant bacteria and the possibility that these strains can spread diseases to humans have prompted many European countries to ban the addition of antibiotics to feed. Probiotics added to the feed control a number of bacterial infections. The combination of Enterococcus faecium, Pediococcus acidilactici, Bacillus animalis, Lactobacillus salivarius and Lactobacillus reuteri reduced colonization of Campylobacter jejuni and Salmonella Enteritidis in the gastrointestinal tract, while Bacillus subtilis improved feed conversion, intestinal morphology, stimulated the immune system and suppressed colonization Campylobacteria jejunum, E. coli and Salmonella of Minnesot. Lactobacillus salivarius and Pediococcus parvulus improved body weight gain, bone characteristics, intestinal morphology and immune response, and decreased colonization of S. Enteritidis. Lactobacillus crispatus, L. salivarius, Lactobacillus gallinarum, Lactobacillus johnsonii, Enterococcus faecalis and Bacillus amyoliquefaciens reduced the number of salmonella [14]. Although the multicomponent probiotic and oxytetracycline stimulate the immune system, probiotics are safer to use than antibiotics and should be the preferred treatment method [7, 9].

Being representatives of the normal microflora, cultures of microorganisms in the composition of probiotics have a number of advantages over wild strains. Firstly, non-pathogenic microorganisms capable of withstanding low pH and high concentrations of bile acids are selected to create probiotics. In addition, the selected strain must tolerate the processes of production, transportation, storage and application, while maintaining its viability and desirable characteristics, including resistance to a number of modern veterinary antibiotics. Spore-forming bacteria, especially from the genus Bacillus, are increasingly being used as probiotics. Bacillus spores are resistant to physical and environmental factors such as heat, drying and UV radiation, which allows them to maintain their viability during feed granulation, storage and processing [2, 7].

Either various probiotics exhibit their effects through various mechanisms, acting in the lumen of the gastrointestinal tract or in the wall of the gastrointestinal tract, (some are also able to penetrate into the bloodstream). Probiotics cause a shift in the balance of microflora towards beneficial (normal) microorganisms. A decrease in the content of pathogenic microorganisms in the gastrointestinal tract may be associated with the production of antimicrobial substances such as bacteriocins and the adhesion of probiotic microbes to the intestinal epithelium, which causes competition for a substrate or induces an immune system response. In particular, enzymes of the cell walls of gram-positive bacteria (peptidoglycans) regulate the immune status of animals, induce the production of specific antibodies, activate the complement system, and cell mitosis.
The effectiveness of the use of various probiotics varies widely and depends on many factors, including the species composition of the microorganisms included in them.

Most of the probiotics known in the world contain several types of symbiotic bacteria, the combination of biological properties of which makes it possible to increase the effectiveness of drugs. Among the most well-known are Lactobacillus, Bifidobacteria and Streptococci (S.lactis, S.cremoris, S.citrovorus, S.paracitrovorus, S.termophilus, L.bulgaricum, L.acidophilum, etc.).

The group of allochthonous microorganisms in the genera Bacillus, Brevibacillus, Clostridium and Sporolactobacillus are the most ancient and widespread saprophytic microorganisms in nature that humans have encountered throughout the history of their existence. Despite the fact that probiotic strains of bacilli are transient in relation to the intestinal microflora of humans, animals and birds, some useful properties make them an important arsenal of replenishing biologics useful for health. Antagonism against a wide range of pathogenic and conditionally pathogenic microorganisms and self-elimination from the gastrointestinal tract make the construction of therapeutic and prophylactic drugs from probiotic bacilli particularly promising. It also attracts their stimulating effect on digestion, anti-allergenic, antitoxic, sanitizing and restorative effects on the body.

Recently, feed additives and biologically active substances have been increasingly used in practice as an alternative to medicines of various directions of action to optimize metabolic processes in the body of animals and, as a result, increase productivity [1, 3, 5-6, 8].

Spore-forming probiotics are gaining popularity in animal husbandry and poultry farming as natural growth stimulants. Spore-forming bacteria, Bacillus spp. and Clostridium spp., due to their ability to encapsulate, can be found not only in the digestive tract of animals and birds, but also in soil, water and dust. This makes the process of developing spore-forming probiotics more accessible. The formation of spores increases the survival of probiotics during the production process, including fermentation, freezing, drying, defrosting and rehydration. Spore-forming probiotics are suitable for use because of their unique ability to encapsulate, which provides them with protection from the harshest conditions and increases accessibility to host organisms. In addition, the spores of these probiotics have a greater ability to survive when passing through the intestine, multiply and colonize the digestive tract. This ability makes spore-forming probiotics an ideal feed additive in animal husbandry. Over the past few decades, they have demonstrated significant success not only in combating pathogens, including drug-resistant strains, but also in stimulating natural growth, improving feed conversion and other zootechnical characteristics [1, 7].

