

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Stimulation of Rumen Microflora in Cattle by Using Probiotic Concentrate.

Sergey Yu Smolentsev<sup>1\*</sup>, Evgeny N Poltaev<sup>1</sup>, Lilia E Matrosova<sup>2</sup>, Elena L Matveeva<sup>2</sup>,  
Alla E Ivanova<sup>2</sup>, Anna M Tremasova<sup>3</sup>, and Marina A Erochondina<sup>3</sup>.

<sup>1</sup>Mari State University, Lenin Square 1, Yoshkar-Ola city, 424000, Russia

<sup>2</sup>Kazan Innovative University named after V.G. Timiryasov, Moskovskaya street 42, Kazan city, 420111, Russia

<sup>3</sup>Federal Center for Toxicological, Radiation and Biological Safety, Scientific town-2, Kazan city, 420075, Russia

### ABSTRACT

The addition of enzyme-probiotic concentrate to the diet of dairy cows stimulated the activity of microorganisms involved in metabolic processes within the rumen. It has been found that nutrient digestion was more intensive when enzyme-probiotic concentrate at a dose of 150 g was added to the mixed cattle feed to supplement the basic diet.

**Keywords:** rumen microflora, cattle, probiotics, diet, productivity

*\*Corresponding author*

## INTRODUCTION

The rumen of ruminants contains a large number of bacteria and protozoa involved in metabolic processes. The anatomical structure and conditions within the rumen almost perfectly suit the requirements for the life of microorganisms. According to different authors, the number of bacteria is on average 10<sup>9</sup>-10<sup>10</sup> cells in 1g of rumen digesta [1-3]. Besides bacteria, various yeast, actinomycete and protozoa species perform feed digestion and synthesis of important organic compounds for animals in the rumen. There can be 3-4 million infusoria in 1 ml [3-5].

The main products of fermentation of fiber and other carbohydrates are butyric acid, carbonic acid and hydrogen. Many rumen bacteria, including cellulolytic bacteria, are involved in the conversion of starch.

Bact. amylophilus, Bact. Ruminicola and some others were isolated from the rumen. Some infusoria species also take a great part in amyolysis. The main fermentation products are acetic acid, succinic acid, formic acid, carbon dioxide and in some cases hydrogen sulphide [6-8].

Utilization of monosaccharides (glucose, fructose, xylose, etc.) that enter the rumen with feed and are mainly formed in the process of hydrolysis of polysaccharides is carried out mainly by rumen micro organisms [9].

Accordingly, the purpose of our research was to study a set of actions for the prevention of imbalance in bacteria in the digestive tract of cattle by using enzyme-probiotic concentrate (EPC).

## MATERIALS AND METHODS

The scientific and economic research on assessing the effectiveness of EPC in the diet of Black-and-White dairy cows during days in milk was carried out in the integrated agricultural production company "Ural" in the Kukmor District in the Republic of Tatarstan. The animals were divided into four groups: a control group (n = 8) and three experimental groups (n = 24) taking into account their age, milk production and physiological state. The cows were kept in standard conditions, given standard feed and looked after by one staff. During 60 days, the animals of the control group were fed the basic diet, the animals of the experimental groups were fed the basic diet to which EPC at a dose of 150 g, 200 g and 250 g, respectively, was added with mixed cattle feed.

**Table 1: The scheme of the experiment**

Group of animals	Heads	Experiment duration, days	Diet
Control group	8	60	BD
Experimental group 1	8	60	BD + EPC (150 g)
Experimental group 2	8	60	BD + EPC (200 g)
Experimental group 3	8	60	BD + EPC (250 g)

Rumen digesta was taken from animals with oropharyngeal and nasopharyngeal probes. The quantitative composition of infusoria and microorganisms, mobility and pH of the medium were determined by standard methods [3].

Statistical processing of the results of the experiment was carried out with Student's t-test. The data of the experiment are presented in Table 2.

## RESULTS OF THE RESEARCH

It has been found that when 150 g and 200 g of EPC per head were added, the pH of the rumen decreased to  $6.4 \pm 0.24$  and  $6.4 \pm 0.24$ , the initial value was  $6.71 \pm 0.06$ . Enzyme activity increased significantly in the second and third experimental groups, it was  $3.36 \pm 0.08$  ( $p < 0.05$ ) and  $3.5 \pm 0.07$  ( $p < 0.05$ ), respectively. When 250 g of EPC per head was added, the pH dropped to  $6.33 \pm 0.17$  but enzyme activity grew to 3.5 suggesting that a decrease in the pH of the rumen by several parts causes an increase in enzyme activity that

facilitates the establishment of symbiotic relations with microorganisms in the digestive tract.

The use of EPC at a dose of 150 g per head caused a slight decrease in the total microbial number by 0.3 CFU/g, however, the use of EPC at a dose of 200 g and 250 g increased that number to  $10.13 \pm 1.84$  and  $10.5 \pm 0.61 \times 10^6$  CFU/g, respectively. The number of bacilli decreased as much as possible when 150 g of EPC was added to the basic diet, making room for an increase in the number of yeast-like microorganisms to  $10.46 \pm 1.4 \times 10^5$  CFU/g and cellulolytic microorganisms to 94% which is the best result of all supplementary feeding. In the first experimental group, when 150 g of EPC was added, the number of infusoria that contribute to the conversion of starch increased. Inverse changes are less effective both economically and physiologically when the amount of EPC increased.

**Table 2: Results of the study**

Indicator	Control group	Experimental groups		
		1	2	3
pH	6.71±0.06	6.4±0.24	6.4±0.4	6.33±0.17
Enzyme activity	3.16±0.04	3.36±0.1	3.36±0.08	3.5±0.07
Total microbial number $\times 10^6$ CFU/g	7.4±2.38	7.1±0.56	10.13±1.84	10.5 ± 0.61
Bacilli $\times 10^6$ CFU/g	6.66±1.92	2.03±1.08	3.46±1.1	3.53±0.99
Yeast-like microorganisms $\times 10^5$ CFU/g	8.23±0.7	10.46±1.4	8.56±3.23	7.16±3.43
Cellulolytic microorganisms, %	85.6 ± 1.47	94±5.09	90±5.65	89±5.52
The number of infusoria, unit	138134.3± 21973.28	209616± 74119.27	191462.3± 73579.46	175167± 66610.6

### CONCLUSION

The results of the research have shown that yeast-like and cellulolytic microorganisms were active and fiber digestion was more intensive when 150 g of EPC was added than after giving feed without adding EPC and after adding EPC at a high dose. Throughout the experiment, in the experimental groups of cattle that received different doses of EPC, the digestion of tested nutrients was at a higher level. In the samples taken from the cows of the first experimental group that received EPC at a dose of 150g per head, the enzyme activity was lower than in all other experimental groups that, however, contributed to better results. The studies have shown that the use of EPC in the diet of cattle stimulates the activity of microorganisms that will improve the digestibility and absorption of not only fiber, but also other nutrients, due to the stabilizing effect on the acidity of the medium in the rumen. This, in turn, will improve metabolic processes and, ultimately, lead to an increase in the efficiency of feed.

### REFERENCES

- [1] Zhang H et al. Field Crops Research 2017; 215: 1-11
- [2] Manzeke MG et al. Field Crops Research 2017; 213: 231-244
- [3] Semenov E.I. et al. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2016;7(1): 1860-1868.
- [4] Manatt RK et al. Environ. Res. Lett. 2013; 8: 035037 doi:10.1088/1748-9326/8/3/035037
- [5] Stefanski R, Sivakumar M. IOP Conf. Series: Earth and Environmental Science 2009; 7: 012016 doi:10.1088/1755-1307/7/1/012016
- [6] Maheswari M et al. The Indian Nitrogen Assessment 2017:175-186
- [7] Cao X et al. Ecological Indicators 2015; 55: 107-117
- [8] Martínez-Romero A et al. Agricultural Water Management 2017; 192: 58-70
- [9] Semenov E.I. et al. Bali Medical Journal 2017; 6(2): 110-114.