The results of numerous studies indicate that the inclusion of probiotics of various groups in the diets of foals and horses allows to increase the efficiency of the use of feed nutrients, has a positive effect on the morpho-biochemical composition of blood, natural resistance, productivity, quality of products and economic indicators. The analysis of literary sources indicates the expediency of using probiotics in horse breeding conditions to improve the physiological status, increase productivity and economic efficiency of livestock production. The search for new biologically active drugs capable of having a multifactorial effect on the animal body is an urgent task today. Given the current rapid development of biotechnology, the use of probiotics in horse breeding is a very promising direction [1, 6].

Studies concerning the effectiveness of the use of probiotic drugs in horses of different age and gender groups have clearly not been conducted enough. There is practically no information on the effect of probiotics containing bifidobacteria and lactobacilli on the formation of foals characterized by the highest growth rate.
Probiotic drugs have a beneficial effect on the formation of intestinal normobiosis in newborn animals; they provide correction of dysbiosis of various genesis and colonization resistance; they have preventive and curative efficacy in gastrointestinal pathology; have immunomodulatory and anti-stress activity; contribute to the normalization of metabolism, stimulation of growth and development of animals. Despite the fact that probiotic drugs have firmly taken their place in the production process of obtaining products from a number of livestock industries, they are only used in horse breeding they are being tested.

The therapeutic and preventive effect of the drugs leads to a decrease in waste, a sharp reduction in sick animals and treatment costs, and contributes to the rehabilitation of farms from gastrointestinal diseases. Unlike antibiotics, long-term use of bacterial preparations in the same household does not reduce their effectiveness. Important advantages of probiotics are their complete utilization by the animal body, the absence of side effects and damage to both the health of the end user of the product and the environment.

One of these means is the feed additive ProVetin, which is a black powder. The product contains bacteria strains Bacillus subtilis, Saccharomyces cerevisiae, Trichoderma reesei. The total number of viable cells in 1 g of probiotic is not less than $1 \times 10^9$ CFU.

The purpose of our research is to study the effectiveness of the use of feed additive in the cultivation of horses.

To achieve this goal, the effect of the feed additive ProVetin on the dynamics of growth and development of foals was determined.

2 Materials and methods of research

Studies were conducted on pregnant mares and foals obtained from them. The mares were divided into two groups according to the principle of analogues. An experimental group of mares in addition to the main diet received a feed additive ProVetin at a dose of 30 g per head per day. Foals obtained from mares of the experimental group, as well as their mothers, received a probiotic feed additive at a dose of 5 g per head per day for 6 months. The development of young animals was monitored for 6 months.

The rations were made taking into account the feeding norms. Feed of own production accounted for more than 50% of the diet. Coarse feed accounted for at least 60% of the daily diet. Table salt was given as a mineral top dressing [2, 4]. The differences in feeding consisted in the fact that the animals of the control group received standard premixes, and the horses and foals of the experimental groups received the feed additive ProVetin.

The daily distribution for lactating mares consisted of 10 kg of grain-mixed hay, 6.3 kg of grain mixture. The composition of the grain mixture did not change during the lactation period and remained the same as during pregnancy.

The maintenance of animals and their service was the same in all groups. Sanitary and hygienic, zootechnical and veterinary requirements were met during the experiments. The horses were kept in standard stables, one in a stall, with a daily walk in the brews. The horses were kept in conditions corresponding to veterinary and zoo technical requirements, received a household ration in accordance with generally accepted norms [2, 7, 9].

Indicators characterizing growth and development, such as changes in body weight and measurements, were evaluated. For this purpose, weighing and taking measurements of foals at birth and at the age of three, six months were carried out.

Statistical processing of experimental data was carried out using a statistical analysis package for Microsoft Excel. The reliability of the differences between the groups on quantitative grounds was assessed using the Student's t-test. The differences were considered statistically significant at $P < 0.05$. 


3 Research results and discussion

The live weight of foals obtained from mares of the experimental group was greater than in the control group by 2.6 kg (Table 1).

<table>
<thead>
<tr>
<th>Age</th>
<th>Control group</th>
<th>Experimental group</th>
</tr>
</thead>
<tbody>
<tr>
<td>At birth</td>
<td>38.6±2.4</td>
<td>41.2±1.9*</td>
</tr>
<tr>
<td>3 months</td>
<td>124.6±9.3</td>
<td>132.5±8.2</td>
</tr>
<tr>
<td>6 м months.</td>
<td>189.9±11.8</td>
<td>202.3±6.7*</td>
</tr>
<tr>
<td>Gross increase</td>
<td>152.4±9.6</td>
<td>164.5±8.3*</td>
</tr>
<tr>
<td>Average daily increase, g</td>
<td>847.3±38.7</td>
<td>903.9±41.4</td>
</tr>
</tbody>
</table>

Note: * – Р ≤ 0.05

Further study of the effect of the feed additive ProVetin on the dynamics of the live weight of foals showed that the young of the experimental group for the entire period of research exceeded their peers from the control group. Thus, at the age of 3 months, the live weight of the experimental group of foals receiving daily feed supplement was 7.9 kg more than in the control group; at 6 months – 12.4 kg (P ≤ 0.05). The gross and average daily increase in live weight of young animals of the control and experimental groups at the time of weaning also differed significantly in favor of foals receiving ProVetin. Thus, the gross increase in foals of the experimental group was by 7.9%, and the average daily increase was by 6.7% more relative to the animals of the control group.

The study of the main measurements of foals in different age periods is presented in Table 2.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Control group</th>
<th>Experimental group</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height at the withers</td>
<td>127.9±2.4</td>
<td>130.1±1.2</td>
</tr>
<tr>
<td>Chest girth</td>
<td>127.2±1.6</td>
<td>129.5±1.3*</td>
</tr>
<tr>
<td>Pastern girth</td>
<td>15.1±0.2</td>
<td>16.0±0.1*</td>
</tr>
<tr>
<td>6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height at the withers</td>
<td>133.9±3.5</td>
<td>137.2±1.1*</td>
</tr>
<tr>
<td>Chest girth</td>
<td>136.7±2.8</td>
<td>141.9±1.85*</td>
</tr>
<tr>
<td>Pastern girth</td>
<td>16.5±0.3</td>
<td>16.8±0.2*</td>
</tr>
</tbody>
</table>

Note: * – P ≤ 0.05

In all age periods, the foals of the experimental group surpassed their peers from the control group in the main measurements.

At the age of 3 months, the height at the withers of the foals of the control group was inferior to the experimental group by 2.2 cm or 2.5%. In terms of chest circumference, the foals of the experimental group exceeded the control foals by 2.3 cm, or 1.8% (P ≤ 0.05); and in terms of pastern circumference, they exceeded 0.9 cm, or 5.9% (P ≤ 0.05).

In the future, with the growth of foals, their measurements also changed, but the tendency to increase them in the experimental group remained.

At the age of 6 months, the foals of the control group were inferior to the young of the experimental group in height at the withers by 3.3 cm, or 2.5% (P ≤ 0.05), in the chest girth – by 5.2 cm, or 3.8% (P < 0.05), in the pastern girth – by 0.3 cm, or 1.8% (P ≤ 0.05).

Thus, the study of measurements of foals showed that the young, whose mothers were injected with the main diet of the feed additive ProVetin, were characterized by better
growth and development rates compared with the peers of the control group.

The results obtained are consistent with the data that increasing the usefulness and level of feeding of pregnant mares has a positive effect on fetal development. Foals obtained from mares of the experimental group had an advantage at birth and increased this superiority by the age of three and six months.

Assessing the dynamics of changes in body weight, measurements of articles of young horses, it should be concluded that the feed additive ProVetin stimulates the growth and development of foals. The young of the experimental group shows greater precocity, which is expressed in higher increments of the studied indicators. The foals of the control group, whose mothers received a standard diet, developed more slowly and lagged behind in dynamics.

4 Conclusion

Based on the conducted studies, it can be concluded that the feed additive ProVetin has a beneficial effect on the body of foals whose mothers received a probiotic supplement during pregnancy, which is expressed in stimulating the set of live weight and increasing the main body measurements – the weight of foals of the experimental group at birth was more by 6.7% (P ≤ 0.05). Further inclusion of a feed additive in the diet of foals at a dose of 5 g per head for 6 months had a positive effect on the dynamics of live weight. Thus, at the age of 3 months, the live weight of the experimental group of foals receiving daily feed supplement was 6.3% higher than in the control group; at 6 months – 6.5% (P ≤ 0.05).

Thus, the overdosed extracts confirmed the multivitamin supplement containing Bacillus subtilis, Saccharomyces cerevisiae, Trichoderma reesei on the growth and development of foals.

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